SUBCHAPTER D—AIRMEN

PART 60—FLIGHT SIMULATION TRAINING DEVICE INITIAL AND CONTINUING QUALIFICATION AND USE

Authority: 49 U.S.C. 106(f), 106(g), 40113, and 44701; Pub. L. 111–216, 124 Stat. 2348 (49 U.S.C. 44701 note)

Source: Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, unless otherwise noted.

§ 60.1 Applicability.

(a) This part prescribes the rules governing the initial and continuing qualification and use of all aircraft flight simulation training devices (FSTD) used for meeting training, evaluation, or flight experience requirements of this chapter for flight crewmember certification or qualification.

(b) The rules of this part apply to each person using or applying to use an FSTD to meet any requirement of this chapter.

(c) The requirements of § 60.33 regarding falsification of applications, records, or reports also apply to each person who uses an FSTD for training, evaluation, or obtaining flight experience required for flight crewmember certification or qualification under this chapter.

§ 60.2 Applicability of sponsor rules to persons who are not sponsors and who are engaged in certain unauthorized activities.

(a) The rules of this part that are directed to a sponsor of an FSTD also apply to any person who uses or causes the use of an FSTD when—

(1) That person knows that the FSTD does not have an FAA-approved sponsor; and

(2) The use of the FSTD by that person is nonetheless claimed for purposes of meeting any requirement of this chapter or that person knows or should have known that the person's acts or omissions would cause another person to mistakenly credit use of the FSTD for purposes of meeting any requirement of this chapter.

(b) A situation in which paragraph (a) of this section would not apply to a person would be when each of the following conditions are met:

(1) The person sold or leased the FSTD and merely represented to the purchaser or lessee that the FSTD is in a condition in which it should be able to obtain FAA approval and qualification under this part;

(2) The person does not falsely claim to be the FAA-approved sponsor for the FSTD;

(3) The person does not falsely make representations that someone else is the FAA-approved sponsor of the FSTD at a time when that other person is not the FAA-approved sponsor of the FSTD; and

(4) The person's acts or omissions do not cause another person to detrimentally rely on such acts or omissions for the mistaken conclusion that the FSTD is FAA-approved and qualified under this part at the time the FSTD is sold or leased.

§ 60.3 Definitions.

In addition to the definitions in part 1 of this chapter, other terms and definitions applicable to this part are found in appendix F of this part.

§ 60.4 Qualification Performance Standards.

The Qualification Performance Standards (QPS) are published in appendices to this part as follows:

(a) Appendix A contains the QPS for Airplane Flight Simulators.

(b) Appendix B contains the QPS for Airplane Flight Training Devices.

(c) Appendix C contains the QPS for Helicopter Flight Simulators.

(d) Appendix D contains the QPS for Helicopter Flight Training Devices.

(e) Appendix E contains the QPS for Quality Management Systems for FSTDs.

(f) Appendix F contains the QPS for Definitions and Abbreviations for FSTDs.

§ 60.5 Quality management system.

(a) After May 30, 2010, no sponsor may use or allow the use of or offer the use of an FSTD for flight crewmember training or evaluation or for obtaining flight experience to meet any requirement of this chapter unless the sponsor has established and follows a quality management system (QMS), currently approved by the responsible Flight Standards office, for the continuing surveillance and analysis of the sponsor's performance and effectiveness in providing a satisfactory FSTD for use on a regular basis as described in QPS appendix E of this part.

(b) The QMS program must provide a process for identifying deficiencies in the program and for documenting how the program will be changed to address these deficiencies.

(c) Whenever the responsible Flight Standards office finds that the QMS program does not adequately address the procedures necessary to meet the requirements of this part, the sponsor must, after notification by the responsible Flight Standards office, change the program so the procedures meet the requirements of this part. Each such change must be approved by the responsible Flight Standards office prior to implementation.

(d) Within 30 days after the sponsor receives a notice described in paragraph (c) of this section, the sponsor may file a petition with the Executive Director of Flight Standards Service (the Executive Director) for reconsideration of the responsible Flight Standards office finding. The sponsor must address its petition to the Executive Director, Flight Standards Service, Federal Aviation Administration, 800 Independence Ave., SW., Washington, DC 20591. The filing of such a petition to reconsider stays the notice pending a decision by the Executive Director. However, if the Executive Director finds that there is a situation that requires immediate action in the interest of safety in air commerce, he may, upon a statement of the reasons, require a change effective without stay.

[Doc. No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006; Amdt. 60–2, 72 FR 59599, Oct. 22, 2007, as amended by Docket FAA–2018–0119, Amdt. 60–5, 83 FR 9170, Mar. 5, 2018; Docket No. FAA–2022–1355; Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.7 Sponsor qualification requirements.

(a) A person is eligible to apply to be a sponsor of an FSTD if the following conditions are met:

(1) The person holds, or is an applicant for, a certificate under part 119, 141, or 142 of this chapter; or holds, or is an applicant for, an approved flight engineer course in accordance with part 63 of this chapter.

(2) The FSTD will be used, or will be offered for use, in the sponsor's FAA-approved flight training program for the aircraft being simulated as evidenced in a request for evaluation submitted to the responsible Flight Standards office.

(b) A person is a sponsor if the following conditions are met:

(1) The person is a certificate holder under part 119, 141, or 142 of this chapter or has an approved flight engineer course in accordance with part 63 of this chapter.

(2) The person has—

(i) Operations specifications authorizing the use of the specific aircraft or set of aircraft and has an FAA-approved training program under which at least one FSTD, simulating the aircraft or set of aircraft and for which the person is the sponsor, is used by the sponsor as described in paragraphs (b)(5) or (b)(6) of this section; or

(ii) Training specifications or an FAA-approved course of training under which at least one FSTD, simulating that aircraft or set of aircraft and for which the person is the sponsor, is used by the sponsor as described in paragraphs (b)(5) or (b)(6) of this section.

(3) The person has a quality management system currently approved by the responsible Flight Standards office in accordance with § 60.5.

(4) The responsible Flight Standards office has accepted the person as the sponsor of the FSTD and that acceptance has not been withdrawn by the FAA.

(5) At least one FSTD (as referenced in paragraph (b)(2)(i) or (b)(2)(ii) of this section) that is initially qualified on or after May 30, 2008, is used within the sponsor's FAA-approved flight training program for the aircraft or set of aircraft at least once within the 12-month period following the initial/upgrade evaluation, and at least once within each subsequent 12-month period thereafter.

(6) At least one FSTD (as referenced in paragraph (b)(2)(i) or (b)(2)(ii) of this section) that was qualified before May 30, 2008, is used within the sponsor's FAA-approved flight training program for the aircraft or set of aircraft at least once within the 12-month period following the first continuing qualification evaluation conducted by the responsible Flight Standards office after May 30, 2008 and at least once within each subsequent 12-month period thereafter.

(c) If the use requirements of paragraphs (b)(2) and either (b)(5) or (b)(6) of this section are not met, the person will forfeit the right to sponsor that FSTD and that person will not be eligible to apply to sponsor that FSTD for at least 12 calendar months following the expiration of the qualification status.

(d) In addition to the FSTD described in paragraph (b) of this section, an FSTD sponsor may sponsor any number of other FSTDs regardless of specific aircraft or set of aircraft provided either—

(1) During the preceding 12-month period, all of the other FSTDs are used within the sponsor's or another certificate holder's FAA-approved flight training program for the aircraft or set of aircraft simulated; or

(2) The sponsor obtains a written statement at least annually from a qualified pilot who has flown the aircraft or set of aircraft (as appropriate) during the preceding 12-month period stating that the subject FSTD's performance and handling qualities, within the normal operating envelope, represent the aircraft or set of aircraft described in the FAA Type Certificate and the type data sheet, if appropriate. The sponsor must retain the two most current written statements for review by the responsible Flight Standards office.

[Doc. No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006; Amdt. 60–2, 72 FR 59599, Oct. 22, 2007, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.9 Additional responsibilities of the sponsor.

(a) The sponsor must allow the responsible Flight Standards office upon request to inspect the FSTD as soon as practicable. This inspection may include all records and documents relating to the FSTD, to determine its compliance with this part.

(b) The sponsor must do the following for each FSTD:

(1) Establish a mechanism to receive written comments regarding the FSTD and its operation in accordance with the QPS appendix E of this part.

(2) Post in or adjacent to the FSTD the Statement of Qualification issued by the responsible Flight Standards office. An electronic copy of the Statement of Qualification that may be accessed by an appropriate terminal or display in or adjacent to the FSTD is satisfactory.

(c) Each sponsor of an FSTD must identify to the responsible Flight Standards office by name, one individual to be the management representative (MR).

(1) One person may serve as an MR for more than one FSTD, but one FSTD must not have more than one person serving in this capacity.

(2) Each MR must be an employee of the sponsor with the responsibility and authority to—

(i) Monitor the on-going qualification of assigned FSTDs to ensure that all matters regarding FSTD qualification are being carried out as provided for in this part;

(ii) Ensure that the QMS is properly established, implemented, and maintained by overseeing the structure (and modifying where necessary) of the QMS policies, practices, and procedures; and

(iii) Regularly brief sponsor's management on the status of the on-going FSTD qualification program and the effectiveness and efficiency of the QMS.

(3) The MR serves as the primary contact point for all matters between the sponsor and the responsible Flight Standards office regarding the qualification of that FSTD as provided for in this part.

(4) The MR may delegate the duties described in paragraph (c)(2) and (c)(3) of this section to an individual at each of the sponsor's locations.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.11 FSTD use.

No person may use or allow the use of or offer the use of an FSTD for flight crewmember training or evaluation or for obtaining flight experience to meet any of the requirements under this chapter unless, in accordance with the QPS for the specific device, the FSTD meets all of the following:

(a) Has a single sponsor who is qualified under § 60.7. The sponsor may arrange with another person for services of document preparation and presentation, as well as FSTD inspection, maintenance, repair, and servicing; however, the sponsor remains responsible for ensuring that these functions are conducted in a manner and with a result of continually meeting the requirements of this part.

(b) Is qualified as described in the Statement of Qualification.

(c) Remains qualified, through satisfactory inspection, continuing qualification evaluations, appropriate maintenance, and use requirements in accordance with this part and the applicable QPS.

(d) Functions during day-to-day training, evaluation, or flight experience activities with the software and hardware that was evaluated as satisfactory by the responsible Flight Standards office and, if modified, modified only in accordance with the provisions of this part. However, this section does not apply to routine software or hardware changes that do not fall under the requirements of § 60.23.

(e) Is operated in accordance with the provisions and limitations of § 60.25.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.13 FSTD objective data requirements.

(a) Except as provided in paragraph (b) and (c) of this section, for the purposes of validating FSTD performance

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and handling qualities during evaluation for qualification, the data made available to the responsible Flight Standards office (the validation data package) must include the aircraft manufacturer's flight test data and all relevant data developed after the type certificate was issued (*e.g.*, data developed in response to an airworthiness directive) if such data results from a change in performance, handling qualities, functions, or other characteristics of the aircraft that must be considered for flight crewmember training, evaluation, or for meeting experience requirements of this chapter.

(b) The validation data package may contain flight test data from a source in addition to or independent of the aircraft manufacturer's data in support of an FSTD qualification, but only if this data is gathered and developed by that source in accordance with flight test methods, including a flight test plan, as described in the applicable QPS.

(c) The validation data package may also contain predicted data, engineering simulation data, data from pilot owner or pilot operating manuals, or data from public domain sources, provided this data is acceptable to the responsible Flight Standards office. If found acceptable the data may then be used in particular applications for FSTD qualification.

(d) Data or other material or elements must be submitted in a form and manner acceptable to the responsible Flight Standards office.

(e) The responsible Flight Standards office may require additional objective data, which may include flight testing if necessary, if the validation data package does not support FSTD qualification requirements as described in this part and the applicable QPS appendix.

(f) When an FSTD sponsor learns, or is advised by an aircraft manufacturer or other data provider, that an addition to, an amendment to, or a revision of data that may relate to FSTD performance or handling characteristics is available, the sponsor must notify the responsible Flight Standards office as described in the applicable QPS.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.14 Special equipment and personnel requirements for qualification of the FSTD.

When notified by the responsible Flight Standards office, the sponsor must make available all special equipment and qualified personnel needed to accomplish or assist in the accomplishment of tests during initial qualification, continuing qualification, or special evaluations.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.15 Initial qualification requirements.

(a) For each FSTD, the sponsor must submit a request to the responsible Flight Standards office to evaluate the FSTD for initial qualification at a specific level and simultaneously request the Training Program Approval Authority (TPAA) forward a concurring letter to the responsible Flight Standards office. The request must be submitted in the form and manner described in the applicable QPS.

(b) The management representative described in § 60.9(c) must sign a statement (electronic signature is acceptable for electronic transmissions) after confirming the following:

(1) The performance and handling qualities of the FSTD represent those of the aircraft or set of aircraft within the normal operating envelope. This determination must be made by a pilot(s) meeting the requirements of paragraph (d) of this section after having flown all of the Operations Tasks listed in the applicable QPS appendix relevant to the qualification level of the FSTD. Exceptions, if any, must be noted. The name of the person(s) making this determination must be available to the responsible Flight Standards office upon request.

(2) The FSTD systems and sub-systems (including the simulated aircraft systems) functionally represent those

in the aircraft or set of aircraft. This determination must be made by the pilot(s) described in paragraph (b)(1) of this section, or by a person(s) trained on simulator systems/sub-systems and trained on the operation of the simulated aircraft systems, after having exercised the operation of the FSTD and the pertinent functions available through the Instructor Operating Station(s). Exceptions, if any, must be noted. The name of the person(s) making this determination must be available to the responsible Flight Standards office upon request.

(3) The cockpit represents the configuration of the specific type; or aircraft make, model, and series aircraft being simulated, as appropriate. This determination must be made by the pilot(s) described in paragraph (b)(1) of this section, or by a person(s) trained on the configuration and operation of the aircraft simulated. Exceptions, if any, must be noted. The name of the person(s) making this determination must be available to the responsible Flight Standards office upon request.

(c) Except for those FSTDs previously qualified and described in § 60.17, each FSTD evaluated for initial qualification must meet the standard that is in effect at the time of the evaluation. However—

(1) If the FAA publishes a change to the existing standard or publishes a new standard for the evaluation for initial qualification, a sponsor may request that the responsible Flight Standards office apply the standard that was in effect when an FSTD was ordered for delivery if the sponsor—

(i) Within 30 days of the publication of the change to the existing standard or publication of the new standard, notifies the responsible Flight Standards office that an FSTD has been ordered;

(ii) Within 90 days of the responsible Flight Standards office notification described in paragraph (c)(1)(i) of this section, requests that the standard in effect at the time the order was placed be used for the evaluation for initial qualification; and

(iii) The evaluation is conducted within 24 months following the publication of the change to the existing standard or publication of the new standard.

(2) This notification must include a description of the FSTD; the anticipated qualification level of the FSTD; the make, model, and series of aircraft simulated; and any other pertinent information.

(3) Any tests, tolerances, or other requirements that are current at the time of the evaluation may be used during the initial evaluation, at the request of the sponsor, if the sponsor provides acceptable updates to the required qualification test guide.

(4) The standards used for the evaluation for initial qualification will be used for all subsequent evaluations of the FSTD.

(5) An FSTD sponsor or FSTD manufacturer may submit a request to the Administrator for approval of a deviation from the QPS requirements as defined in Appendix A through Appendix D of this part.

(i) Requests for deviation must be submitted in a form and manner acceptable to the Administrator and must provide sufficient justification that the deviation meets or exceeds the testing requirements and tolerances as specified in the part 60 QPS or will otherwise not adversely affect the fidelity and capability of the FSTDs evaluated and qualified under the deviation.

(ii) The Administrator may consider deviation from the minimum requirements tables, the objective testing tables, the functions and subjective testing tables, and other supporting tables and requirements in the part 60 QPS.

(iii) Deviations may be issued to an FSTD manufacturer for the initial qualification of multiple FSTDs, subject to terms and limitations as determined by Administrator. Approved deviations will become a part of the permanent qualification basis of the individual FSTD and will be noted in the FSTD's Statement of Qualification.

(iv) If the FAA publishes a change to the existing part 60 standards as described in paragraph (c)(1) of this section or issues an FSTD Directive as described in § 60.23(b), which conflicts with or supersedes an approved deviation, the Administrator may terminate or revise a grant of deviation authority issued under this paragraph.

(d) The pilot(s) who contributes to the confirmation statement required by paragraph (b) of this section must—

(1) Be designated by the sponsor; and

(2) Be qualified in—

(i) The aircraft or set of aircraft being simulated; or

(ii) For aircraft not yet issued a type certificate, or aircraft not previously operated by the sponsor or not having previous FAA-approved training programs conducted by the sponsor, an aircraft similar in size and configuration.

(e) The subjective tests that form the basis for the statements described in paragraph (b) of this section and the objective tests referenced in paragraph (f) of this section must be accomplished at the sponsor's training facility or other sponsor designated location where training will take place, except as provided for in the applicable QPS.

(f) The person seeking to qualify the FSTD must provide the responsible Flight Standards office access to the FSTD for the length of time necessary for the responsible Flight Standards office to complete the required evaluation of the FSTD for initial qualification, which includes the conduct and evaluation of objective and subjective tests, including general FSTD requirements, as described in the applicable QPS, to determine that the FSTD meets the standards in that QPS.

(g) When the FSTD passes an evaluation for initial qualification, the responsible Flight Standards office issues a Statement of Qualification that includes all of the following:

(1) Identification of the sponsor.

(2) Identification of the make, model, and series of the aircraft or set of aircraft being simulated.

(3) Identification of the configuration of the aircraft or set of aircraft being simulated (*e.g.*, engine model or models, flight instruments, or navigation or other systems).

(4) A statement that the FSTD is qualified as either a full flight simulator or a flight training device.

(5) Identification of the qualification level of the FSTD.

(6) A statement that (with the exception of the noted exclusions for which the FSTD has not been subjectively tested by the sponsor or the responsible Flight Standards office and for which qualification is not sought) the qualification of the FSTD includes the tasks set out in the applicable QPS appendix relevant to the qualification level of the FSTD.

(7) A statement referencing any deviations that have been granted and included in the permanent qualification basis of the FSTD.

(h) After the responsible Flight Standards office completes the evaluation for initial qualification, the sponsor must update the Qualification Test Guide (QTG), with the results of the FAA-witnessed tests together with the results of all the objective tests described in the applicable QPS.

(i) Upon issuance of the Statement of Qualification the updated QTG becomes the Master Qualification Test Guide (MQTG). The MQTG must be made available to the responsible Flight Standards office upon request.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket FAA–2014–0391, Amdt. 60–4, 81 FR 18217, Mar. 30, 2016; Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.16 Additional qualifications for a currently qualified FSTD.

(a) A currently qualified FSTD is required to undergo an additional qualification process if a user intends to use the FSTD for meeting training, evaluation, or flight experience requirements of this chapter beyond the qualification issued for that FSTD. This process consists of the following:

(1) The sponsor:

(i) Must submit to the responsible Flight Standards office all modifications to the MQTG that are required to support the additional qualification.

(ii) Must describe to the responsible Flight Standards office all modifications to the FSTD that are required to support the additional qualification.

(iii) Must submit to the responsible Flight Standards office a confirmation statement as described in § 60.15(c) that a pilot, designated by the sponsor in accordance with § 60.15(d), has subjectively evaluated the FSTD in those areas not previously evaluated.

(2) The FSTD must successfully pass an evaluation—

(i) Consisting of all the elements of an initial evaluation for qualification in those circumstances where the responsible Flight Standards office has determined that all the elements of an initial evaluation for qualification is necessary; or

(ii) Consisting of those elements of an initial evaluation for qualification designated as necessary by the responsible Flight Standards office.

(b) In making the determinations described in paragraph (a)(2) of this section, the responsible Flight Standards office considers factors including the existing qualification of the FSTD, any modifications to the FSTD hardware or software that are involved, and any additions or modifications to the MQTG.

(c) The FSTD is qualified for the additional uses when the responsible Flight Standards office issues an amended Statement of Qualification in accordance with § 60.15(h).

(d) The sponsor may not modify the FSTD except as described in § 60.23.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.17 Previously qualified FSTDs.

(a) Unless otherwise specified by an FSTD Directive, further referenced in the applicable QPS, or as specified in paragraph (e) of this section, an FSTD qualified before May 31, 2016 will retain its qualification basis as long as it continues to meet the standards, including the objective test results recorded in the MQTG and subjective tests, under which it was originally evaluated, regardless of sponsor. The sponsor of such an FSTD must comply with the other applicable provisions of this part.

(b) For each FSTD qualified before May 30, 2008, no sponsor may use or allow the use of or offer the use of such an FSTD after May 30, 2014 for flight crewmember training, evaluation or flight experience to meet any of the requirements of this chapter, unless that FSTD has been issued a Statement of Qualification, including the Configuration List and the List of Qualified Tasks in accordance with the procedures set out in the applicable QPS.

(c) If the FSTD qualification is lost under § 60.27 and—

(i) Restored under § 60.27 in less than (2) years, then the qualification basis (in terms of objective tests and subjective tests) for the re-qualification will be those against which the FSTD was originally evaluated and qualified.

(ii) Not restored under § 60.27 for two (2) years or more, then the qualification basis (in terms of objective tests and subjective tests) for the re-qualification will be those standards in effect and current at the time of re-qualification application.

(d) Except as provided in paragraph (e) of this section, any change in FSTD qualification level initiated on or after May 30, 2008 requires an evaluation for initial qualification in accordance with this part.

(e) A sponsor may request that an FSTD be permanently downgraded. In such a case, the responsible Flight Standards office may downgrade a qualified FSTD without requiring and without conducting an initial evaluation for the new qualification level. Subsequent continuing qualification evaluations will use the existing MQTG, modified as necessary to reflect the new qualification level.

(f) When the sponsor has appropriate validation data available and receives approval from the responsible Flight Standards office, the sponsor may adopt tests and associated tolerances described in the current qualification standards as the tests and tolerances applicable for the continuing qualification of a previously qualified FSTD. The updated test(s) and tolerance(s) must be made a permanent part of the MQTG.

[Doc. No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006; Amdt. 60–2, 72 FR 59599, Oct. 22, 2007, as amended by Docket FAA–2014–0391, Amdt. 60–4, 81 FR 18218, Mar. 30, 2016; Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.19 Inspection, continuing qualification evaluation, and maintenance requirements.

(a) *Inspection.* No sponsor may use or allow the use of or offer the use of an FSTD for flight crewmember training, evaluation, or flight experience to meet any of the requirements of this chapter unless the sponsor does the following:

(1) Accomplishes all appropriate objective tests each year as specified in the applicable QPS.

(2) Completes a functional preflight check within the preceding 24 hours.

(b) *Continuing qualification evaluation.* (1) This evaluation consists of objective tests, and subjective tests, including general FSTD requirements, as described in the applicable QPS or as may be amended by an FSTD Directive.

(2) The sponsor must contact the responsible Flight Standards office to schedule the FSTD for continuing qualification evaluations not later than 60 days before the evaluation is due.

(3) The sponsor must provide the responsible Flight Standards office responsible Flight Standards office access to the objective test results in the MQTG and access to the FSTD for the length of time necessary for the responsible Flight Standards office to complete the required continuing qualification evaluations.

(4) The frequency of the responsible Flight Standards office-conducted continuing qualification evaluations for each FSTD will be established by the responsible Flight Standards office and specified in the Statement of Qualification.

(5) Continuing qualification evaluations conducted in the 3 calendar months before or after the calendar month in which these continuing qualification evaluations are required will be considered to have been conducted in the calendar month in which they were required.

(6) No sponsor may use or allow the use of or offer the use of an FSTD for flight crewmember training or evaluation or for obtaining flight experience for the flight crewmember to meet any requirement of this chapter unless the FSTD has passed a responsible Flight Standards office-conducted continuing qualification evaluation within the time frame specified in the Statement of Qualification or within the grace period as described in paragraph (b)(5) of this section.

(c) *Maintenance.* The sponsor is responsible for continuing corrective and preventive maintenance on the FSTD to ensure that it continues to meet the requirements of this part and the applicable QPS appendix. No sponsor may use or allow the use of or offer the use of an FSTD for flight crewmember training, evaluation, or flight experience to meet any of the requirements of this chapter unless the sponsor does the following:

(1) Maintains a discrepancy log.

(2) Ensures that, when a discrepancy is discovered, the following requirements are met:

(i) A description of each discrepancy is entered in the log and remains in the log until the discrepancy is corrected as specified in § 60.25(b).

(ii) A description of the corrective action taken for each discrepancy, the identity of the individual taking the action, and the date that action is taken is entered in the log.

(iii) The discrepancy log is kept in a form and manner acceptable to the Administrator and is kept in or adjacent to the FSTD. An electronic log that may be accessed by an appropriate terminal or display in or adjacent to the FSTD is satisfactory.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket FAA–2014–0391, Amdt. 60–4, 81 FR 18218, Mar. 30, 2016; Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.20 Logging FSTD discrepancies.

Each instructor, check airman, or representative of the Administrator conducting training, evaluation, or flight experience, and each person conducting the preflight inspection who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the FSTD, must write or cause to be written a description of that discrepancy into the discrepancy log at the end of the FSTD preflight or FSTD use session.

§ 60.21 Interim qualification of FSTDs for new aircraft types or models.

(a) A sponsor may apply for and the responsible Flight Standards office may issue an interim qualification level for an FSTD for a new type or model of aircraft, even though the aircraft manufacturer's aircraft data package is preliminary, if the sponsor provides the following to the satisfaction of the responsible Flight Standards office—

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(1) The aircraft manufacturer's data, which consists of at least predicted data, validated by a limited set of flight test data;

(2) The aircraft manufacturer's description of the prediction methodology used to develop the predicted data; and

(3) The QTG test results.

(b) An FSTD that has been issued interim qualification is deemed to have been issued initial qualification unless the responsible Flight Standards office rescinds the qualification. Interim qualification terminates two years after its issuance, unless the responsible Flight Standards office determines that specific conditions warrant otherwise.

(c) Within twelve months of the release of the final aircraft data package by the aircraft manufacturer, but no later than two years after the issuance of the interim qualification status, the sponsor must apply for initial qualification in accordance with § 60.15 based on the final aircraft data package approved by the aircraft manufacturer, unless the responsible Flight Standards office determines that specific conditions warrant otherwise.

(d) An FSTD with interim qualification may be modified only in accordance with § 60.23.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.23 Modifications to FSTDs.

(a) *Description of a modification.* For the purposes of this part, an FSTD is said to have been modified when:

(1) Equipment or devices intended to simulate aircraft appliances are added to or removed from FSTD, which change the Statement of Qualification or the MQTG; or

(2) Changes are made to either software or hardware that are intended to impact flight or ground dynamics; changes are made that impact performance or handling characteristics of the FSTD (including motion, visual, control loading, or sound systems for those FSTD levels requiring sound tests and measurements); or changes are made to the MQTG. Changes to the MQTG which do not affect required objective testing results or validation data approved during the initial evaluation of the FSTD are not considered modifications under this section.

(b) *FSTD Directive.* When the FAA determines that FSTD modification is necessary for safety of flight reasons, the sponsor of each affected FSTD must ensure that the FSTD is modified according to the FSTD Directive regardless of the original qualification standards applicable to any specific FSTD.

(c) *Using the modified FSTD.* The sponsor may not use, or allow the use of, or offer the use of, the FSTD with the proposed modification for flight crewmember training or evaluation or for obtaining flight experience for the flight crewmember to meet any requirement of this chapter unless:

(1) The sponsor has notified the responsible Flight Standards office and the TPAA of their intent to incorporate the proposed modification, and one of the following has occurred;

(i) Twenty-one days have passed since the sponsor notified the responsible Flight Standards office and the TPAA of the proposed modification and the sponsor has not received any response from either the responsible Flight Standards office or the TPAA;

(ii) Twenty-one days have passed since the sponsor notified the responsible Flight Standards office and the TPAA of the proposed modification and one has approved the proposed modification and the other has not responded;

(iii) Fewer than twenty-one days have passed since the sponsor notified the responsible Flight Standards office and the TPAA of the proposed modification and the responsible Flight Standards office and TPAA both approve the proposed modification;

(iv) The sponsor has successfully completed any evaluation the responsible Flight Standards office may require in accordance with the standards for an evaluation for initial qualification or any part thereof before the modified FSTD is placed in service.

(2) The notification is submitted with the content as, and in a form and manner as, specified in the applicable QPS.

(d) *User notification.* When a modification is made to an FSTD that affects the Statement of Qualification, the sponsor must post an addendum to the Statement of Qualification until such time as a permanent, updated statement is posted.

(e) *MQTG update*. The MQTG must be updated with current objective test results in accordance with § 60.15(h) and (i) and appropriate objective data in accordance with § 60.13, each time an FSTD is modified and an objective test or other MQTG section is affected by the modification. If an FSTD Directive is the cause of this update, the direction to make the modification and the record of the modification completion must be filed in the MQTG.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket FAA–2014–0391, Amdt. 60–4, 81 FR 18218, Mar. 30, 2016; Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.25 Operation with missing, malfunctioning, or inoperative components.

(a) No person may knowingly use or allow the use of or misrepresent the capability of an FSTD for any maneuver, procedure, or task that is to be accomplished to meet training, evaluation, or flight experience requirements of this chapter for flight crewmember certification or qualification when there is a missing, malfunctioning, or inoperative (MMI) component that is required to be present and correctly operate for the satisfactory completion of that maneuver, procedure, or task.

(b) Each MMI component as described in paragraph (a) of this section, or any MMI component installed and required to operate correctly to meet the current Statement of Qualification, must be repaired or replaced within 30 calendar days, unless otherwise required or authorized by the responsible Flight Standards office.

(c) A list of the current MMI components must be readily available in or adjacent to the FSTD for review by users of the device. Electronic access to this list via an appropriate terminal or display in or adjacent to the FSTD is satisfactory. The discrepancy log may be used to satisfy this requirement provided each currently MMI component is listed in the discrepancy log.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.27 Automatic loss of qualification and procedures for restoration of qualification.

(a) An FSTD qualification is automatically lost when any of the following occurs:

(1) The FSTD is not used in the sponsor's FAA-approved flight training program in accordance with § 60.7(b)(5) or (b)(6) and the sponsor does not obtain and maintain the written statement as described in § 60.7(d)(2).

(2) The FSTD is not inspected in accordance with § 60.19.

(3) The FSTD is physically moved from one location and installed in a different location, regardless of distance.

(4) The MQTG is missing or otherwise not available and a replacement is not made within 30 days.

(b) If FSTD qualification is lost under paragraph (a) of this section, qualification is restored when either of the following provisions is met:

(1) The FSTD successfully passes an evaluation:

(i) For initial qualification, in accordance with §§ 60.15 and 60.17(c) in those circumstances where the responsible Flight Standards office has determined that a full evaluation for initial qualification is necessary; or

(ii) For those elements of an evaluation for initial qualification, in accordance with §§ 60.15 and 60.17(c), as determined to be necessary by the responsible Flight Standards office.

(2) The responsible Flight Standards office advises the sponsor that an evaluation is not necessary.

(c) In making the determinations described in paragraph (b) of this section, the responsible Flight Standards office considers factors including the number of continuing qualification evaluations missed, the number of sponsor-conducted quarterly inspections missed,

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and the care that had been taken of the device since the last evaluation.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.29 Other losses of qualification and procedures for restoration of qualification.

(a) Except as provided in paragraph (c) of this section, when the responsible Flight Standards office determines that the FSTD no longer meets qualification standards, the following procedure applies:

(1) The responsible Flight Standards office notifies the sponsor in writing that the FSTD no longer meets some or all of its qualification standards.

(2) The responsible Flight Standards office sets a reasonable period (but not less than 7 days) within which the sponsor may submit written information, views, and arguments on the FSTD qualification.

(3) After considering all material presented, the responsible Flight Standards office notifies the sponsor about the determination with regard to the qualification of the FSTD.

(4) When the responsible Flight Standards office notifies the sponsor that some or all of the FSTD is no longer qualified, the action described in the notification becomes effective not less than 30 days after the sponsor receives that notice unless—

(i) The responsible Flight Standards office finds under paragraph (c) of this section that there is an emergency requiring immediate action with respect to safety in air commerce; or

(ii) The sponsor petitions the Executive Director of Flight Standards Service for reconsideration of the responsible Flight Standards office finding under paragraph (b) of this section.

(b) When a sponsor seeks reconsideration of a decision from the responsible Flight Standards office concerning the FSTD qualification, the following procedure applies:

(1) The sponsor must petition for reconsideration of that decision within 30 days of the date that the sponsor receives a notice that some or all of the FSTD is no longer qualified.

(2) The sponsor must address its petition to the Executive Director, Flight Standards Service, Federal Aviation Administration, 800 Independence Ave., SW., Washington, DC 20591.

(3) A petition for reconsideration, if filed within the 30-day period, suspends the effectiveness of the determination by the responsible Flight Standards office that the FSTD is no longer qualified unless the responsible Flight Standards office has found, under paragraph (c) of this section, that an emergency exists requiring immediate action with respect to safety in air commerce.

(c) If the responsible Flight Standards office find that an emergency exists requiring immediate action with respect to safety in air commerce that makes the procedures set out in this section impracticable or contrary to the public interest:

(1) The responsible Flight Standards office withdraws qualification of some or all of the FSTD and makes the withdrawal of qualification effective on the day the sponsor receives notice of it.

(2) In the notice to the sponsor, the responsible Flight Standards office articulates the reasons for its finding that an emergency exists requiring immediate action with respect to safety in air transportation or air commerce or that makes it impracticable or contrary to the public interest to stay the effectiveness of the finding.

(d) FSTD qualification lost under paragraph (a) or (c) of this section may be restored when either of the following provisions are met:

(1) The FSTD successfully passes an evaluation for initial qualification, in accordance with §§ 60.15 and 60.17(c) in those circumstances where the responsible Flight Standards office has determined that a full evaluation for initial qualification is necessary; or

(2) The FSTD successfully passes an evaluation for those elements of an initial qualification evaluation, in accordance with §§ 60.15 and 60.17(c), as determined to be necessary by the responsible Flight Standards office.

(e) In making the determinations described in paragraph (d) of this section, the responsible Flight Standards office considers factors including the reason for the loss of qualification, any repairs or replacements that may have to have been completed, the number of continuing qualification evaluations missed, the number of sponsor-conducted quarterly inspections missed, and the care that had been taken of the device since the loss of qualification.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket FAA–2018–0119, Amdt. 60–5, 83 FR 9170, Mar. 5, 2018; Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.31 Recordkeeping and reporting.

(a) The FSTD sponsor must maintain the following records for each FSTD it sponsors:

(1) The MQTG and each amendment thereto.

(2) A record of all FSTD modifications affected under § 60.23 since the issuance of the original Statement of Qualification.

(3) A copy of all of the following:

(i) Results of the qualification evaluations (initial and each upgrade) since the issuance of the original Statement of Qualification.

(ii) Results of the objective tests conducted in accordance with § 60.19(a) for a period of 2 years.

(iii) Results of the previous three continuing qualification evaluations, or the continuing qualification evaluations from the previous 2 years, whichever covers a longer period.

(iv) Comments obtained in accordance with § 60.9(b) for a period of at least 90 days.

(4) A record of all discrepancies entered in the discrepancy log over the previous 2 years, including the following:

(i) A list of the components or equipment that were or are missing, malfunctioning, or inoperative.

(ii) The action taken to correct the discrepancy.

(iii) The date the corrective action was taken.

(iv) The identity of the person determining that the discrepancy has been corrected.

(b) The records specified in this section must be maintained in plain language form or in coded form if the coded form provides for the preservation and retrieval of information in a manner acceptable to the responsible Flight Standards office.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

§ 60.33 Applications, logbooks, reports, and records: Fraud, falsification, or incorrect statements.

(a) No person may make, or cause to be made, any of the following:

(1) A fraudulent or intentionally false statement in any application or any amendment thereto, or any other report or test result required by this part.

(2) A fraudulent or intentionally false statement in or a known omission from any record or report that is kept, made, or used to show compliance with this part, or to exercise any privileges under this chapter.

(3) Any reproduction or alteration, for fraudulent purpose, of any report, record, or test result required under this part.

(b) The commission by any person of any act prohibited under paragraph (a) of this section is a basis for any one or any combination of the following:

(1) A civil penalty.

(2) Suspension or revocation of any certificate held by that person that was issued under this chapter.

(3) The removal of FSTD qualification and approval for use in a training program.

(c) The following may serve as a basis for removal of qualification of an FSTD including the withdrawal of approval for use of an FSTD; or denying an application for a qualification:

(1) An incorrect statement, upon which the FAA relied or could have relied, made in support of an application for a qualification or a request for approval for use.

(2) An incorrect entry, upon which the FAA relied or could have relied, made in any logbook, record, or report that is kept, made, or used to show compliance with any requirement for an FSTD qualification or an approval for use.

§ 60.35 Specific full flight simulator compliance requirements.

(a) No device will be eligible for initial or upgrade qualification to a FFS at Level C or Level D under this part unless it includes the equipment and appliances installed and operating to the extent necessary for the issuance of an airman certificate or rating.

(b) No device will be eligible for initial or upgrade qualification to a FFS at Level A or Level B under this part unless it includes the equipment and appliances installed and operating to the extent necessary for the training, testing, and/or checking that comprise the simulation portion of the requirements for issuance of an airman certificate or rating.

§ 60.37 FSTD qualification on the basis of a Bilateral Aviation Safety Agreement (BASA).

(a) The evaluation and qualification of an FSTD by a contracting State to the Convention on International Civil Aviation for the sponsor of an FSTD located in that contracting State may be used as the basis for issuing a U.S. statement of qualification (see applicable QPS, attachment 4, figure 4) by the responsible Flight Standards office to the sponsor of that FSTD in accordance with—

(1) A BASA between the United States and the Contracting State that issued the original qualification; and

(2) A Simulator Implementation Procedure (SIP) established under the BASA.

(b) The SIP must contain any conditions and limitations on validation and issuance of such qualification by the U.S.

[Docket No. FAA–2002–12461, 71 FR 63426, Oct. 30, 2006, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

Appendix A to Part 60—Qualification Performance Standards for Airplane Full Flight Simulators

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Begin Information

This appendix establishes the standards for Airplane FFS evaluation and qualification. The Flight Standards Service is responsible for the development, application, and implementation of the standards contained within this appendix. The procedures and criteria specified in this appendix will be used by the responsible Flight Standards office, when conducting airplane FFS evaluations.

Table of Contents

END INFORMATION

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1. INTRODUCTION

BEGIN INFORMATION

a. This appendix contains background information as well as regulatory and informative material as described later in this section. To assist the reader in determining what areas are required and what areas are permissive, the text in this appendix is divided into two sections: ''QPS Requirements'' and ''Information.'' The QPS Requirements sections contain details regarding compliance with the part 60 rule language. These details are regulatory, but are found only in this appendix. The Information sections contain material that is advisory in nature, and designed to give the user general information about the regulation.

b. [Reserved]

c. The responsible Flight Standards office encourages the use of electronic media for all communication, including any record, report, request, test, or statement required by this appendix. The electronic media used must have adequate security provisions and be acceptable to the responsible Flight Standards office.

d. Related Reading References.

(1) 14 CFR part 60.

(2) 14 CFR part 61.

(3) 14 CFR part 63.

(4) 14 CFR part 119.

(5) 14 CFR part 121.

(6) 14 CFR part 125.

(7) 14 CFR part 135.

(8) 14 CFR part 141.

(9) 14 CFR part 142.

(10) AC 120–28, as amended, Criteria for Approval of Category III Landing Weather Minima.

(11) AC 120–29, as amended, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.

(12) AC 120–35, as amended, Flightcrew Member, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.

(13) AC 120–40, as amended, Airplane Simulator Qualification.

(14) AC 120–41, as amended, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.

(15) AC 120–57, as amended, Surface Movement Guidance and Control System (SMGCS).

(16) AC 150/5300–13, as amended, Airport Design.

(17) AC 150/5340–1, as amended, Standards for Airport Markings.

(18) AC 150/5340–4, as amended, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.

(19) AC 150/5340–19, as amended, Taxiway Centerline Lighting System.

(20) AC 150/5340–24, as amended, Runway and Taxiway Edge Lighting System.

(21) AC 150/5345–28, as amended, Precision Approach Path Indicator (PAPI) Systems.

(22) International Air Transport Association document, ''Flight Simulation Training Device Design and Performance Data Requirements,'' as amended.

(23) AC 25–7, as amended, Flight Test Guide for Certification of Transport Category Airplanes.

(24) AC 23–8, as amended, Flight Test Guide for Certification of Part 23 Airplanes.

(25) International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulation Training Devices, as amended.

(26) Aeroplane Flight Simulation Training Device Evaluation Handbook, Volume I, as amended and Volume II, as amended, The Royal Aeronautical Society, London, UK.

(27) FAA Airman Certification Standards and Practical Test Standards for Airline Transport Pilot, Type Ratings, Commercial Pilot, and Instrument Ratings

(28) The FAA Aeronautical Information Manual (AIM). An electronic version of the AIM is on the Internet at *http://www.faa.gov/atpubs*.

(29) Aeronautical Radio, Inc. (ARINC) document number 436, titled *Guidelines For Electronic Qualification Test Guide* (as amended).

(30) Aeronautical Radio, Inc. (ARINC) document 610, *Guidance for Design and Integration of Aircraft Avionics Equipment in Simulators* (as amended).

END INFORMATION

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2. APPLICABILITY (§§ 60.1 AND 60.2)

BEGIN INFORMATION

No additional regulatory or informational material applies to § 60.1, Applicability, or to § 60.2, Applicability of sponsor rules to persons who are not sponsors and who are engaged in certain unauthorized activities.

END INFORMATION

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3. DEFINITIONS (§ 60.3)

BEGIN INFORMATION

See Appendix F of this part for a list of definitions and abbreviations from part 1 and part 60, including the appropriate appendices of part 60.

END INFORMATION

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4. QUALIFICATION PERFORMANCE STANDARDS (§ 60.4)

BEGIN INFORMATION

No additional regulatory or informational material applies to § 60.4, Qualification Performance Standards.

END INFORMATION

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5. QUALITY MANAGEMENT SYSTEM (§ 60.5)

BEGIN INFORMATION

See Appendix E of this part for additional regulatory and informational material regarding Quality Management Systems.

END INFORMATION

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6. SPONSOR QUALIFICATION REQUIREMENTS (§ 60.7)

BEGIN INFORMATION

a. The intent of the language in § 60.7(b) is to have a specific FFS, identified by the sponsor, used at least once in an FAA-approved flight training program for the airplane simulated during the 12-month period described. The identification of the specific FFS may change from one 12-month period to the next 12-month period as long as the sponsor sponsors and uses at least one FFS at least once during the prescribed period. No minimum number of hours or minimum FFS periods are required.

b. The following examples describe acceptable operational practices:

(1) Example One.

(a) A sponsor is sponsoring a single, specific FFS for its own use, in its own facility or elsewhere—this single FFS forms the basis for the sponsorship. The sponsor uses that FFS at least once in each 12-month period in the sponsor's FAA-approved flight training program for the airplane simulated. This 12-month period is established according to the following schedule:

(i) If the FFS was qualified prior to May 30, 2008, the 12-month period begins on the date of the first continuing qualification evaluation conducted in accordance with § 60.19 after May 30, 2008, and continues for each subsequent 12-month period;

(ii) A device qualified on or after May 30, 2008, will be required to undergo an initial or upgrade evaluation in accordance with § 60.15. Once the initial or upgrade evaluation is complete, the first continuing qualification evaluation will be conducted within 6 months. The 12-month continuing qualification evaluation cycle begins on that date and continues for each subsequent 12-month period.

(b) There is no minimum number of hours of FFS use required.

(c) The identification of the specific FFS may change from one 12-month period to the next 12-month period as long as the sponsor sponsors and uses at least one FFS at least once during the prescribed period.

(2) Example Two.

(a) A sponsor sponsors an additional number of FFSs, in its facility or elsewhere. Each additionally sponsored FFS must be—

(i) Used by the sponsor in the sponsor's FAA-approved flight training program for the airplane simulated (as described in § 60.7(d)(1));

OR

(ii) Used by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the airplane simulated (as described in § 60.7(d)(1)). This 12-month period is established in the same manner as in example one;

OR

(iii) Provided a statement each year from a qualified pilot (after having flown the airplane, not the subject FFS or another FFS, during the preceding 12-month period), stating that the subject FFS's performance and handling qualities represent the airplane (as described in § 60.7(d)(2)). This statement is provided at least once in each 12-month period established in the same manner as in example one.

(b) No minimum number of hours of FFS use is required.

(3) Example Three.

(a) A sponsor in New York (in this example, a Part 142 certificate holder) establishes ''satellite'' training centers in Chicago and Moscow.

(b) The satellite function means that the Chicago and Moscow centers must operate under the New York center's certificate (in accordance with all of the New York center's practices, procedures, and policies; e.g., instructor and/or technician training/checking requirements, record keeping, QMS program).

(c) All of the FFSs in the Chicago and Moscow centers could be dry-leased (i.e., the certificate holder does not have and use FAA-approved flight training programs for the FFSs in the Chicago and Moscow centers) because—

(i) Each FFS in the Chicago center and each FFS in the Moscow center is used at least once each 12-month period by another

FAA certificate holder in that other certificate holder's FAA-approved flight training program for the airplane (as described in §60.7(d)(1));

OR

(ii) A statement is obtained from a qualified pilot (having flown the airplane, not the subject FFS or another FFS, during the preceding 12-month period) stating that the performance and handling qualities of each FFS in the Chicago and Moscow centers represents the airplane (as described in §60.7(d)(2)).

END INFORMATION

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7. ADDITIONAL RESPONSIBILITIES OF THE SPONSOR (§60.9)

BEGIN INFORMATION

The phrase ''as soon as practicable'' in §60.9(a) means without unnecessarily disrupting or delaying beyond a reasonable time the training, evaluation, or experience being conducted in the FFS.

END INFORMATION

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8. FFS USE (§60.11)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.11, Simulator Use.

END INFORMATION

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9. FFS OBJECTIVE DATA REQUIREMENTS (§60.13)

BEGIN QPS REQUIREMENTS

a. Flight test data used to validate FFS performance and handling qualities must have been gathered in accordance with a flight test program containing the following:

(1) A flight test plan consisting of:

(a) The maneuvers and procedures required for aircraft certification and simulation programming and validation.

(b) For each maneuver or procedure—

(i) The procedures and control input the flight test pilot and/or engineer used.

(ii) The atmospheric and environmental conditions.

(iii) The initial flight conditions.

(iv) The airplane configuration, including weight and center of gravity.

(v) The data to be gathered.

(vi) All other information necessary to recreate the flight test conditions in the FFS.

(2) Appropriately qualified flight test personnel.

(3) An understanding of the accuracy of the data to be gathered using appropriate alternative data sources, procedures, and instrumentation that is traceable to a recognized standard as described in Attachment 2, Table A2E of this appendix.

(4) Appropriate and sufficient data acquisition equipment or system(s), including appropriate data reduction and analysis methods and techniques, as would be acceptable to the FAA's Aircraft Certification Service.

b. The data, regardless of source, must be presented as follows:

(1) In a format that supports the FFS validation process.

(2) In a manner that is clearly readable and annotated correctly and completely.

(3) With resolution sufficient to determine compliance with the tolerances set forth in Attachment 2, Table A2A of this appendix.

(4) With any necessary instructions or other details provided, such as yaw damper or throttle position.

(5) Without alteration, adjustments, or bias. Data may be corrected to address known data calibration errors provided that an explanation of the methods used to correct the errors appears in the QTG. The corrected data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation.

c. After completion of any additional flight test, a flight test report must be submitted in support of the validation data. The report must contain sufficient data and rationale to support qualification of the FFS at the level requested.

d. As required by §60.13(f), the sponsor must notify the responsible Flight Standards office when it becomes aware that an addition to, an amendment to, or a revision of data that may relate to FFS performance or handling characteristics is available. The data referred to in this paragraph is data used to validate the performance, handling qualities, or other characteristics of the aircraft, including data related to any relevant changes occurring after the type certificate was issued. The sponsor must—

(1) Within 10 calendar days, notify the responsible Flight Standards office of the existence of this data; and

(2) Within 45 calendar days, notify the responsible Flight Standards office of—

(a) The schedule to incorporate this data into the FFS; or

(b) The reason for not incorporating this data into the FFS.

e. In those cases where the objective test results authorize a ''snapshot test'' or a ''series of snapshot tests'' results in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the "snapshot." The steady state condition must exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snapshot.

END QPS REQUIREMENTS

BEGIN INFORMATION

f. The FFS sponsor is encouraged to maintain a liaison with the manufacturer of the aircraft being simulated (or with the holder of the aircraft type certificate for the aircraft being simulated if the manufacturer is no longer in business), and, if appropriate, with the person having supplied the aircraft data package for the FFS in order to facilitate the notification required by § 60.13(f).

g. It is the intent of the responsible Flight Standards office that for new aircraft entering service, at a point well in advance of preparation of the Qualification Test Guide (QTG), the sponsor should submit to the responsible Flight Standards office for approval, a descriptive document (see Table A2C, Sample Validation Data Roadmap for Airplanes) containing the plan for acquiring the validation data, including data sources. This document should clearly identify sources of data for all required tests, a description of the validity of these data for a specific engine type and thrust rating configuration, and the revision levels of all avionics affecting the performance or flying qualities of the aircraft. Additionally, this document should provide other information, such as the rationale or explanation for cases where data or data parameters are missing, instances where engineering simulation data are used or where flight test methods require further explanations. It should also provide a brief narrative describing the cause and effect of any deviation from data requirements. The aircraft manufacturer may provide this document.

h. There is no requirement for any flight test data supplier to submit a flight test plan or program prior to gathering flight test data. However, the responsible Flight Standards office notes that inexperienced data gatherers often provide data that is irrelevant, improperly marked, or lacking adequate justification for selection. Other problems include inadequate information regarding initial conditions or test maneuvers. The responsible Flight Standards office has been forced to refuse these data submissions as validation data for an FFS evaluation. It is for this reason that the responsible Flight Standards office recommends that any data supplier not previously experienced in this area review the data necessary for programming and for validating the performance of the FFS, and discuss the flight test plan anticipated for acquiring such data with the responsible Flight Standards office well in advance of commencing the flight tests.

i. The responsible Flight Standards office will consider, on a case-by-case basis, whether to approve supplemental validation data derived from flight data recording systems, such as a Quick Access Recorder or Flight Data Recorder.

END INFORMATION

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10. SPECIAL EQUIPMENT AND PERSONNEL REQUIREMENTS FOR QUALIFICATION OF THE FFSS (§ 60.14)

BEGIN INFORMATION

a. In the event that the responsible Flight Standards office determines that special equipment or specifically qualified persons will be required to conduct an evaluation, the responsible Flight Standards office will make every attempt to notify the sponsor at least one (1) week, but in no case less than 72 hours, in advance of the evaluation. Examples of special equipment include spot photometers, flight control measurement devices, and sound analyzers. Examples of specially qualified personnel include individuals specifically qualified to install or use any special equipment when its use is required.

b. Examples of a special evaluation include an evaluation conducted after an FFS is moved, at the request of the TPAA, or as a result of comments received from users of the FFS that raise questions about the continued qualification or use of the FFS.

END INFORMATION

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11. INITIAL (AND UPGRADE) QUALIFICATION REQUIREMENTS (§ 60.15)

BEGIN QPS REQUIREMENTS

a. In order to be qualified at a particular qualification level, the FFS must:

(1) Meet the general requirements listed in Attachment 1 of this appendix;

(2) Meet the objective testing requirements listed in Attachment 2 of this appendix; and

(3) Satisfactorily accomplish the subjective tests listed in Attachment 3 of this appendix.

b. The request described in § 60.15(a) must include all of the following:

(1) A statement that the FFS meets all of the applicable provisions of this part and all applicable provisions of the QPS.

(2) Unless otherwise authorized through prior coordination with the responsible Flight Standards office, a confirmation that

the sponsor will forward to the responsible Flight Standards office the statement described in §60.15(b) in such time as to be received no later than 5 business days prior to the scheduled evaluation and may be forwarded to the responsible Flight Standards office via traditional or electronic means.

(3) A QTG, acceptable to the responsible Flight Standards office, that includes all of the following:

(a) Objective data obtained from traditional aircraft testing or another approved source.

(b) Correlating objective test results obtained from the performance of the FFS as prescribed in the appropriate QPS.

(c) The result of FFS subjective tests prescribed in the appropriate QPS.

(d) A description of the equipment necessary to perform the evaluation for initial qualification and the continuing qualification evaluations.

c. The QTG described in paragraph (a)(3) of this section, must provide the documented proof of compliance with the simulator objective tests in Attachment 2, Table A2A of this appendix.

d. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, to the responsible Flight Standards office for review and approval, and must include, for each objective test:

(1) Parameters, tolerances, and flight conditions;

(2) Pertinent and complete instructions for the conduct of automatic and manual tests;

(3) A means of comparing the FFS test results to the objective data;

(4) Any other information as necessary, to assist in the evaluation of the test results;

(5) Other information appropriate to the qualification level of the FFS.

e. The QTG described in paragraphs (a)(3) and (b) of this section, must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see Attachment 4, Figure A4C, of this appendix for a sample QTG cover page).

(2) [Reserved]

(3) An FFS information page that provides the information listed in this paragraph (see Attachment 4, Figure A4B, of this appendix for a sample FFS information page). For convertible FFSs, the sponsor must submit a separate page for each configuration of the FFS.

(a) The sponsor's FFS identification number or code.

(b) The airplane model and series being simulated.

(c) The aerodynamic data revision number or reference.

(d) The source of the basic aerodynamic model and the aerodynamic coefficient data used to modify the basic model.

(e) The engine model(s) and its data revision number or reference.

(f) The flight control data revision number or reference.

(g) The flight management system identification and revision level.

(h) The FFS model and manufacturer.

(i) The date of FFS manufacture.

(j) The FFS computer identification.

(k) The visual system model and manufacturer, including display type.

(l) The motion system type and manufacturer, including degrees of freedom.

(4) A Table of Contents.

(5) A log of revisions and a list of effective pages.

(6) A list of all relevant data references.

(7) A glossary of terms and symbols used (including sign conventions and units).

(8) Statements of Compliance and Capability (SOCs) with certain requirements.

(9) Recording procedures or equipment required to accomplish the objective tests.

(10) The following information for each objective test designated in Attachment 2, Table A2A, of this appendix as applicable to the qualification level sought:

(a) Name of the test.

(b) Objective of the test.

(c) Initial conditions.

(d) Manual test procedures.

(e) Automatic test procedures (if applicable).

(f) Method for evaluating FFS objective test results.

(g) List of all relevant parameters driven or constrained during the automatically conducted test(s).

(h) List of all relevant parameters driven or constrained during the manually conducted test(s).

(i) Tolerances for relevant parameters.

(j) Source of Validation Data (document and page number).

(k) Copy of the Validation Data (if located in a separate binder, a cross reference for the identification and page number for pertinent data location must be provided).

(l) Simulator Objective Test Results as obtained by the sponsor. Each test result must reflect the date completed and must be clearly labeled as a product of the device being tested.

f. A convertible FFS is addressed as a separate FFS for each model and series airplane to which it will be converted and for the FAA qualification level sought. If a sponsor seeks qualification for two or more models of an airplane type using a convertible FFS, the sponsor must submit a QTG for each airplane model, or a QTG for the first airplane model and a supplement to that QTG for each additional airplane model. The responsible Flight Standards office will conduct evaluations for each airplane model.

g. Form and manner of presentation of objective test results in the QTG:

(1) The sponsor's FFS test results must be recorded in a manner acceptable to the responsible Flight Standards office, that allows easy comparison of the FFS test results to the validation data (e.g., use of a multi-channel recorder, line printer, cross plotting, overlays, transparencies).

(2) FFS results must be labeled using terminology common to airplane parameters as opposed to computer software identifications.

(3) Validation data documents included in a QTG may be photographically reduced only if such reduction will not alter the graphic scaling or cause difficulties in scale interpretation or resolution.

(4) Scaling on graphical presentations must provide the resolution necessary to evaluate the parameters shown in Attachment 2, Table A2A of this appendix.

(5) Tests involving time histories, data sheets (or transparencies thereof) and FFS test results must be clearly marked with appropriate reference points to ensure an accurate comparison between the FFS and the airplane with respect to time. Time histories recorded via a line printer are to be clearly identified for cross plotting on the airplane data. Over-plots must not obscure the reference data.

h. The sponsor may elect to complete the QTG objective and subjective tests at the manufacturer's facility or at the sponsor's training facility (or other sponsor designated location where training will take place). If the tests are conducted at the manufacturer's facility, the sponsor must repeat at least one-third of the tests at the sponsor's training facility in order to substantiate FFS performance. The QTG must be clearly annotated to indicate when and where each test was accomplished. Tests conducted at the manufacturer's facility and at the sponsor's designated training facility must be conducted after the FFS is assembled with systems and sub-systems functional and operating in an interactive manner. The test results must be submitted to the responsible Flight Standards office.

i. The sponsor must maintain a copy of the MQTG at the FFS location.

j. All FFSs for which the initial qualification is conducted after May 30, 2014, must have an electronic MQTG (eMQTG) including all objective data obtained from airplane testing, or another approved source (reformatted or digitized), together with correlating objective test results obtained from the performance of the FFS (reformatted or digitized) as prescribed in this appendix. The eMQTG must also contain the general FFS performance or demonstration results (reformatted or digitized) prescribed in this appendix, and a description of the equipment necessary to perform the initial qualification evaluation and the continuing qualification evaluations. The eMQTG must include the original validation data used to validate FFS performance and handling qualities in either the original digitized format from the data supplier or an electronic scan of the original time-history plots that were provided by the data supplier. A copy of the eMQTG must be provided to the responsible Flight Standards office.

k. All other FFSs not covered in subparagraph "j" must have an electronic copy of the MQTG by May 30, 2014. An electronic copy of the MQTG must be provided to the responsible Flight Standards office. This may be provided by an electronic scan presented in a Portable Document File (PDF), or similar format acceptable to the responsible Flight Standards office.

l. During the initial (or upgrade) qualification evaluation conducted by the responsible Flight Standards office, the sponsor must also provide a person who is a user of the device (e.g., a qualified pilot or instructor pilot with flight time experience in that aircraft) and knowledgeable about the operation of the aircraft and the operation of the FFS.

END QPS REQUIREMENTS

BEGIN INFORMATION

m. Only those FFSs that are sponsored by a certificate holder as defined in Appendix F of this part will be evaluated by the responsible Flight Standards office. However, other FFS evaluations may be conducted on a case-by-case basis as the Administrator deems appropriate, but only in accordance with applicable agreements.

n. The responsible Flight Standards office will conduct an evaluation for each configuration, and each FFS must be evaluated as completely as possible. To ensure a thorough and uniform evaluation, each FFS is subjected to the general simulator requirements in Attachment 1 of this appendix, the objective tests listed in Attachment 2 of this appendix, and the subjective tests listed in Attachment 3 of this appendix. The evaluations described herein will include, but not necessarily be limited to the following:

(1) Airplane responses, including longitudinal and lateral-directional control responses (see Attachment 2 of this appendix);

(2) Performance in authorized portions of the simulated airplane's operating envelope, to include tasks evaluated by the responsible Flight Standards office in the areas of surface operations, takeoff, climb, cruise, descent, approach, and landing as well as abnormal and emergency operations (see Attachment 2 of this appendix);

(3) Control checks (see Attachment 1 and Attachment 2 of this appendix);

(4) Flight deck configuration (see Attachment 1 of this appendix);

(5) Pilot, flight engineer, and instructor station functions checks (see Attachment 1 and Attachment 3 of this appendix);

(6) Airplane systems and sub-systems (as appropriate) as compared to the airplane simulated (see Attachment 1 and Attachment 3 of this appendix);

(7) FFS systems and sub-systems, including force cueing (motion), visual, and aural (sound) systems, as appropriate (see Attachment 1 and Attachment 2 of this appendix); and

(8) Certain additional requirements, depending upon the qualification level sought, including equipment or circumstances that may become hazardous to the occupants. The sponsor may be subject to Occupational Safety and Health Administration requirements.

o. The responsible Flight Standards office administers the objective and subjective tests, which includes an examination of functions. The tests include a qualitative assessment of the FFS by a pilot from the responsible Flight Standards office. The evaluation team leader may assign other qualified personnel to assist in accomplishing the functions examination and/or the objective and subjective tests performed during an evaluation when required.

(1) Objective tests provide a basis for measuring and evaluating FFS performance and determining compliance with the requirements of this part.

(2) Subjective tests provide a basis for:

(a) Evaluating the capability of the FFS to perform over a typical utilization period;

(b) Determining that the FFS satisfactorily simulates each required task;

(c) Verifying correct operation of the FFS controls, instruments, and systems; and

(d) Demonstrating compliance with the requirements of this part.

p. The tolerances for the test parameters listed in Attachment 2 of this appendix reflect the range of tolerances acceptable to the responsible Flight Standards office for FFS validation and are not to be confused with design tolerances specified for FFS manufacture. In making decisions regarding tests and test results, the responsible Flight Standards office relies on the use of operational and engineering judgment in the application of data (including consideration of the way in which the flight test was flown and the way the data was gathered and applied), data presentations, and the applicable tolerances for each test.

q. In addition to the scheduled continuing qualification evaluation, each FFS is subject to evaluations conducted by the responsible Flight Standards office at any time without prior notification to the sponsor. Such evaluations would be accomplished in a normal manner (i.e., requiring exclusive use of the FFS for the conduct of objective and subjective tests and an examination of functions) if the FFS is not being used for flight crewmember training, testing, or checking. However, if the FFS were being used, the evaluation would be conducted in a non-exclusive manner. This non-exclusive evaluation will be conducted by the FFS evaluator accompanying the check airman, instructor, Aircrew Program Designee (APD), or FAA inspector aboard the FFS along with the student(s) and observing the operation of the FFS during the training, testing, or checking activities.

r. Problems with objective test results are handled as follows:

(1) If a problem with an objective test result is detected by the evaluation team during an evaluation, the test may be repeated or the QTG may be amended.

(2) If it is determined that the results of an objective test do not support the level requested but do support a lower level, the responsible Flight Standards office may qualify the FFS at that lower level. For example, if a Level D evaluation is requested and the FFS fails to meet sound test tolerances, it could be qualified at Level C.

s. After an FFS is successfully evaluated, the responsible Flight Standards office issues a Statement of Qualification (SOQ) to the sponsor. The responsible Flight Standards office recommends the FFS to the TPAA, who will approve the FFS for use in a flight training program. The SOQ will be issued at the satisfactory conclusion of the initial or continuing qualification evaluation and will list the tasks for which the FFS is qualified, referencing the tasks described in Table A1B in Attachment 1 of this appendix. However, it is the sponsor's responsibility to obtain TPAA approval prior to using the FFS in an FAA-approved flight training program.

t. Under normal circumstances, the responsible Flight Standards office establishes a date for the initial or upgrade evaluation within ten (10) working days after determining that a complete QTG is acceptable. Unusual circumstances may warrant establishing an evaluation date before this determination is made. A sponsor may schedule an evaluation date as early as 6 months in advance. However, there may be a delay of 45 days or more in rescheduling and completing the evaluation if the sponsor is unable to meet the scheduled date. See Attachment 4 of this appendix, Figure A4A, Sample Request for Initial, Upgrade, or Reinstatement Evaluation.

u. The numbering system used for objective test results in the QTG should closely follow the numbering system set out in Attachment 2 of this appendix, FFS Objective Tests, Table A2A.

v. Contact the responsible Flight Standards office for additional information regarding the preferred qualifications of pilots used to meet the requirements of § 60.15(d).

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w. Examples of the exclusions for which the FFS might not have been subjectively tested by the sponsor or the responsible Flight Standards office and for which qualification might not be sought or granted, as described in §60.15(g)(6), include windshear training and circling approaches.

END INFORMATION

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12. ADDITIONAL QUALIFICATIONS FOR A CURRENTLY QUALIFIED FFS (§60.16)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.16, Additional Qualifications for a Currently Qualified FFS.

END INFORMATION

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13. PREVIOUSLY QUALIFIED FFSS (§60.17)

BEGIN QPS REQUIREMENTS

a. In instances where a sponsor plans to remove an FFS from active status for a period of less than two years, the following procedures apply:

(1) The responsible Flight Standards office must be notified in writing and the notification must include an estimate of the period that the FFS will be inactive;

(2) Continuing Qualification evaluations will not be scheduled during the inactive period;

(3) The responsible Flight Standards office will remove the FFS from the list of qualified FSTDs on a mutually established date not later than the date on which the first missed continuing qualification evaluation would have been scheduled;

(4) Before the FFS is restored to qualified status, it must be evaluated by the responsible Flight Standards office. The evaluation content and the time required to accomplish the evaluation is based on the number of continuing qualification evaluations and sponsor-conducted quarterly inspections missed during the period of inactivity.

(5) The sponsor must notify the responsible Flight Standards office of any changes to the original scheduled time out of service;

b. Simulators qualified prior to May 31, 2016, are not required to meet the general simulation requirements, the objective test requirements or the subjective test requirements of attachments 1, 2, and 3 of this appendix as long as the simulator continues to meet the test requirements contained in the MQTG developed under the original qualification basis.

c. After May 30, 2009, each visual scene or airport model beyond the minimum required for the FFS qualification level that is installed in and available for use in a qualified FFS must meet the requirements described in attachment 3 of this appendix.

d. Simulators qualified prior to May 31, 2016, may be updated. If an evaluation is deemed appropriate or necessary by the responsible Flight Standards office after such an update, the evaluation will not require an evaluation to standards beyond those against which the simulator was originally qualified.

e. Other certificate holders or persons desiring to use an FFS may contract with FFS sponsors to use FFSs previously qualified at a particular level for an airplane type and approved for use within an FAA-approved flight training program. Such FFSs are not required to undergo an additional qualification process, except as described in §60.16.

f. Each FFS user must obtain approval from the appropriate TPAA to use any FFS in an FAA-approved flight training program.

g. The intent of the requirement listed in §60.17(b), for each FFS to have a SOQ within 6 years, is to have the availability of that statement (including the configuration list and the limitations to authorizations) to provide a complete picture of the FFS inventory regulated by the FAA. The issuance of the statement will not require any additional evaluation or require any adjustment to the evaluation basis for the FFS.

h. Downgrading of an FFS is a permanent change in qualification level and will necessitate the issuance of a revised SOQ to reflect the revised qualification level, as appropriate. If a temporary restriction is placed on an FFS because of a missing, malfunctioning, or inoperative component or ongoing repairs, the restriction is not a permanent change in qualification level. Instead, the restriction is temporary and is removed when the reason for the restriction has been resolved.

i. The responsible Flight Standards office will determine the evaluation criteria for an FFS that has been removed from active status. The criteria will be based on the number of continuing qualification evaluations and quarterly inspections missed during the period of inactivity. For example, if the FFS were out of service for a 1 year period, it would be necessary to complete the entire QTG, since all of the quarterly evaluations would have been missed. The responsible Flight Standards office will also consider how the FFS was stored, whether parts were removed from the FFS and whether the FFS was disassembled.

j. The FFS will normally be requalified using the FAA-approved MQTG and the criteria that was in effect prior to its removal from qualification. However, inactive periods of 2 years or more will require requalification under the standards in effect and current at the time of requalification.

END INFORMATION

14. INSPECTION, CONTINUING QUALIFICATION EVALUATION, AND MAINTENANCE REQUIREMENTS (§60.19)

BEGIN QPS REQUIREMENTS

a. The sponsor must conduct a minimum of four evenly spaced inspections throughout the year. The objective test sequence and content of each inspection must be developed by the sponsor and must be acceptable to the responsible Flight Standards office.

b. The description of the functional preflight check must be contained in the sponsor's QMS.

c. Record "functional preflight" in the FFS discrepancy log book or other acceptable location, including any item found to be missing, malfunctioning, or inoperative.

d. During the continuing qualification evaluation conducted by the responsible Flight Standards office, the sponsor must also provide a person knowledgeable about the operation of the aircraft and the operation of the FFS.

e. The responsible Flight Standards office will conduct continuing qualification evaluations every 12 months unless:

(1) The responsible Flight Standards office becomes aware of discrepancies or performance problems with the device that warrants more frequent evaluations; or

(2) The sponsor implements a QMS that justifies less frequent evaluations. However, in no case shall the frequency of a continuing qualification evaluation exceed 36 months.

END QPS REQUIREMENTS

BEGIN INFORMATION

f. The sponsor's test sequence and the content of each quarterly inspection required in §60.19(a)(1) should include a balance and a mix from the objective test requirement areas listed as follows:

(1) Performance.

(2) Handling qualities.

(3) Motion system (where appropriate).

(4) Visual system (where appropriate).

(5) Sound system (where appropriate).

(6) Other FFS systems.

g. If the evaluator plans to accomplish specific tests during a normal continuing qualification evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; but not less than 72 hours. Examples of such tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests.

h. The continuing qualification evaluations, described in §60.19(b), will normally require 4 hours of FFS time. However, flexibility is necessary to address abnormal situations or situations involving aircraft with additional levels of complexity (e.g., computer controlled aircraft). The sponsor should anticipate that some tests may require additional time. The continuing qualification evaluations will consist of the following:

(1) Review of the results of the quarterly inspections conducted by the sponsor since the last scheduled continuing qualification evaluation.

(2) A selection of approximately 8 to 15 objective tests from the MQTG that provide an adequate opportunity to evaluate the performance of the FFS. The tests chosen will be performed either automatically or manually and should be able to be conducted within approximately one-third (1/3) of the allotted FFS time.

(3) A subjective evaluation of the FFS to perform a representative sampling of the tasks set out in attachment 3 of this appendix. This portion of the evaluation should take approximately two-thirds (2/3) of the allotted FFS time.

(4) An examination of the functions of the FFS may include the motion system, visual system, sound system, instructor operating station, and the normal functions and simulated malfunctions of the airplane systems. This examination is normally accomplished simultaneously with the subjective evaluation requirements.

END INFORMATION

15. LOGGING FFS DISCREPANCIES (§60.20)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.20. Logging FFS Discrepancies.

END INFORMATION

16. INTERIM QUALIFICATION OF FFSS FOR NEW AIRPLANE TYPES OR MODELS (§60.21)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.21, Interim Qualification of FFSs for New Airplane Types or Models.

END INFORMATION

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17. MODIFICATIONS TO FFSS (§ 60.23)

BEGIN QPS REQUIREMENTS

a. The notification described in § 60.23(c)(2) must include a complete description of the planned modification, with a description of the operational and engineering effect the proposed modification will have on the operation of the FFS and the results that are expected with the modification incorporated.

b. Prior to using the modified FFS:

(1) All the applicable objective tests completed with the modification incorporated, including any necessary updates to the MQTG (e.g., accomplishment of FSTD Directives) must be acceptable to the responsible Flight Standards office; and

(2) The sponsor must provide the responsible Flight Standards office with a statement signed by the MR that the factors listed in § 60.15(b) are addressed by the appropriate personnel as described in that section.

END QPS REQUIREMENTS

BEGIN INFORMATION

FSTD Directives are considered modifications of an FFS. See Attachment 4 of this appendix for a sample index of effective FSTD Directives. See Attachment 6 of this appendix for a list of all effective FSTD Directives applicable to Airplane FFSs.

END INFORMATION

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18. OPERATION WITH MISSING, MALFUNCTIONING, OR INOPERATIVE COMPONENTS (§ 60.25)

BEGIN INFORMATION

a. The sponsor's responsibility with respect to § 60.25(a) is satisfied when the sponsor fairly and accurately advises the user of the current status of an FFS, including any missing, malfunctioning, or inoperative (MMI) component(s).

b. It is the responsibility of the instructor, check airman, or representative of the administrator conducting training, testing, or checking to exercise reasonable and prudent judgment to determine if any MMI component is necessary for the satisfactory completion of a specific maneuver, procedure, or task.

c. If the 29th or 30th day of the 30-day period described in § 60.25(b) is on a Saturday, a Sunday, or a holiday, the FAA will extend the deadline until the next business day.

d. In accordance with the authorization described in § 60.25(b), the sponsor may develop a discrepancy prioritizing system to accomplish repairs based on the level of impact on the capability of the FFS. Repairs having a larger impact on FFS capability to provide the required training, evaluation, or flight experience will have a higher priority for repair or replacement.

END INFORMATION

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19. AUTOMATIC LOSS OF QUALIFICATION AND PROCEDURES FOR RESTORATION OF QUALIFICATION (§ 60.27)

BEGIN INFORMATION

If the sponsor provides a plan for how the FFS will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems; routine replacement of hydraulic fluid; control of the environmental factors in which the FFS is to be maintained) there is a greater likelihood that the responsible Flight Standards office will be able to determine the amount of testing required for requalification.

END INFORMATION

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20. OTHER LOSSES OF QUALIFICATION AND PROCEDURES FOR RESTORATION OF QUALIFICATION (§ 60.29)

BEGIN INFORMATION

If the sponsor provides a plan for how the FFS will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems; routine replacement of hydraulic fluid; control of the environmental factors in which the FFS is to be maintained) there is a greater likelihood that the responsible Flight Standards office will be able to determine the amount of testing required for requalification.

END INFORMATION

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21. RECORDKEEPING AND REPORTING (§ 60.31)

BEGIN QPS REQUIREMENTS

a. FFS modifications can include hardware or software changes. For FFS modifications involving software programming changes, the record required by § 60.31(a)(2) must consist of the name of the aircraft system software, aerodynamic model, or engine model change, the date of the change, a summary of the change, and the reason for the change.

b. If a coded form for record keeping is used, it must provide for the preservation and retrieval of information with appropriate security or controls to prevent the inappropriate alteration of such records after the fact.

END QPS REQUIREMENTS

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22. APPLICATIONS, LOGBOOKS, REPORTS, AND RECORDS: FRAUD, FALSIFICATION, OR INCORRECT STATEMENTS (§60.33)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.33, Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements.

23. SPECIFIC FFS COMPLIANCE REQUIREMENTS (§60.35)

No additional regulatory or informational material applies to §60.35, Specific FFS Compliance Requirements.

24. [RESERVED]

25. FFS QUALIFICATION ON THE BASIS OF A BILATERAL AVIATION SAFETY AGREEMENT (BASA) (§60.37)

No additional regulatory or informational material applies to §60.37, FFS Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA).

END INFORMATION

ATTACHMENT 1 TO APPENDIX A TO PART 60—GENERAL SIMULATOR REQUIREMENTS

BEGIN QPS REQUIREMENTS

1. REQUIREMENTS

a. Certain requirements included in this appendix must be supported with an SOC as defined in Appendix F, which may include objective and subjective tests. The requirements for SOCs are indicated in the ‘‘General Simulator Requirements’’ column in Table A1A of this appendix.

b. Table A1A describes the requirements for the indicated level of FFS. Many devices include operational systems or functions that exceed the requirements outlined in this section. However, all systems will be tested and evaluated in accordance with this appendix to ensure proper operation.

END QPS REQUIREMENTS

BEGIN INFORMATION

2. DISCUSSION

a. This attachment describes the general simulator requirements for qualifying an airplane FFS. The sponsor should also consult the objective tests in Attachment 2 of this appendix and the examination of functions and subjective tests listed in Attachment 3 of this appendix to determine the complete requirements for a specific level simulator.

b. The material contained in this attachment is divided into the following categories:

(1) General flight deck configuration.
(2) Simulator programming.
(3) Equipment operation.
(4) Equipment and facilities for instructor/evaluator functions.
(5) Motion system.
(6) Visual system.
(7) Sound system.

c. Table A1A provides the standards for the General Simulator Requirements.

d. Table A1B provides the tasks that the sponsor will examine to determine whether the FFS satisfactorily meets the requirements for flight crew training, testing, and experience, and provides the tasks for which the simulator may be qualified.

e. Table A1C provides the functions that an instructor/check airman must be able to control in the simulator.

f. It is not required that all of the tasks that appear on the List of Qualified Tasks (part of the SOQ) be accomplished during the initial or continuing qualification evaluation.

END INFORMATION

Table A1A – Minimum Simulator Requirements

QPS REQUIREMENTS						INFORMATION
Entry Number	General Simulator Requirements	Simulator Levels A	B	C	D	Notes
1. General Flight Deck Configuration.						
1.a.	The simulator must have a flight deck that is a replica of the airplane simulated with controls, equipment, observable flight deck indicators, circuit breakers, and bulkheads properly located, functionally accurate and replicating the airplane. The direction of movement of controls and switches must be identical to the airplane. Pilot seats must allow the occupant to achieve the design "eye position" established for the airplane being simulated. Equipment for the operation of the flight deck windows must be included, but the actual windows need not be operable. Additional equipment such as fire axes, extinguishers, and spare light bulbs must be available in the FFS but may be relocated to a suitable location as near as practical to the original position. Fire axes, landing gear pins, and any similar purpose instruments need only be represented in silhouette. The use of electronically displayed images with physical overlay or masking for simulator instruments and/or instrument panels is acceptable provided: (1) All instruments and instrument panel layouts are dimensionally correct with differences, if any, being imperceptible to the pilot; (2) Instruments replicate those of the airplane including full instrument functionality and embedded logic; (3) Instruments displayed are free of quantization (stepping); (4) Instrument display characteristics replicate those of the airplane including: resolution, colors, luminance, brightness, fonts, fill patterns, line styles and symbology; (5) Overlay or masking, including bezels and bugs, as applicable, replicates the airplane panel(s); (6) Instrument controls and switches replicate and operate with the same technique, effort, travel and in the same direction as those in the airplane;	X	X	X	X	For simulator purposes, the flight deck consists of all that space forward of a cross section of the flight deck at the most extreme aft setting of the pilots' seats, including additional required crewmember duty stations and those required bulkheads aft of the pilot seats. For clarification, bulkheads containing only items such as landing gear pin storage compartments, fire axes and extinguishers, spare light bulbs, and aircraft document pouches are not considered essential and may be omitted.

	(7) Instrument lighting replicates that of the airplane and is operated from the FSTD control for that lighting and, if applicable, is at a level commensurate with other lighting operated by that same control; and (8) As applicable, instruments must have faceplates that replicate those in the airplane; and Level C and Level D only; (1) The display image of any three dimensional instrument, such as an electro-mechanical instrument, should appear to have the same three dimensional depth as the replicated instrument. The appearance of the simulated instrument, when viewed from the principle operator's angle, should replicate that of the actual airplane instrument. Any instrument reading inaccuracy due to viewing angle and parallax present in the actual airplane instrument should be duplicated in the simulated instrument display image. Viewing angle error and parallax must be minimized on shared instruments such and engine displays and standby indicators.			X	X	
1.b.	Those circuit breakers that affect procedures or result in observable flight deck indications must be properly located and functionally accurate.	X	X	X	X	
2. Programming.						
2.a.	A flight dynamics model that accounts for various combinations of drag and thrust normally encountered in flight must correspond to actual flight conditions, including the effect of change in airplane attitude, thrust, drag, altitude, temperature, gross weight, moments of inertia, center of gravity location, and configuration. An SOC is required.	X	X	X	X	The SOC should include a range of tabulated target values to enable a demonstration of the mass properties model to be conducted from the instructor's station. The data at a minimum should contain 3 weight conditions including zero fuel weight and maximum taxi weight with a least 2 different combinations of zero fuel weight, fuel weight and payload for each condition.
	For Level C and Level D simulators, the effects of pitch attitude and of fuel slosh on the aircraft center of gravity must be simulated.			X	X	
2.b.	The simulator must have the computer capacity, accuracy, resolution, and dynamic response needed to meet the qualification level sought. An SOC is required.	X	X	X	X	

2.c.	Surface operations must be represented to the extent that allows turns within the confines of the runway and adequate controls on the landing and roll-out from a crosswind approach to a landing.	X				
2.d.	Ground handling and aerodynamic programming must include the following:					
2.d.1.	Ground effect.		X	X	X	Ground effect includes modeling that accounts for roundout, flare, touchdown, lift, drag, pitching moment, trim, and power while in ground effect.
2.d.2.	Ground reaction. Ground reaction modeling must produce the appropriate effects during bounced or skipped landings, including the effects and indications of ground contact due to landing in an abnormal aircraft attitude (e.g. tailstrike or nosewheel contact). An SOC is required.		X	X	X	Ground reaction includes modeling that accounts for strut deflections, tire friction, and side forces. This is the reaction of the airplane upon contact with the runway during landing, and may differ with changes in factors such as gross weight, airspeed, or rate of descent on touchdown.
2.d.3.	Ground handling characteristics, including aerodynamic and ground reaction modeling including steering inputs, operations with crosswind, braking, thrust reversing, deceleration, and turning radius. Aerodynamic and ground reaction modeling to support training in crosswinds and gusting crosswinds up to the aircraft's maximum demonstrated crosswind component. Realistic gusting crosswind profiles must be available to the instructors that have been tuned in intensity and variation to require pilot intervention to avoid runway departure during takeoff or landing roll. An SOC is required describing source data used to construct gusting crosswind profiles.		X	X X	X X	In developing gust models for use in training, the FSTD sponsor should coordinate with the data provider to ensure that the gust models do not exceed the capabilities of the aerodynamic and ground models.
2.e.	If the aircraft being simulated is one of the aircraft listed in § 121.358, Low-altitude windshear system equipment requirements, the simulator must employ windshear models that provide training for recognition of windshear			X	X	If desired, Level A and B simulators may qualify for windshear training by meeting these standards; see

	phenomena and the execution of recovery procedures. Models must be available to the instructor/evaluator for the following critical phases of flight: (1) Prior to takeoff rotation; (2) At liftoff; (3) During initial climb; and (4) On final approach, below 500 ft AGL. The QTG must reference the FAA Windshear Training Aid or present alternate airplane related data, including the implementation method(s) used. If the alternate method is selected, wind models from the Royal Aerospace Establishment (RAE), the Joint Airport Weather Studies (JAWS) Project and other recognized sources may be implemented, but must be supported and properly referenced in the QTG. Only those simulators meeting these requirements may be used to satisfy the training requirements of part 121 pertaining to a certificate holder's approved low-altitude windshear flight training program as described in § 121.409. The addition of realistic levels of turbulence associated with each required windshear profile must be available and selectable to the instructor. In addition to the four basic windshear models required for qualification, at least two additional "complex" windshear models must be available to the instructor which represent the complexity of actual windshear encounters. These models must be available in the takeoff and landing configurations and must consist of independent variable winds in multiple simultaneous components. The Windshear Training Aid provides two such example "complex" windshear models that may be used to satisfy this requirement.					Attachment 5 of this appendix. Windshear models may consist of independent variable winds in multiple simultaneous components. The FAA Windshear Training Aid presents one acceptable means of compliance with simulator wind model requirements. The simulator should employ a method to ensure the required survivable and non-survivable windshear scenarios are repeatable in the training environment.
2.f.	The simulator must provide for manual and automatic testing of simulator hardware and software programming to determine compliance with simulator objective tests as prescribed in Attachment 2 of this appendix. An SOC is required.			**X**	**X**	Automatic "flagging" of out-of-tolerance situations is encouraged.
2.g.	Relative responses of the motion system, visual system, and flight deck instruments, measured by latency tests or transport delay tests. Motion onset should occur before the start of the visual scene change (the start of the scan of the first video field containing different information) but must occur before the end of the scan of that video field. Instrument response may not occur prior to motion onset. Test results must be within the following limits:					The intent is to verify that the simulator provides instrument, motion, and visual cues that are, within the stated time delays, like the airplane responses. For airplane

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						response, acceleration in the appropriate, corresponding rotational axis is preferred.
2.g.1.	300 milliseconds of the airplane response.	X	X			
2.g.2.	100 milliseconds of the airplane response (motion and instrument cues) 120 milliseconds of the airplane response (visual system cues)			X	X	
2.h.	The simulator must accurately reproduce the following runway conditions: (1) Dry; (2) Wet; (3) Icy; (4) Patchy Wet; (5) Patchy Icy; and (6) Wet on Rubber Residue in Touchdown Zone. An SOC is required.			X	X	
2.i.	The simulator must simulate: (1) brake and tire failure dynamics, including antiskid failure; and (2) decreased brake efficiency due to high brake temperatures, if applicable. An SOC is required.			X	X	Simulator pitch, side loading, and directional control characteristics should be representative of the airplane.
2.j.	Engine and Airframe Icing Modeling that includes the effects of icing, where appropriate, on the airframe, aerodynamics, and the engine(s). Icing models must simulate the aerodynamic degradation effects of ice accretion on the airplane lifting surfaces including loss of lift, decrease in stall angle of attack, change in pitching moment, decrease in control effectiveness, and changes in control forces in addition to any overall increase in drag. Aircraft systems (such as the stall protection system and autoflight system) must respond properly to ice accretion consistent with the simulated aircraft. Aircraft OEM data or other acceptable analytical methods must be utilized to develop ice accretion models. Acceptable analytical methods may include wind tunnel analysis and/or engineering analysis of the aerodynamic effects of icing on the lifting surfaces coupled with tuning and supplemental subjective assessment by a subject matter expert pilot.			X	X	SOC should be provided describing the effects which provide training in the specific skills required for recognition of icing phenomena and execution of recovery. The SOC should describe the source data and any analytical methods used to develop ice accretion models including verification that these effects have been tested. Icing effects simulation models are only required for those

	SOC and tests required. See objective testing requirements (Attachment 2, test 2.i.).					airplanes authorized for operations in icing conditions. See Attachment 7 of this Appendix for further guidance material.
2.k.	The aerodynamic modeling in the simulator must include: (1) Low-altitude level-flight ground effect; (2) Mach effect at high altitude; (3) Normal and reverse dynamic thrust effect on control surfaces; (4) Aeroelastic representations; and (5) Nonlinearities due to sideslip. An SOC is required and must include references to computations of aeroelastic representations and of nonlinearities due to sideslip.				**X**	See Attachment 2 of this appendix, paragraph 5, for further information on ground effect.
2.l.	The simulator must have aerodynamic and ground reaction modeling for the effects of reverse thrust on directional control, if applicable. An SOC is required.		**X**	**X**	**X**	
2.m.	High Angle of Attack Modeling Aerodynamic stall modeling that includes degradation in static/dynamic lateral-directional stability, degradation in control response (pitch, roll, and yaw), uncommanded roll response or roll-off requiring significant control deflection to counter, apparent randomness or non-repeatability, changes in pitch stability, Mach effects, and stall buffet, as appropriate to the aircraft type. The aerodynamic model must incorporate an angle of attack and sideslip range to support the training tasks. At a minimum, the model must support an angle of attack range to ten degrees beyond the stall identification angle of attack. The stall identification angle of attack is defined as the point where the behavior of the airplane gives the pilot a clear and distinctive indication through the inherent flight characteristics or the characteristics resulting from the operation of a stall identification device (e.g., a stick pusher) that the airplane has stalled.			**X**	**X**	The requirements in this section only apply to those FSTDs that are qualified for full stall training tasks. Sponsors may elect to not qualify an FSTD for full stall training tasks; however, the FSTD's qualification will be restricted to approach to stall training tasks that terminate at the activation of the stall warning system. Specific guidance should be available to the instructor which clearly communicates the flight configurations and stall maneuvers that have been

	The model must be capable of capturing the variations seen in the stall characteristics of the airplane (e.g., the presence or absence of a pitch break, deterrent buffet, or other indications of a stall where present on the aircraft). The aerodynamic modeling must support stall training maneuvers in the following flight conditions: (1) Stall entry at wings level (1g); (2) Stall entry in turning flight of at least 25° bank angle (accelerated stall); (3) Stall entry in a power-on condition (required only for propeller driven aircraft); and (4) Aircraft configurations of second segment climb, high altitude cruise (near performance limited condition), and approach or landing. A Statement of Compliance (SOC) is required which describes the aerodynamic modeling methods, validation, and checkout of the stall characteristics of the FSTD. The SOC must also include verification that the FSTD has been evaluated by a subject matter expert pilot acceptable to the FAA. See Attachment 7 of this Appendix for detailed requirements. Where known limitations exist in the aerodynamic model for particular stall maneuvers (such as aircraft configurations and stall entry methods), these limitations must be declared in the required SOC. FSTDs qualified for full stall training tasks must also meet the instructor operating station (IOS) requirements for upset prevention and recovery training (UPRT) tasks as described in section 2.n. of this table. See Attachment 7 of this Appendix for additional requirements.					evaluated in the FSTD for use in training. See Attachment 7 of this Appendix for additional guidance material.
2.n.	Upset Prevention and Recovery Training (UPRT). Aerodynamics Evaluation: The simulator must be evaluated for specific upset recovery maneuvers for the purpose of determining that the combination of angle of attack and sideslip does not exceed the range of flight test validated data or wind tunnel/analytical data while performing the recovery maneuver. The following minimum set of required upset recovery maneuvers must be evaluated in this manner and made available to the instructor/evaluator. Other upset recovery scenarios as developed by the FSTD sponsor must be evaluated in the same manner:			**X**	**X**	This section generally applies to the qualification of airplane upset recovery training maneuvers or unusual attitude training maneuvers that exceed one or more of the following conditions: ▪ Pitch attitude greater than 25 degrees, nose up

<table>
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<td>(1) A nose-high, wings level aircraft upset;
(2) A nose-low aircraft upset; and
(3) A high bank angle aircraft upset.

Upset Scenarios: IOS selectable dynamic airplane upsets must provide guidance to the instructor concerning the method used to drive the FSTD into an upset condition, including any malfunction or degradation in the FSTD's functionality required to initiate the upset. The unrealistic degradation of simulator functionality (such as degrading flight control effectiveness) to drive an airplane upset is generally not acceptable unless used purely as a tool for repositioning the FSTD with the pilot out of the loop.

Instructor Operating System (IOS): The simulator must have a feedback mechanism in place to notify the instructor/evaluator when the simulator's validated aerodynamic envelope and aircraft operating limits have been exceeded during an upset recovery training task. This feedback mechanism must include:

(1) FSTD validation envelope. This must be in the form of an alpha/beta envelope (or equivalent method) depicting the "confidence level" of the aerodynamic model depending on the degree of flight validation or source of predictive methods The envelopes must provide the instructor real-time feedback on the simulation during a maneuver. There must be a minimum of a flaps up and flaps down envelope available;
(2) Flight control inputs. This must enable the instructor to assess the pilot's flight control displacements and forces (including fly-by-wire as appropriate); and
(3) Airplane operational limits. This must display the aircraft operating limits during the maneuver as applicable for the configuration of the airplane.

Statement of Compliance (SOC): An SOC is required that defines the source data used to construct the FSTD validation envelope. The SOC must also verify that each upset prevention and recovery feature programmed at the instructor station and the associated training maneuver has been evaluated by a suitably qualified pilot using methods described in this section. The statement must confirm that the recovery maneuver can be performed such</td>
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<td>▪ Pitch attitude greater than 10 degrees, nose down
▪ Bank angle greater than 45 degrees
▪ Flight at airspeeds inappropriate for conditions.

FSTDs used to conduct upset recovery maneuvers at angles of attack above the stall warning system activation must meet the requirements for high angle of attack modeling as described in section 2.m.

Special consideration should be given to the motion system response during upset prevention and recovery maneuvers. Notwithstanding the limitations of simulator motion, specific emphasis should be placed on tuning out motion system responses.

Consideration should be taken with flight envelope protected airplanes as artificially positioning the airplane to a specified attitude may incorrectly initialize flight control laws.

See Attachment 7 of this Appendix for further guidance material.</td>
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	that the FSTD does not exceed the FSTD validation envelope, or when exceeded, that it is within the realm of confidence in the simulation accuracy.					
3. Equipment Operation.						
3.a.	All relevant instrument indications involved in the simulation of the airplane must automatically respond to control movement or external disturbances to the simulated airplane; e.g., turbulence or windshear. Numerical values must be presented in the appropriate units. For Level C and Level D simulators, instrument indications must also respond to effects resulting from icing.	X	X	X	X	
3.b.	Communications, navigation, caution, and warning equipment must be installed and operate within the tolerances applicable for the airplane. Instructor control of internal and external navigational aids. Navigation aids must be usable within range or line-of-sight without restriction, as applicable to the geographic area.	X	X	X	X	See Attachment 3 of this appendix for further information regarding long-range navigation equipment.
3.b.1.	Complete navigation database for at least 3 airports with corresponding precision and non-precision approach procedures, including navigational database updates.			X	X	
3.b.2.	Complete navigation database for at least 1 airport with corresponding precision and non-precision approach procedures, including navigational database updates.	X	X			
3.c.	Simulated airplane systems must operate as the airplane systems operate under normal, abnormal, and emergency operating conditions on the ground and in flight. Once activated, proper systems operation must result from system management by the crew member and not require any further input from the instructor's controls.	X	X	X	X	Airplane system operation should be predicated on, and traceable to, the system data supplied by the airplane manufacturer, original equipment manufacturer or alternative approved data for the airplane system or component. At a minimum, alternate approved data should validate the operation of all normal, abnormal, and emergency operating procedures and

						training tasks the FSTD is qualified to conduct.
3.d.	The simulator must provide pilot controls with control forces and control travel that correspond to the simulated airplane. The simulator must also react in the same manner as in the airplane under the same flight conditions. Control systems must replicate airplane operation for the normal and any non-normal modes including back-up systems and should reflect failures of associated systems. Appropriate cockpit indications and messages must be replicated.	**X**	**X**	**X**	**X**	
3.e.	Simulator control feel dynamics must replicate the airplane. This must be determined by comparing a recording of the control feel dynamics of the simulator to airplane measurements. For initial and upgrade qualification evaluations, the control dynamic characteristics must be measured and recorded directly from the flight deck controls, and must be accomplished in takeoff, cruise, and landing flight conditions and configurations.			**X**	**X**	
3.f.	For aircraft equipped with a stick pusher system, control forces, displacement, and surface position must correspond to that of the airplane being simulated. A Statement of Compliance (SOC) is required verifying that the stick pusher system has been modeled, programmed, and validated using the aircraft manufacturer's design data or other acceptable data source. The SOC must address, at a minimum, stick pusher activation and cancellation logic as well as system dynamics, control displacement and forces as a result of the stick pusher activation. Tests required.			**X**	**X**	See Appendix A, Table A2A, test 2.a.10 (stick pusher system force calibration) for objective testing requirements. The requirements in this section only apply to those FSTDs that are qualified for full stall training tasks.
4. Instructor or Evaluator Facilities.						
4.a.	In addition to the flight crewmember stations, the simulator must have at least two suitable seats for the instructor/check airman and FAA inspector. These seats must provide adequate vision to the pilot's panel and forward windows. All seats other than flight crew seats need not represent those found in the airplane, but must be adequately secured to the floor and equipped with similar positive restraint devices.	**X**	**X**	**X**	**X**	The responsible Flight Standards office will consider alternatives to this standard for additional seats based on unique flight deck configurations.
4.b.	The simulator must have controls that enable the instructor/evaluator to control all required system variables and insert all abnormal or emergency conditions into the simulated airplane systems as described in the sponsor's	**X**	**X**	**X**	**X**	

	FAA-approved training program; or as described in the relevant operating manual as appropriate.					
4.c.	The simulator must have instructor controls for all environmental effects expected to be available at the IOS; e.g., clouds, visibility, icing, precipitation, temperature, storm cells and microbursts, turbulence, and intermediate and high altitude wind speed and direction.	**X**	**X**	**X**	**X**	
4.d.	The simulator must provide the instructor or evaluator the ability to present ground and air hazards.			**X**	**X**	For example, another airplane crossing the active runway or converging airborne traffic.
5. Motion System.						
5.a.	The simulator must have motion (force) cues perceptible to the pilot that are representative of the motion in an airplane.	**X**	**X**	**X**	**X**	For example, touchdown cues should be a function of the rate of descent (RoD) of the simulated airplane.
5.b.	The simulator must have a motion (force cueing) system with a minimum of three degrees of freedom (at least pitch, roll, and heave). An SOC is required.	**X**	**X**			
5.c.	The simulator must have a motion (force cueing) system that produces cues at least equivalent to those of a six-degrees-of-freedom, synergistic platform motion system (i.e., pitch, roll, yaw, heave, sway, and surge). An SOC is required.			**X**	**X**	
5.d.	The simulator must provide for the recording of the motion system response time. An SOC is required.	**X**	**X**	**X**	**X**	
5.e.	The simulator must provide motion effects programming to include:					
5.e.1.	(1) Thrust effect with brakes set; (2) Runway rumble, oleo deflections, effects of ground speed, uneven runway, centerline lights, and taxiway characteristics; (3) Buffets on the ground due to spoiler/speedbrake extension and thrust reversal; (4) Bumps associated with the landing gear; (5) Buffet during extension and retraction of landing gear; (6) Buffet in the air due to flap and spoiler/speedbrake extension; (7) Approach-to-stall buffet and stall buffet (where applicable);		**X**	**X**	**X**	If there are known flight conditions where buffet is the first indication of the stall, or where no stall buffet occurs, this characteristic should be included in the model.

	(8) Representative touchdown cues for main and nose gear; (9) Nosewheel scuffing, if applicable; (10) Mach and maneuver buffet; (11) Engine failures, malfunctions, and engine damage (12) Tail and pod strike;					
5.e.2.	(13) Taxiing effects such as lateral and directional cues resulting from steering and braking inputs; (14) Buffet due to atmospheric disturbances (e.g. buffets due to turbulence, gusting winds, storm cells, windshear, etc.) in three linear axes (isotropic); (15) Tire failure dynamics; and (16) Other significant vibrations, buffets and bumps that are not mentioned above (e.g. RAT), or checklist items such as motion effects due to pre-flight flight control inputs.			**X**	**X**	
5.f.	The simulator must provide characteristic motion vibrations that result from operation of the airplane if the vibration marks an event or airplane state that can be sensed in the flight deck.				**X**	The simulator should be programmed and instrumented in such a manner that the characteristic buffet modes can be measured and compared to airplane data.
6. Visual System.						
6.a.	The simulator must have a visual system providing an out-of-the-flight deck view.	**X**	**X**	**X**	**X**	
6.b.	The simulator must provide a continuous collimated field-of-view of at least 45° horizontally and 30° vertically per pilot seat or the number of degrees necessary to meet the visual ground segment requirement, whichever is greater. Both pilot seat visual systems must be operable simultaneously. The minimum horizontal field-of-view coverage must be plus and minus one-half (½) of the minimum continuous field-of-view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. An SOC is required and must explain the system geometry measurements including system linearity and field-of-view.	**X**	**X**			Additional field-of-view capability may be added at the sponsor's discretion provided the minimum fields of view are retained.
6.c.	(Reserved)					
6.d.	The simulator must provide a continuous collimated visual field-of-view of at least176° horizontally and 36° vertically or the number of degrees necessary to meet the visual ground segment requirement, whichever is greater. The minimum horizontal field-of-view coverage must be plus and minus one-half			**X**	**X**	The horizontal field-of-view is traditionally described as a 180° field-of-view. However, the field-of-view is technically

	(½) of the minimum continuous field-of-view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. An SOC is required and must explain the system geometry measurements including system linearity and field-of-view.					no less than 176º. Additional field-of-view capability may be added at the sponsor's discretion provided the minimum fields of view are retained.
6.e.	The visual system must be free from optical discontinuities and artifacts that create non-realistic cues.	X	X	X	X	Non-realistic cues might include image "swimming" and image "roll-off," that may lead a pilot to make incorrect assessments of speed, acceleration, or situational awareness.
6.f.	The simulator must have operational landing lights for night scenes. Where used, dusk (or twilight) scenes require operational landing lights.	X	X	X	X	
6.g.	The simulator must have instructor controls for the following: (1) Visibility in statute miles (km) and runway visual range (RVR) in ft.(m); (2) Airport selection; and (3) Airport lighting.	X	X	X	X	
6.h.	The simulator must provide visual system compatibility with dynamic response programming.	X	X	X	X	
6.i.	The simulator must show that the segment of the ground visible from the simulator flight deck is the same as from the airplane flight deck (within established tolerances) when at the correct airspeed, in the landing configuration, at the appropriate height above the touchdown zone, and with appropriate visibility.	X	X	X	X	This will show the modeling accuracy of RVR, glideslope, and localizer for a given weight, configuration, and speed within the airplane's operational envelope for a normal approach and landing.
6.j.	The simulator must provide visual cues necessary to assess sink rates (provide depth perception) during takeoffs and landings, to include: (1) Surface on runways, taxiways, and ramps; and (2) Terrain features.		X	X	X	
6.k.	The simulator must provide for accurate portrayal of the visual environment relating to the simulator attitude.	X	X	X	X	Visual attitude vs. simulator attitude is a comparison of pitch and roll of the horizon as displayed in the visual scene

						compared to the display on the attitude indicator.
6.l.	The simulator must provide for quick confirmation of visual system color, RVR, focus, and intensity. An SOC is required.			X	X	
6.m.	The simulator must be capable of producing at least 10 levels of occulting.			X	X	
6.n.	Night Visual Scenes. When used in training, testing, or checking activities, the simulator must provide night visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Scenes must include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by airplane landing lights.	X	X	X	X	
6.o.	Dusk (or Twilight) Visual Scenes. When used in training, testing, or checking activities, the simulator must provide dusk (or twilight) visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Dusk (or twilight) scenes, as a minimum, must provide full color presentations of reduced ambient intensity, sufficient surfaces with appropriate textural cues that include self-illuminated objects such as road networks, ramp lighting and airport signage, to conduct a visual approach, landing and airport movement (taxi). Scenes must include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by airplane landing lights. If provided, directional horizon lighting must have correct orientation and be consistent with surface shading effects. Total night or dusk (twilight) scene content must be comparable in detail to that produced by 10,000 visible textured surfaces and 15,000 visible lights with sufficient system capacity to display 16 simultaneously moving objects. An SOC is required.			X	X	
6.p.	Daylight Visual Scenes. The simulator must provide daylight visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Any ambient lighting must not "washout" the displayed visual scene. Total daylight scene content must be			X	X	

	comparable in detail to that produced by 10,000 visible textured surfaces and 6,000 visible lights with sufficient system capacity to display 16 simultaneously moving objects. The visual display must be free of apparent and distracting quantization and other distracting visual effects while the simulator is in motion. An SOC is required.					
6.q.	The simulator must provide operational visual scenes that portray physical relationships known to cause landing illusions to pilots.			X	X	For example: short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path, unique topographic features.
6.r.	The simulator must provide special weather representations of light, medium, and heavy precipitation near a thunderstorm on takeoff and during approach and landing. Representations need only be presented at and below an altitude of 2,000 ft. (610 m) above the airport surface and within 10 miles (16 km) of the airport.			X	X	
6.s.	The simulator must present visual scenes of wet and snow-covered runways, including runway lighting reflections for wet conditions, partially obscured lights for snow conditions, or suitable alternative effects.			X	X	
6.t.	The simulator must present realistic color and directionality of all airport lighting.			X	X	
6.u.	The following weather effects as observed on the visual system must be simulated and respective instructor controls provided. (1) Multiple cloud layers with adjustable bases, tops, sky coverage and scud effect; (2) Storm cells activation and/or deactivation; (3) Visibility and runway visual range (RVR), including fog and patchy fog effect; (4) Effects on ownship external lighting; (5) Effects on airport lighting (including variable intensity and fog effects); (6) Surface contaminants (including wind blowing effect); (7) Variable precipitation effects (rain, hail, snow); (8) In-cloud airspeed effect; and (9) Gradual visibility changes entering and breaking out of cloud.			X	X	Scud effects are low, detached, and irregular clouds below a defined cloud layer. Atmospheric model should support representative effects of wake turbulence and mountain waves as needed to enhance UPRT training. The mountain wave model should support the atmospheric climb, descent, and roll rates which can be encountered in

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						mountain wave and rotor conditions.
6.v.	The simulator must provide visual effects for: (1) Light poles; (2) Raised edge lights as appropriate; and (3) Glow associated with approach lights in low visibility before physical lights are seen,			X	X	Visual effects for light poles and raised edge lights are for the purpose of providing additional depth perception during takeoff, landing, and taxi training tasks. Three dimensional modeling of the actual poles and stanchions is not required.
7. Sound System.						
7.a.	The simulator must provide flight deck sounds that result from pilot actions that correspond to those that occur in the airplane.	X	X	X	X	
7.b.	The volume control must have an indication of sound level setting which meets all qualification requirements.	X	X	X	X	For Level D simulators, this indication should be readily available to the instructor on or about the IOS and is the sound level setting required to meet the objective testing requirements as described in Table A2A of this Appendix. For all other simulator levels, this indication is the sound level setting as evaluated during the simulator's initial evaluation.
7.c.	The simulator must accurately simulate the sound of precipitation, windshield wipers, and other significant airplane noises perceptible to the pilot during normal and abnormal operations, and include the sound of a crash (when the simulator is landed in an unusual attitude or in excess of the structural gear limitations); normal engine and thrust reversal sounds; and the sounds of flap, gear, and spoiler extension and retraction. Sounds must be directionally representative.			X	X	For simulators qualified for full stall training tasks, sounds associated with stall buffet should be replicated if significant in the airplane.

	A SOC is required.					
7.d.	The simulator must provide realistic amplitude and frequency of flight deck noises and sounds. Simulator performance must be recorded, compared to amplitude and frequency of the same sounds recorded in the airplane, and be made a part of the QTG.				**X**	

TABLE A1B—TABLE OF TASKS VS. SIMULATOR LEVEL

QPS requirements						Information
Entry No.	Subjective requirements In order to be qualified at the simulator qualification level indicated, the simulator must be able to perform at least the tasks associated with that level of qualification.	Simulator levels				Notes
		A	B	C	D	
1. Preflight Procedures						
1.a.	Preflight Inspection (flight deck only)	X	X	X	X	
1.b.	Engine Start	X	X	X	X	
1.c.	Taxiing		R	X	X	
1.d.	Pre-takeoff Checks	X	X	X	X	
2. Takeoff and Departure Phase						
2.a.	Normal and Crosswind Takeoff		R	X	X	
2.b.	Instrument Takeoff	X	X	X	X	
2.c.	Engine Failure During Takeoff	A	X	X	X	
2.d.	Rejected Takeoff	X	X	X	X	
2.e.	Departure Procedure	X	X	X	X	
3. Inflight Maneuvers						
3.a.	Steep Turns	X	X	X	X	
3.b. High Angle of Attack Maneuvers						
3.b.1	Approaches to Stall	X	X	X	X	
3.b.2	Full Stall			X	X	Stall maneuvers at angles of attack above the activation of the stall warning system. Required only for FSTDs qualified to conduct full stall training tasks as indicated on the Statement of Qualification.
3.c.	Engine Failure—Multiengine Airplane	X	X	X	X	
3.d.	Engine Failure—Single-Engine Airplane	X	X	X	X	
3.e.	Specific Flight Characteristics incorporated into the user's FAA approved flight training program.	A	A	A	A	
3.f.	Recovery From Unusual Attitudes	X	X	X	X	Within the normal flight envelope supported by applicable simulation validation data.
3.g.	Upset Prevention and Recovery Training (UPRT)			X	X	Upset recovery or unusual attitude training maneuvers within the FSTD's validation envelope that are intended to exceed pitch attitudes greater than 25 degrees nose up; pitch attitudes greater than 10 degrees nose down, and bank angles greater than 45 degrees.
4. Instrument Procedures						
4.a.	Standard Terminal Arrival/Flight Management System Arrivals Procedures.	X	X	X	X	

TABLE A1B—TABLE OF TASKS VS. SIMULATOR LEVEL—Continued

QPS requirements						Information
Entry No.	Subjective requirements In order to be qualified at the simulator qualification level indicated, the simulator must be able to perform at least the tasks associated with that level of qualification.	Simulator levels				Notes
		A	B	C	D	
4.b.	Holding	X	X	X	X	
4.c.	Precision Instrument.					
4.c.1.	All Engines Operating	X	X	X	X	e.g., Autopilot, Manual (Flt. Dir. Assisted), Manual (Raw Data).
4.c.2.	One Engine Inoperative	X	X	X	X	e.g., Manual (Flt. Dir. Assisted), Manual (Raw Data).
4.d.	Non-Precision Instrument Approach	X	X	X	X	e.g., NDB, VOR, VOR/DME, VOR/TAC, RNAV, LOC, LOC/BC, ADF, and SDF.
4.e.	Circling Approach	X	X	X	X	Specific authorization required.
4.f.	Missed Approach.					
4.f.1.	Normal	X	X	X	X	
4.f.2.	One Engine Inoperative	X	X	X	X	
5. Landings and Approaches to Landings						
5.a.	Normal and Crosswind Approaches and Landings		R	X	X	
5.b.	Landing From a Precision/Non-Precision Approach		R	X	X	
5.c.	Approach and Landing with (Simulated) Engine Failure—Multiengine Airplane.	....	R	X	X	
5.d.	Landing From Circling Approach		R	X	X	
5.e.	Rejected Landing	X	X	X	X	
5.f.	Landing From a No Flap or a Nonstandard Flap Configuration Approach.		R	X	X	
6. Normal and Abnormal Procedures						
6.a.	Engine (including shutdown and restart)	X	X	X	X	
6.b.	Fuel System	X	X	X	X	
6.c.	Electrical System	X	X	X	X	
6.d.	Hydraulic System	X	X	X	X	
6.e.	Environmental and Pressurization Systems	X	X	X	X	
6.f.	Fire Detection and Extinguisher Systems	X	X	X	X	
6.g.	Navigation and Avionics Systems	X	X	X	X	
6.h.	Automatic Flight Control System, Electronic Flight Instrument System, and Related Subsystems.	X	X	X	X	
6.i.	Flight Control Systems	X	X	X	X	
6.j.	Anti-ice and Deice Systems	X	X	X	X	
6.k.	Aircraft and Personal Emergency Equipment	X	X	X	X	
7. Emergency Procedures						
7.a.	Emergency Descent (Max. Rate)	X	X	X	X	

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TABLE A1B—TABLE OF TASKS VS. SIMULATOR LEVEL—Continued

QPS requirements						Information
Entry No.	Subjective requirements In order to be qualified at the simulator qualification level indicated, the simulator must be able to perform at least the tasks associated with that level of qualification.	Simulator levels				Notes
		A	B	C	D	
7.b.	Inflight Fire and Smoke Removal	X	X	X	X	
7.c.	Rapid Decompression	X	X	X	X	
7.d.	Emergency Evacuation	X	X	X	X	
8. Postflight Procedures						
8.a.	After-Landing Procedures	X	X	X	X	
8.b.	Parking and Securing	X	X	X	X	

"A"—indicates that the system, task, or procedure may be examined if the appropriate aircraft system or control is simulated in the FSTD and is working properly.
"R"—indicates that the simulator may be qualified for this task for continuing qualification training.
"X"—indicates that the simulator must be able to perform this task for this level of qualification.

TABLE A1C—TABLE OF SIMULATOR SYSTEM TASKS

QPS requirements						Information
Entry No.	Subjective requirements In order to be qualified at the simulator qualification level indicated, the simulator must be able to perform at least the tasks associated with that level of qualification.	Simulator levels				Notes
		A	B	C	D	
1. Instructor Operating Station (IOS), as appropriate						
1.a.	Power switch(es)	X	X	X	X	
1.b.	Airplane conditions	X	X	X	X	e.g., GW, CG, Fuel loading and Systems.
1.c.	Airports/Runways	X	X	X	X	e.g., Selection, Surface, Presets, Lighting controls.
1.d.	Environmental controls	X	X	X	X	e.g., Clouds, Visibility, RVR, Temp, Wind, Ice, Snow, Rain, and Windshear.
1.e.	Airplane system malfunctions (Insertion/deletion)	X	X	X	X	
1.f.	Locks, Freezes, and Repositioning	X	X	X	X	
2. Sound Controls						
2.a.	On/off/adjustment	X	X	X	X	
3. Motion/Control Loading System						
3.a.	On/off/emergency stop	X	X	X	X	
4. Observer Seats/Stations						
4.a.	Position/Adjustment/Positive restraint system	X	X	X	X	

ATTACHMENT 2 TO APPENDIX A TO PART 60—FFS OBJECTIVE TESTS

TABLE OF CONTENTS

TABLE OF CONTENTS—Continued

BEGIN INFORMATION

1. INTRODUCTION

a. For the purposes of this attachment, the flight conditions specified in the Flight Conditions Column of Table A2A of this appendix, are defined as follows:

(1) Ground—on ground, independent of airplane configuration;

(2) Take-off—gear down with flaps/slats in any certified takeoff position;

(3) First segment climb—gear down with flaps/slats in any certified takeoff position (normally not above 50 ft AGL);

(4) Second segment climb—gear up with flaps/slats in any certified takeoff position (normally between 50 ft and 400 ft AGL);

(5) Clean—flaps/slats retracted and gear up;

(6) Cruise—clean configuration at cruise altitude and airspeed;

(7) Approach—gear up or down with flaps/slats at any normal approach position as recommended by the airplane manufacturer; and

(8) Landing—gear down with flaps/slats in any certified landing position.

b. The format for numbering the objective tests in Appendix A, Attachment 2, Table A2A, and the objective tests in Appendix B, Attachment 2, Table B2A, is identical. However, each test required for FFSs is not necessarily required for FTDs. Also, each test required for FTDs is not necessarily required for FFSs. Therefore, when a test number (or series of numbers) is not required, the term ''Reserved'' is used in the table at that location. Following this numbering format provides a degree of commonality between the two tables and substantially reduces the potential for confusion when referring to objective test numbers for either FFSs or FTDs.

c. The reader is encouraged to review the Airplane Flight Simulator Evaluation Handbook, Volumes I and II, published by the Royal Aeronautical Society, London, UK, and AC 25–7, as amended, Flight Test Guide for Certification of Transport Category Airplanes, and AC 23–8, as amended, Flight Test Guide for Certification of Part 23 Airplanes, for references and examples regarding flight testing requirements and techniques.

d. If relevant winds are present in the objective data, the wind vector should be clearly noted as part of the data presentation, expressed in conventional terminology, and related to the runway being used for the test.

END INFORMATION

BEGIN QPS REQUIREMENTS

2. TEST REQUIREMENTS

a. The ground and flight tests required for qualification are listed in Table A2A, FFS Objective Tests. Computer generated simulator test results must be provided for each test except where an alternative test is specifically authorized by the responsible Flight Standards office. If a flight condition or operating condition is required for the test but does not apply to the airplane being simulated or to the qualification level sought, it may be disregarded (e.g., an engine out missed approach for a single-engine airplane or a maneuver using reverse thrust for an airplane without reverse thrust capability). Each test result is compared against the validation data described in §60.13 and in this appendix. Although use of a driver program designed to automatically accomplish the tests is encouraged for all simulators and required for Level C and Level D simulators, it must be possible to conduct each test manually while recording all appropriate parameters. The results must be produced on an appropriate recording device acceptable to the responsible Flight Standards office and must include simulator number, date, time, conditions, tolerances, and appropriate dependent variables portrayed in comparison to the validation data. Time histories are required unless otherwise indicated in Table A2A. All results must be labeled using the tolerances and units given.

b. Table A2A in this attachment sets out the test results required, including the parameters, tolerances, and flight conditions for simulator validation. Tolerances are provided for the listed tests because mathematical modeling and acquisition and development of reference data are often inexact. All tolerances listed in the following tables are applied to simulator performance. When two tolerance values are given for a parameter, the less restrictive may be used unless otherwise indicated. In those cases where a tolerance is expressed only as a percentage, the tolerance percentage applies to the maximum value of that parameter within its normal operating range as measured from the neutral or zero position unless otherwise indicated.

c. Certain tests included in this attachment must be supported with an SOC. In Table A2A, requirements for SOCs are indicated in the ''Test Details'' column.

d. When operational or engineering judgment is used in making assessments for flight test data applications for simulator validity, such judgment must not be limited to a single parameter. For example, data that exhibit rapid variations of the measured parameters may require interpolations or a ''best fit'' data selection. All relevant parameters related to a given maneuver or flight condition must be provided to allow overall interpretation. When it is difficult or impossible to match simulator to airplane data throughout a time history, differences must be justified by providing a comparison of other related variables for the condition being assessed.

e. It is not acceptable to program the FFS so that the mathematical modeling is correct only at the validation test points. Unless otherwise noted, simulator tests must represent airplane performance and handling qualities at operating weights and centers of gravity (CG) typical of normal operation. Simulator tests at extreme weight or CG conditions may be acceptable where required for concurrent aircraft certification testing. Tests of handling qualities must include validation of augmentation devices.

f. When comparing the parameters listed to those of the airplane, sufficient data must also be provided to verify the correct flight condition and airplane configuration changes. For example, to show that control force is within the parameters for a static stability test, data to show the correct airspeed, power, thrust or torque, airplane configuration, altitude, and other appropriate datum identification parameters must also be given. If comparing short period dynamics, normal acceleration may be used to establish a match to the airplane, but airspeed, altitude, control input, airplane configuration, and other appropriate data must also be given. If comparing landing gear change dynamics, pitch, airspeed, and altitude may be used to establish a match to the airplane, but landing gear position must also be provided. All airspeed values must be properly annotated (e.g., indicated versus calibrated). In addition, the same variables must be used for comparison (e.g., compare inches to inches rather than inches to centimeters).

g. The QTG provided by the sponsor must clearly describe how the simulator will be set up and operated for each test. Each simulator subsystem may be tested independently, but overall integrated testing of the simulator must be accomplished to assure that the total simulator system meets the prescribed standards. A manual test procedure with explicit and detailed steps for completing each test must also be provided.

h. For previously qualified simulators, the tests and tolerances of this attachment may be used in subsequent continuing qualification evaluations for any given test if the sponsor has submitted a proposed MQTG revision to the responsible Flight Standards office and has received responsible Flight Standards office approval.

i. Simulators are evaluated and qualified with an engine model simulating the airplane data supplier's flight test engine. For qualification of alternative engine models (either variations of the flight test engines or other manufacturer's engines) additional tests with the alternative engine models may be required. This attachment contains guidelines for alternative engines.

j. For testing Computer Controlled Aircraft (CCA) simulators, or other highly augmented airplane simulators, flight test data is required for the Normal (N) and/or Non-normal (NN) control states, as indicated in this attachment. Where test results are independent of control state, Normal or Non-normal control data may be used. All tests in Table A2A require test results in the Normal control state unless specifically noted otherwise in the Test Details section following the CCA designation. The responsible Flight Standards office will determine what tests are appropriate for airplane simulation data. When making this determination, the responsible Flight Standards office may require other levels of control state degradation for specific airplane tests. Where Non-normal control states are required, test data must be provided for one or more Non-normal control states, and must include the least augmented state. Where applicable, flight test data must record Normal and Non-normal states for:

(1) Pilot controller deflections or electronically generated inputs, including location of input; and

(2) Flight control surface positions unless test results are not affected by, or are independent of, surface positions.

k. Tests of handling qualities must include validation of augmentation devices. FFSs for highly augmented airplanes will be validated both in the unaugmented configuration (or failure state with the maximum permitted degradation in handling qualities) and the augmented configuration. Where various levels of handling qualities result from failure states, validation of the effect of the failure is necessary. Requirements for testing will be mutually agreed to between the sponsor and the responsible Flight Standards office on a case-by-case basis.

l. Some tests will not be required for airplanes using airplane hardware in the simulator flight deck (e.g., ''side stick controller''). These exceptions are noted in Section 2 ''Handling Qualities'' in Table A2A of this attachment. However, in these cases, the sponsor must provide a statement that the airplane hardware meets the appropriate manufacturer's specifications and the sponsor must have supporting information to that fact available for responsible Flight Standards office review.

m. For objective test purposes, see Appendix F of this part for the definitions of ''Near maximum,'' ''Light,'' and ''Medium'' gross weight.

END QPS REQUIREMENTS

BEGIN INFORMATION

n. In those cases where the objective test results authorize a ''snapshot test'' or a ''series of snapshot tests'' results in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the ''snapshot.'' The steady state condition should exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snap shot.

o. For references on basic operating weight, see AC 120–27, ''Aircraft Weight and Balance;'' and FAA–H–8083–1, ''Aircraft Weight and Balance Handbook.''

END INFORMATION

Table A2A - Full Flight Simulator (FFS) Objective Tests

QPS REQUIREMENTS									INFORMATION
Test		Tolerance	Flight Conditions	Test Details	Simulator Level				Notes
Entry Number	Title				A	B	C	D	
1. Performance.									
1.a.	**Taxi.**								
1.a.1	Minimum radius turn.	±0.9 m (3 ft) or ±20% of airplane turn radius.	Ground.	Plot both main and nose gear loci and key engine parameter(s). Data for no brakes and the minimum thrust required to maintain a steady turn except for airplanes requiring asymmetric thrust or braking to achieve the minimum radius turn.		X	X	X	
1.a.2	Rate of turn versus nosewheel steering angle (NWA).	±10% or ±2°/s of turn rate.	Ground.	Record for a minimum of two speeds, greater than minimum turning radius speed with one at a typical taxi speed, and with a spread of at least 5 kt.		X	X	X	
1.b.	**Takeoff.**			*Note.— All airplane manufacturer commonly-used certificated take-off flap settings must be demonstrated at least once either in minimum unstick speed (1.b.3), normal take-off (1.b.4), critical engine failure on take-off (1.b.5) or crosswind take-off (1.b.6).*					
1.b.1	Ground acceleration time and distance.	±1.5 s or ±5% of time; and ±61 m (200 ft) or ±5% of distance.	Takeoff.	Acceleration time and distance must be recorded for a minimum of 80% of the total time from brake release to V_r. Preliminary aircraft certification data may be used.	X	X	X	X	May be combined with normal takeoff (1.b.4.) or rejected takeoff (1.b.7.). Plotted data should be shown using appropriate scales for each portion of the maneuver.
1.b.2	Minimum control speed, ground (V_{mcg}) using aerodynamic controls only per applicable airworthiness requirement or alternative engine inoperative test to demonstrate ground control characteristics.	±25% of maximum airplane lateral deviation reached or ±1.5 m (5 ft). For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of rudder pedal force.	Takeoff.	Engine failure speed must be within ±1 kt of airplane engine failure speed. Engine thrust decay must be that resulting from the mathematical model for the engine applicable to the FSTD under test. If the modeled engine is not the same as the airplane manufacturer's flight test engine, a further test may be run with the same initial conditions using the thrust from the flight test data as the driving parameter.	X	X	X	X	If a V_{mcg} test is not available, an acceptable alternative is a flight test snap engine deceleration to idle at a speed between V_1 and V_1-10 kt, followed by control of heading using aerodynamic control only and recovery should be achieved with the main gear on the ground. To ensure only aerodynamic control, nosewheel steering should be disabled (i.e. castored) or the nosewheel held slightly off the ground.

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1.b.3	Minimum unstick speed (V_{mu}) or equivalent test to demonstrate early rotation take-off characteristics.	±3 kt airspeed. ±1.5° pitch angle.	Takeoff.	Record time history data from 10 knots before start of rotation until at least 5 seconds after the occurrence of main gear lift-off.	X	X	X	X	V_{mu} is defined as the minimum speed at which the last main landing gear leaves the ground. Main landing gear strut compression or equivalent air/ground signal should be recorded. If a V_{mu} test is not available, alternative acceptable flight tests are a constant high-attitude takeoff run through main gear lift-off or an early rotation takeoff. If either of these alternative solutions is selected, aft body contact/tail strike protection functionality, if present on the airplane, should be active.
1.b.4	Normal take-off.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±6 m (20 ft) height. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force.	Takeoff.	Data required for near maximum certificated takeoff weight at mid center of gravity location and light takeoff weight at an aft center of gravity location. If the airplane has more than one certificated takeoff configuration, a different configuration must be used for each weight. Record takeoff profile from brake release to at least 61 m (200 ft) AGL.	X	X	X	X	The test may be used for ground acceleration time and distance (1.b.1). Plotted data should be shown using appropriate scales for each portion of the maneuver.
1.b.5	Critical engine failure on take-off.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±6 m (20 ft) height. ±2° roll angle. ±2° side-slip angle. ±3° heading angle. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force; ±1.3 daN (3 lbf) or ±10% of wheel force; and	Takeoff.	Record takeoff profile to at least 61 m (200 ft) AGL. Engine failure speed must be within ±3 kt of airplane data. Test at near maximum takeoff weight.	X	X	X	X	

		±2.2 daN (5 lbf) or ±10% of rudder pedal force.							
1.b.6	Crosswind takeoff.	± 3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±6 m (20 ft) height. ±2° roll angle. ±2° side-slip angle. ±3° heading angle. Correct trends at ground speeds below 40 kt for rudder/pedal and heading angle. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force; ±1.3 daN (3 lbf) or ±10% of wheel force; and ±2.2 daN (5 lbf) or ±10% of rudder pedal force.	Takeoff.	Record takeoff profile from brake release to at least 61 m (200 ft) AGL. This test requires test data, including wind profile, for a crosswind component of at least 60% of the airplane performance data value measured at 10 m (33 ft) above the runway. Wind components must be provided as headwind and crosswind values with respect to the runway.	**X**	**X**	**X**	**X**	In those situations where a maximum crosswind or a maximum demonstrated crosswind is not known, contact the responsible Flight Standards office.
1.b.7.	Rejected Takeoff.	±5% of time or ±1.5 s. ±7.5% of distance or ±76 m (250 ft).	Takeoff.	Record at mass near maximum takeoff weight. Speed for reject must be at least 80% of V_1. Maximum braking effort, auto or manual. Where a maximum braking demonstration is not available, an acceptable alternative is a test using approximately 80% braking and full reverse, if applicable. Time and distance must be recorded from brake release to a full stop.	**X**	**X**	**X**	**X**	Autobrakes will be used where applicable.
1.b.8.	Dynamic Engine Failure After Takeoff.	±2°/s or ±20% of body angular rates.	Takeoff.	Engine failure speed must be within ±3 kt of airplane data. Engine failure may be a snap deceleration to idle.			**X**	**X**	For safety considerations, airplane flight test may be performed out of ground effect at a safe altitude, but with correct airplane configuration and airspeed.

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				Record hands-off from 5 s before engine failure to +5 s or 30° roll angle, whichever occurs first. **CCA**: Test in Normal and Non-normal control state.					
1.c.	**Climb.**								
1.c.1.	Normal Climb, all engines operating.	±3 kt airspeed. ±0.5 m/s (100 ft/ min) or ±5% of rate of climb.	Clean.	Flight test data are preferred; however, airplane performance manual data are an acceptable alternative. Record at nominal climb speed and mid initial climb altitude. FSTD performance is to be recorded over an interval of at least 300 m (1 000 ft).	X	X	X	X	
1.c.2.	One-engine-inoperative 2nd segment climb.	±3 kt airspeed. ±0.5 m/s (100 ft/ min) or ±5% of rate of climb, but not less than airplane performance data requirements.	2nd segment climb.	Flight test data is preferred; however, airplane performance manual data is an acceptable alternative. Record at nominal climb speed. FSTD performance is to be recorded over an interval of at least 300 m (1,000 ft). Test at WAT (weight, altitude or temperature) limiting condition.	X	X	X	X	
1.c.3.	One Engine Inoperative En route Climb.	±10% time, ±10% distance, ±10% fuel used	Clean	Flight test data or airplane performance manual data may be used. Test for at least a 1,550 m (5,000 ft) segment.			X	X	
1.c.4.	One Engine Inoperative Approach Climb for airplanes with icing accountability if provided in the airplane performance data for this phase of flight.	±3 kt airspeed. ±0.5 m/s (100 ft/ min) or ±5% rate of climb, but not less than airplane performance data.	Approach	Flight test data or airplane performance manual data may be used. FSTD performance to be recorded over an interval of at least 300 m (1,000 ft). Test near maximum certificated landing weight as may be applicable to an approach in icing conditions.	X	X	X	X	Airplane should be configured with all anti-ice and de-ice systems operating normally, gear up and go-around flap. All icing accountability considerations, in accordance with the airplane performance data for an approach in icing conditions, should be applied.
1.d.	**Cruise / Descent.**								
1.d.1.	Level flight acceleration	±5% Time	Cruise	Time required to increase airspeed a minimum of 50 kt, using maximum continuous thrust rating or equivalent. For airplanes with a small operating speed range, speed change may be reduced to 80% of operational speed change.	X	X	X	X	

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1.d.2.	Level flight deceleration.	±5% Time	Cruise	Time required to decrease airspeed a minimum of 50 kt, using idle power. For airplanes with a small operating speed range, speed change may be reduced to 80% of operational speed change.	X	X	X	X	
1.d.3.	Cruise performance.	±.05 EPR or ±3% N1 or ±5% of torque. ±5% of fuel flow.	Cruise.	The test may be a single snapshot showing instantaneous fuel flow, or a minimum of two consecutive snapshots with a spread of at least 3 minutes in steady flight.			X	X	
1.d.4.	Idle descent.	±3 kt airspeed. ±1.0 m/s (200 ft/min) or ±5% of rate of descent.	Clean.	Idle power stabilized descent at normal descent speed at mid altitude. FSTD performance to be recorded over an interval of at least 300 m (1,000 ft).	X	X	X	X	
1.d.5.	Emergency descent.	±5 kt airspeed. ±1.5 m/s (300 ft/min) or ±5% of rate of descent.	As per airplane performance data.	FSTD performance to be recorded over an interval of at least 900 m (3,000 ft).	X	X	X	X	Stabilized descent to be conducted with speed brakes extended if applicable, at mid altitude and near V_{mo} or according to emergency descent procedure.
1.e.	**Stopping.**								
1.e.1.	Deceleration time and distance, manual wheel brakes, dry runway, no reverse thrust.	±1.5 s or ±5% of time. For distances up to 1,220 m (4, 000 ft), the smaller of ±61 m (200 ft) or ±10% of distance. For distances greater than 1,220 m (4, 000 ft), ±5% of distance.	Landing.	Time and distance must be recorded for at least 80% of the total time from touchdown to a full stop. Position of ground spoilers and brake system pressure must be plotted (if applicable). Data required for medium and near maximum certificated landing mass. Engineering data may be used for the medium mass condition.	X	X	X	X	
1.e.2.	Deceleration time and distance, reverse thrust, no wheel brakes, dry runway.	±1.5 s or ±5% of time; and the smaller of ±61 m (200 ft) or ±10% of distance.	Landing	Time and distance must be recorded for at least 80% of the total time from initiation of reverse thrust to full thrust reverser minimum operating speed. Position of ground spoilers must be plotted (if applicable). Data required for medium and near maximum certificated landing mass. Engineering data may be used for the medium mass condition.	X	X	X	X	
1.e.3.	Stopping distance, wheel brakes, wet runway.	±61 m (200 ft) or ±10% of distance.	Landing.	Either flight test or manufacturer's performance manual data must be used, where available. Engineering data, based on dry runway flight test stopping distance and the effects of contaminated			X	X	

				runway braking coefficients, are an acceptable alternative.					
1.e.4.	Stopping distance, wheel brakes, icy runway.	±61 m (200 ft) or ±10% of distance.	Landing.	Either flight test or manufacturer's performance manual data must be used, where available. Engineering data, based on dry runway flight test stopping distance and the effects of contaminated runway braking coefficients, are an acceptable alternative.			X	X	
1.f.	**Engines.**								
1.f.1.	Acceleration.	±10% Ti or ±0.25 s; and ±10% Tt or ±0.25 s.	Approach or landing	Total response is the incremental change in the critical engine parameter from idle power to go-around power.	X	X	X	X	See Appendix F of this part for definitions of T_i and T_t.
1.f.2.	Deceleration.	±10% Ti or ±0.25 s; and ±10% Tt or ±0.25 s.	Ground	Total response is the incremental change in the critical engine parameter from maximum takeoff power to idle power.	X	X	X	X	See Appendix F of this part for definitions of T_i and T_t.
2. Handling Qualities.									
2.a.	**Static Control Tests.**								
	Note.1 — Testing of position versus force is not applicable if forces are generated solely by use of airplane hardware in the FSTD. *Note 2 — Pitch, roll and yaw controller position versus force or time should be measured at the control. An alternative method in lieu of external test fixtures at the flight controls would be to have recording and measuring instrumentation built into the FSTD. The force and position data from this instrumentation could be directly recorded and matched to the airplane data. Provided the instrumentation was verified by using external measuring equipment while conducting the static control checks, or equivalent means, and that evidence of the satisfactory comparison is included in the MQTG, the instrumentation could be used for both initial and recurrent evaluations for the measurement of all required control checks. Verification of the instrumentation by using external measuring equipment should be repeated if major modifications and/or repairs are made to the control loading system. Such a permanent installation could be used without any time being lost for the installation of external devices. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures as the validation data where applicable.* *Note 3 — FSTD static control testing from the second set of pilot controls is only required if both sets of controls are not mechanically interconnected on the FSTD. A rationale is required from the data provider if a single set of data is applicable to both sides. If controls are mechanically interconnected in the FSTD, a single set of tests is sufficient.*								
2.a.1.a.	Pitch controller position versus force and surface position calibration.	±0.9 daN (2 lbf) breakout. ±2.2 daN (5 lbf) or ±10% of force. ±2° elevator angle.	Ground.	Record results for an uninterrupted control sweep to the stops.	X	X	X	X	Test results should be validated with in-flight data from tests such as longitudinal static stability, stalls, etc.
2.a.1.b.	**(Reserved)**								
2.a.2.a.	Roll controller position versus force and surface position calibration.	±0.9 daN (2 lbf) breakout. ±1.3 daN (3 lbf) or ±10% of force. ±2° aileron angle. ±3° spoiler angle.	Ground.	Record results for an uninterrupted control sweep to the stops.	X	X	X	X	Test results should be validated with in-flight data from tests such as engine-out trims, steady state side-slips, etc.
2.a.2.b.	**(Reserved)**								
2.a.3.a.	Rudder pedal position versus force and surface position calibration.	±2.2 daN (5 lbf) breakout.	Ground.	Record results for an uninterrupted control sweep to the stops.	X	X	X	X	Test results should be validated with in-flight data from tests such as engine-out

		±2.2 daN (5 lbf) or ±10% of force. ±2° rudder angle.							trims, steady state side-slips, etc.
2.a.3.b.	**(Reserved)**								
2.a.4.	Nosewheel Steering Controller Force and Position Calibration.	±0.9 daN (2 lbf) breakout. ±1.3 daN (3 lbf) or ±10% of force. ±2° NWA.	Ground.	Record results of an uninterrupted control sweep to the stops.	X	X	X	X	
2.a.5.	Rudder Pedal Steering Calibration.	±2° NWA.	Ground.	Record results of an uninterrupted control sweep to the stops.	X	X	X	X	
2.a.6.	Pitch Trim Indicator vs. Surface Position Calibration.	±0.5° trim angle.	Ground.		X	X	X	X	The purpose of the test is to compare FSTD surface position and indicator against the flight control model computed value.
2.a.7.	Pitch Trim Rate.	±10% of trim rate (°/s) or ±0.1°/s trim rate.	Ground and approach.	Trim rate to be checked at pilot primary induced trim rate (ground) and autopilot or pilot primary trim rate in-flight at go-around flight conditions. For CCA, representative flight test conditions must be used.	X	X	X	X	
2.a.8.	Alignment of cockpit throttle lever versus selected engine parameter.	When matching engine parameters: ±5° of TLA. When matching detents: ±3% N1 or ±.03 EPR or ±3% torque, or equivalent. Where the levers do not have angular travel, a tolerance of ±2 cm (±0.8 in) applies.	Ground.	Simultaneous recording for all engines. The tolerances apply against airplane data. For airplanes with throttle detents, all detents to be presented and at least one position between detents/ endpoints (where practical). For airplanes without detents, end points and at least three other positions are to be presented.	X	X	X	X	Data from a test airplane or engineering test bench are acceptable, provided the correct engine controller (both hardware and software) is used. In the case of propeller-driven airplanes, if an additional lever, usually referred to as the propeller lever, is present, it should also be checked. This test may be a series of snapshot tests.
2.a.9.	Brake pedal position versus force and brake system pressure calibration.	±2.2 daN (5 lbf) or ±10% of force. ±1.0 MPa (150 psi) or ±10% of brake system pressure.	Ground.	Relate the hydraulic system pressure to pedal position in a ground static test. Both left and right pedals must be checked.	X	X	X	X	FFS computer output results may be used to show compliance.
2.a.10	Stick Pusher System Force Calibration (if applicable)	±10% or ±5 lb (2.2 daN)) Stick/Column force	Ground or Flight	Test is intended to validate the stick/column transient forces as a result of a stick pusher system activation. This test may be conducted in an on-ground condition through stimulation of the stall			X	X	Aircraft manufacturer design data may be utilized as validation data as determined acceptable by the responsible Flight Standards office.

				protection system in a manner that generates a stick pusher response that is representative of an in-flight condition.					Test requirement may be met through column force validation testing in conjunction with the Stall Characteristics test (2.c.8.a.). This test is required only for FSTDs qualified to conduct full stall training tasks.
2.b.	**Dynamic Control Tests.**								
	Note.— Tests 2.b.1, 2.b.2 and 2.b.3 are not applicable for FSTDs where the control forces are completely generated within the airplane controller unit installed in the FSTD. Power setting may be that required for level flight unless otherwise specified. See paragraph 4 of this attachment.								
2.b.1.	Pitch Control.	**For underdamped systems**: $T(P_0)$ ±10% of P_0 or ±0.05 s. $T(P_1)$ ±20% of P_1 or ±0.05 s. $T(P_2)$ ±30% of P_2 or ±0.05 s. $T(P_n)$ ±10*(n+1)% of P_n or ±0.05 s. $T(A_n)$ ±10% of A_{max}, where A_{max} is the largest amplitude or ±0.5% of the total control travel (stop to stop). $T(A_d)$ ±5% of A_d = residual band or ±0.5% of the maximum control travel = residual band. ±1 significant overshoots (minimum of 1 significant overshoot). Steady state position within residual band. *Note 1.— Tolerances should not be applied on period or amplitude after the last significant overshoot.*	Takeoff, Cruise, and Landing.	Data must be for normal control displacements in both directions (approximately 25% to 50% of full throw or approximately 25% to 50% of maximum allowable pitch controller deflection for flight conditions limited by the maneuvering load envelope). Tolerances apply against the absolute values of each period (considered independently).			X	X	n = the sequential period of a full oscillation. Refer to paragraph 4 of this Attachment. For overdamped and critically damped systems, see Figure A2B of Appendix A for an illustration of the reference measurement.

		Note 2.— Oscillations within the residual band are not considered significant and are not subject to tolerances. **For overdamped and critically damped systems only**, the following tolerance applies: $T(P_0)$ ±10% of P_0 or ±0.05 s.							
2.b.2.	Roll Control.	Same as 2.b.1.	Takeoff, Cruise, and Landing.	Data must be for normal control displacement (approximately 25% to 50% of full throw or approximately 25% to 50% of maximum allowable roll controller deflection for flight conditions limited by the maneuvering load envelope).			X	X	Refer to paragraph 4 of this Attachment. For overdamped and critically damped systems, see Figure A2B of Appendix A for an illustration of the reference measurement.
2.b.3.	Yaw Control.	Same as 2.b.1.	Takeoff, Cruise, and Landing.	Data must be for normal control displacement (approximately 25% to 50% of full throw).			X	X	Refer to paragraph 4 of this Attachment. For overdamped and critically damped systems, see Figure A2B of Appendix A for an illustration of the reference measurement.
2.b.4.	Small Control Inputs – Pitch.	±0.15°/s body pitch rate or ±20% of peak body pitch rate applied throughout the time history.	Approach or Landing.	Control inputs must be typical of minor corrections made while established on an ILS approach (approximately 0.5 to 2°/s pitch rate). Test in both directions. Show time history data from 5 s before until at least 5 s after initiation of control input. If a single test is used to demonstrate both directions, there must be a minimum of 5 s before control reversal to the opposite direction. **CCA**: Test in normal and non-normal control state.			X	X	
2.b.5.	Small Control Inputs – Roll.	±0.15°/s body roll rate or ±20% of peak body roll rate applied throughout the time history.	Approach or landing.	Control inputs must be typical of minor corrections made while established on an ILS approach (approximately 0.5 to 2°/s roll rate). Test in one direction. For airplanes that exhibit non-symmetrical behavior, test in both directions. Show time history data from 5 s before until at least 5 s after initiation of control input.			X	X	

				If a single test is used to demonstrate both directions, there must be a minimum of 5 s before control reversal to the opposite direction. **CCA**: Test in normal and non-normal control state.					
2.b.6.	Small Control Inputs – Yaw.	±0.15°/s body yaw rate or ±20% of peak body yaw rate applied throughout the time history.	Approach or landing.	Control inputs must be typical of minor corrections made while established on an ILS approach (approximately 0.5 to 2°/s yaw rate). Test in both directions. Show time history data from 5 s before until at least 5 s after initiation of control input. If a single test is used to demonstrate both directions, there must be a minimum of 5 s before control reversal to the opposite direction. **CCA:** Test in normal and non-normal control state.			X	X	
2.c.	**Longitudinal Control Tests.**								
	Power setting is that required for level flight unless otherwise specified.								
2.c.1.	Power Change Dynamics.	±3 kt airspeed. ±30 m (100 ft) altitude. ±1.5° or ±20% of pitch angle.	Approach.	Power change from thrust for approach or level flight to maximum continuous or go-around power. Time history of uncontrolled free response for a time increment equal to at least 5 s before initiation of the power change to the completion of the power change + 15 s. **CCA:** Test in normal and non-normal control mode	X	X	X	X	
2.c.2.	Flap/Slat Change Dynamics.	±3 kt airspeed. ±30 m (100 ft) altitude. ±1.5° or ±20% of pitch angle.	Takeoff through initial flap retraction, and approach to landing.	Time history of uncontrolled free response for a time increment equal to at least 5 s before initiation of the reconfiguration change to the completion of the reconfiguration change + 15 s. **CCA:** Test in normal and non-normal control mode	X	X	X	X	
2.c.3.	Spoiler/Speedbrake Change Dynamics.	±3 kt airspeed. ±30 m (100 ft) altitude. ±1.5° or ±20% of pitch angle.	Cruise.	Time history of uncontrolled free response for a time increment equal to at least 5 s before initiation of the configuration change to the completion of the configuration change +15 s. Results required for both extension and retraction.	X	X	X	X	

				CCA: Test in normal and non-normal control mode					
2.c.4.	Gear Change Dynamics.	±3 kt airspeed. ±30 m (100 ft) altitude. ±1.5° or ±20% of pitch angle.	Takeoff (retraction), and Approach (extension).	Time history of uncontrolled free response for a time increment equal to at least 5 s before initiation of the configuration change to the completion of the configuration change + 15 s. **CCA:** Test in normal and non-normal control mode	**X**	**X**	**X**	**X**	
2.c.5.	Longitudinal Trim.	±1° elevator angle. ±0.5° stabilizer or trim surface angle. ±1° pitch angle. ±5% of net thrust or equivalent.	Cruise, Approach, and Landing.	Steady-state wings level trim with thrust for level flight. This test may be a series of snapshot tests. **CCA**: Test in normal or non-normal control mode, as applicable.	**X**	**X**	**X**	**X**	
2.c.6.	Longitudinal Maneuvering Stability (Stick Force/g).	±2.2 daN (5 lbf) or ±10% of pitch controller force. Alternative method: ±1° or ±10% of the change of elevator angle.	Cruise, Approach, and Landing.	Continuous time history data or a series of snapshot tests may be used. Test up to approximately 30° of roll angle for approach and landing configurations. Test up to approximately 45° of roll angle for the cruise configuration. Force tolerance not applicable if forces are generated solely by the use of airplane hardware in the FSTD. Alternative method applies to airplanes which do not exhibit stick-force-per-g characteristics. **CCA:** Test in normal or non-normal control mode	**X**	**X**	**X**	**X**	
2.c.7.	Longitudinal Static Stability.	±2.2 daN (5 lbf) or ±10% of pitch controller force. Alternative method: ±1° or ±10% of the change of elevator angle.	Approach.	Data for at least two speeds above and two speeds below trim speed. The speed range must be sufficient to demonstrate stick force versus speed characteristics. This test may be a series of snapshot tests. Force tolerance is not applicable if forces are generated solely by the use of airplane hardware in the FSTD. Alternative method applies to airplanes which do not exhibit speed stability characteristics. **CCA:** Test in normal or non-normal control mode, as applicable.	**X**	**X**	**X**	**X**	

2.c.8.a	Stall Characteristics	±3 kt airspeed for stall warning and stall speeds. ±2.0° angle of attack for buffet threshold of perception and initial buffet based upon Nz component. Control inputs must be plotted and demonstrate correct trend and magnitude. Approach to stall: ±2.0° pitch angle; ±2.0° angle of attack; and ±2.0° bank angle Stall warning up to stall: ±2.0° pitch angle; ±2.0° angle of attack; and Correct trend and magnitude for roll rate and yaw rate. Stall Break and Recovery: SOC Required (see Attachment 7) Additionally, for those simulators with reversible flight control systems or equipped with stick pusher systems: ±10% or ±5 lb (2.2 daN)) Stick/Column force (prior to the stall angle of attack).	Second Segment Climb, High Altitude Cruise (Near Performance Limited Condition), and Approach or Landing	Each of the following stall entries must be demonstrated in at least one of the three flight conditions: ▪ Stall entry at wings level (1g) ▪ Stall entry in turning flight of at least 25° bank angle (accelerated stall) ▪ Stall entry in a power-on condition (required only for propeller driven aircraft) The cruise flight condition must be conducted in a flaps-up (clean) configuration. The second segment climb flight condition must use a different flap setting than the approach or landing flight condition. Record the stall warning signal and initial buffet, if applicable. Time history data must be recorded for full stall through recovery to normal flight. The stall warning signal must occur in the proper relation to buffet/stall. FSTDs of airplanes exhibiting a sudden pitch attitude change or "g break" must demonstrate this characteristic. FSTDs of airplanes exhibiting a roll off or loss of roll control authority must demonstrate this characteristic. Numerical tolerances are not applicable past the stall angle of attack, but must demonstrate correct trend through recovery. See Attachment 7 for additional requirements and information concerning data sources and required angle of attack ranges. **CCA:** Test in normal and non-normal control states. For CCA aircraft with stall envelope protection systems, the normal mode testing is only required to an angle of attack range necessary to demonstrate the correct operation of the system. These tests may be used to satisfy the required (angle of attack) flight maneuver and envelope protection tests (test 2.h.6.). Non-normal control states must be tested through stall identification and recovery.			X	X	Buffet threshold of perception should be based on 0.03 g peak to peak normal acceleration above the background noise at the pilot seat. Initial buffet to be based on normal acceleration at the pilot seat with a larger peak to peak value relative to buffet threshold of perception (some airframe manufacturers have used 0.1 g peak to peak). Demonstrate correct trend in growth of buffet amplitude from initial buffet to stall speed for normal and lateral acceleration. The FSTD sponsor/FSTD manufacturer may limit maximum buffet based on motion platform capability/limitations or other simulator system limitations. Tests may be conducted at centers of gravity and weights typically required for airplane certification stall testing. This test is required only for FSTDs qualified to conduct full stall training tasks. In instances where flight test validation data is limited due to safety of flight considerations, engineering simulator validation data may be used in lieu of flight test validation data for angles of attack that exceed the activation of a stall protection system or stick pusher system. Where approved engineering simulation validation is used, the reduced engineering tolerances (as defined in paragraph 11 of this appendix) do not apply.
2.c.8.b	Approach to Stall Characteristics	±3 kt airspeed for stall warning speeds. ±2.0° angle of attack for initial buffet.	Second Segment Climb, High Altitude Cruise (Near Performance Limited Condition), and Approach or Landing	Each of the following stall entries must be demonstrated in at least one of the three flight conditions: ▪ Approach to stall entry at wings level (1g)	X	X			Tests may be conducted at centers of gravity and weights typically required for airplane certification stall testing.

		Control displacements and flight control surfaces must be plotted and demonstrate correct trend and magnitude. ±2.0° pitch angle; ±2.0° angle of attack; and ±2.0° bank angle Additionally, for those simulators with reversible flight control systems: ±10% or ±5 lb (2.2 daN)) Stick/Column force		▪ Approach to stall entry in turning flight of at least 25° bank angle (accelerated stall) ▪ Approach to stall entry in a power-on condition (required only for propeller driven aircraft) The cruise flight condition must be conducted in a flaps-up (clean) configuration. The second segment climb flight condition must use a different flap setting than the approach or landing flight condition. **CCA:** Test in Normal and Non-normal control states. For CCA aircraft with stall envelope protection systems, the normal mode testing is only required to an angle of attack range necessary to demonstrate the correct operation of the system. These tests may be used to satisfy the required (angle of attack) flight maneuver and envelope protection tests (test 2.h.6.).					Tolerances on stall buffet are not applicable where the first indication of the stall is the activation of the stall warning system (i.e. stick shaker).
2.c.9.	Phugoid Dynamics.	±10% of period. ±10% of time to one half or double amplitude or ±0.02 of damping ratio.	Cruise.	Test must include three full cycles or that necessary to determine time to one half or double amplitude, whichever is less. **CCA:** Test in non-normal control mode.	**X**	**X**	**X**	**X**	
2.c.10	Short Period Dynamics.	±1.5° pitch angle or ±2°/s pitch rate. ±0.1 g normal acceleration	Cruise.	**CCA:** Test in normal and non-normal control mode.	**X**	**X**	**X**	**X**	
2.c.11.	**(Reserved)**								
2.d.	**Lateral Directional Tests.**								
	Power setting is that required for level flight unless otherwise specified.								
2.d.1.	Minimum control speed, air (V_{mca}) or landing (V_{mcl}), per applicable airworthiness requirement or low speed engine-inoperative handling characteristics in the air.	±3 kt airspeed.	Takeoff or Landing (whichever is most critical in the airplane).	Takeoff thrust must be set on the operating engine(s). Time history or snapshot data may be used. **CCA**: Test in normal or non-normal control state, as applicable.	**X**	**X**	**X**	**X**	Minimum speed may be defined by a performance or control limit which prevents demonstration of V_{mca} or V_{mcl} in the conventional manner.
2.d.2.	Roll Response (Rate).	±2°/s or ±10% of roll rate. For airplanes with reversible flight control systems: ±1.3 daN (3 lbf) or ±10% of wheel force.	Cruise, and Approach or Landing.	Test with normal roll control displacement (approximately one-third of maximum roll controller travel). This test may be combined with step input of flight deck roll controller test 2.d.3.	**X**	**X**	**X**	**X**	
2.d.3.	Step input of flight deck roll controller.	±2° or ±10% of roll angle.	Approach or Landing.	This test may be combined with roll response (rate) test 2.d.2.	**X**	**X**	**X**	**X**	With wings level, apply a step roll control input using

				CCA: Test in normal and non-normal control mode					approximately one-third of the roll controller travel. When reaching approximately 20° to 30° of bank, abruptly return the roll controller to neutral and allow approximately 10 seconds of airplane free response.
2.d.4.	Spiral Stability.	Correct trend and ±2° or ±10% of roll angle in 20 s. If alternate test is used: correct trend and ±2° aileron angle.	Cruise, and Approach or Landing.	Airplane data averaged from multiple tests may be used. Test for both directions. As an alternative test, show lateral control required to maintain a steady turn with a roll angle of approximately 30°. **CCA:** Test in non-normal control mode.	**X**	**X**	**X**	**X**	
2.d.5.	Engine Inoperative Trim.	±1° rudder angle or ±1° tab angle or equivalent rudder pedal. ±2° side-slip angle.	Second Segment Climb, and Approach or Landing.	This test may consist of snapshot tests.	**X**	**X**	**X**	**X**	Test should be performed in a manner similar to that for which a pilot is trained to trim an engine failure condition. 2nd segment climb test should be at takeoff thrust. Approach or landing test should be at thrust for level flight.
2.d.6.	Rudder Response.	±2°/s or ±10% of yaw rate.	Approach or Landing.	Test with stability augmentation on and off. Test with a step input at approximately 25% of full rudder pedal throw. **CCA:** Test in normal and non-normal control mode	**X**	**X**	**X**	**X**	
2.d.7.	Dutch Roll	±0.5 s or ±10% of period. ±10% of time to one half or double amplitude or ±.02 of damping ratio. ±1 s or ±20% of time difference between peaks of roll angle and side-slip angle.	Cruise, and Approach or Landing.	Test for at least six cycles with stability augmentation off. **CCA:** Test in non-normal control mode.		**X**	**X**	**X**	
2.d.8.	Steady State Sideslip.	For a given rudder position: ±2° roll angle;	Approach or Landing.	This test may be a series of snapshot tests using at least two rudder positions (in each direction for propeller-driven airplanes), one of which must be near maximum allowable rudder.	**X**	**X**	**X**	**X**	

		±1° side-slip angle; ±2° or ±10% of aileron angle; and ±5° or ±10% of spoiler or equivalent roll controller position or force. For airplanes with reversible flight control systems: ±1.3 daN (3 lbf) or ±10% of wheel force. ±2.2 daN (5 lbf) or ±10% of rudder pedal force.							
2.e.	**Landings.**								
2.e.1.	Normal Landing.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±3 m (10 ft) or ±10% of height. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force.	Landing.	Test from a minimum of 61 m (200 ft) AGL to nosewheel touchdown. **CCA:** Test in normal and non-normal control mode, if applicable.		**X**	**X**	**X**	Two tests should be shown, including two normal landing flaps (if applicable) one of which should be near maximum certificated landing mass, the other at light or medium mass.
2.e.2.	Minimum Flap Landing.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±3 m (10 ft) or ±10% of height. For airplanes with reversible flight control systems:	Minimum Certified Landing Flap Configuration.	Test from a minimum of 61 m (200 ft) AGL to nosewheel touchdown. Test at near maximum certificated landing weight.			**X**	**X**	

		±2.2 daN (5 lbf) or ±10% of column force.							
2.e.3.	Crosswind Landing.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±3 m (10 ft) or ±10% of height. ±2° roll angle. ±2° side-slip angle. ±3° heading angle. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force. ±1.3 daN (3 lbf) or ±10% of wheel force. ±2.2 daN (5 lbf) or ±10% of rudder pedal force.	Landing.	Test from a minimum of 61 m (200 ft) AGL to a 50% decrease in main landing gear touchdown speed. Test data is required, including wind profile, for a crosswind component of at least 60% of airplane performance data value measured at 10 m (33 ft) above the runway. Wind components must be provided as headwind and crosswind values with respect to the runway.		X	X	X	In those situations where a maximum crosswind or a maximum demonstrated crosswind is not known, contact the responsible Flight Standards office.
2.e.4.	One Engine Inoperative Landing.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±3 m (10 ft) or ±10% of height. ±2° roll angle. ±2° side-slip angle. ±3° heading angle.	Landing.	Test from a minimum of 61 m (200 ft) AGL to a 50% decrease in main landing gear touchdown speed.		X	X	X	
2.e.5.	Autopilot landing (if applicable).	±1.5 m (5 ft) flare height. ±0.5 s or ± 10% of Tf.	Landing.	If autopilot provides roll-out guidance, record lateral deviation from touchdown to a 50% decrease in main landing gear touchdown speed. Time of autopilot flare mode engage and main gear touchdown must be noted.		X	X	X	See Appendix F of this part for definition of T_f.

		±0.7 m/s (140 ft/min) rate of descent at touchdown. ±3 m (10 ft) lateral deviation during roll-out.							
2.e.6.	All-engine autopilot go-around.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA.	As per airplane performance data.	Normal all-engine autopilot go-around must be demonstrated (if applicable) at medium weight.		X	X	X	
2.e.7.	One engine inoperative go around.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±2° roll angle. ±2° side-slip angle.	As per airplane performance data.	Engine inoperative go-around required near maximum certificated landing weight with critical engine inoperative. Provide one test with autopilot (if applicable) and one without autopilot. **CCA**: Non-autopilot test to be conducted in non-normal mode.		X	X	X	
2.e.8.	Directional control (rudder effectiveness) with symmetric reverse thrust.	±5 kt airspeed. ±2°/s yaw rate.	Landing.	Apply rudder pedal input in both directions using full reverse thrust until reaching full thrust reverser minimum operating speed.		X	X	X	
2.e.9.	Directional control (rudder effectiveness) with asymmetric reverse thrust.	±5 kt airspeed. ±3° heading angle.	Landing.	With full reverse thrust on the operating engine(s), maintain heading with rudder pedal input until maximum rudder pedal input or thrust reverser minimum operation speed is reached.		X	X	X	
2.f.	**Ground Effect.**								
	Test to demonstrate Ground Effect.	±1° elevator angle. ±0.5° stabilizer angle. ±5% of net thrust or equivalent. ±1° AOA. ±1.5 m (5 ft) or ±10% of height. ±3 kt airspeed. ±1° pitch angle.	Landing.	A rationale must be provided with justification of results. **CCA:** Test in normal or non-normal control mode, as applicable.		X	X	X	See paragraph 5 of this Attachment for additional information.
2.g.	**Windshear.**								
	Four tests, two takeoff and two landing, with one of each conducted in still air and the other	See Attachment 5 of this appendix.	Takeoff and Landing.	Requires windshear models that provide training in the specific skills needed to recognize windshear phenomena and to execute recovery procedures. See Attachment 5 of this appendix for tests, tolerances, and procedures.			X	X	See Attachment 5 of this appendix for information related to Level A and B simulators.

	with windshear active to demonstrate windshear models.								
2.h.	**Flight Maneuver and Envelope Protection Functions.**								
	Note. — The requirements of 2.h are only applicable to computer-controlled airplanes. Time history results of response to control inputs during entry into each envelope protection function (i.e. with normal and degraded control states if their function is different) are required. Set thrust as required to reach the envelope protection function.								
2.h.1.	Overspeed.	±5 kt airspeed.	Cruise.			X	X	X	
2.h.2.	Minimum Speed.	±3 kt airspeed.	Takeoff, Cruise, and Approach or Landing.			X	X	X	
2.h.3.	Load Factor.	±0.1g normal load factor	Takeoff, Cruise.			X	X	X	
2.h.4.	Pitch Angle.	±1.5° pitch angle	Cruise, Approach.			X	X	X	
2.h.5.	Bank Angle.	±2° or ±10% bank angle	Approach.			X	X	X	
2.h.6.	Angle of Attack.	±1.5° angle of attack	Second Segment Climb, and Approach or Landing.			X	X	X	
2.i.	**Engine and Airframe Icing Effects**								
2.i.	Engine and Airframe Icing Effects Demonstration (High Angle of Attack)		Takeoff or Approach or Landing [One flight condition – two tests (ice on and off)]	Time history of a full stall and initiation of the recovery. Tests are intended to demonstrate representative aerodynamic effects caused by in-flight ice accretion. Flight test validation data is not required. Two tests are required to demonstrate engine and airframe icing effects. One test will demonstrate the FSTDs baseline performance without ice accretion, and the second test will demonstrate the aerodynamic effects of ice accretion relative to the baseline test. The test must utilize the icing model(s) as described in the required Statement of Compliance in Table A1A, section 2.j. Test must include rationale that describes the icing effects being demonstrated. Icing effects may include, but are not limited to, the following effects as applicable to the particular airplane type: ▪ Decrease in stall angle of attack ▪ Changes in pitching moment ▪ Decrease in control effectiveness ▪ Changes in control forces ▪ Increase in drag ▪ Change in stall buffet characteristics and threshold of perception ▪ Engine effects (power reduction/variation, vibration, etc. where expected to be present on the aircraft in the ice accretion scenario being tested)			X	X	Tests will be evaluated for representative effects on relevant aerodynamic and other parameters such as angle of attack, control inputs, and thrust/power settings. Plotted parameters must include: • Altitude • Airspeed • Normal acceleration • Engine power • Angle of attack • Pitch attitude • Bank angle • Flight control inputs • Stall warning and stall buffet onset
3. Motion System.									
3.a.	**Frequency response.**								

		As specified by the sponsor for FSTD qualification.	Not applicable.	Appropriate test to demonstrate required frequency response.	X	X	X	X	See paragraph 6 of this Attachment.
3.b.	**Turn-around check.**								
		As specified by the sponsor for FSTD qualification.	Not applicable.	Appropriate test to demonstrate required smooth turn-around.	X	X	X	X	See paragraph 6 of this Attachment.
3.c	**Motion effects.**				X	X	X	X	Refer to Attachment 3 of this Appendix on subjective testing.
3.d.	**Motion system repeatability.**								
	Motion system repeatability	±0.05 g actual platform linear accelerations.	None.		X	X	X	X	Ensure that motion system hardware and software (in normal FSTD operating mode) continue to perform as originally qualified. Performance changes from the original baseline can be readily identified with this information. See paragraph 6.c. of this Attachment.
3.e.	**Motion cueing fidelity**								
3.e.1.	Motion cueing fidelity – Frequency-domain criterion.	As specified by the FSTD manufacturer for initial qualification.	Ground and flight.	For the motion system as applied during training, record the combined modulus and phase of the motion cueing algorithm and motion platform over the frequency range appropriate to the characteristics of the simulated aircraft. This test is only required for initial FSTD qualification.			X	X	Testing may be accomplished by the FSTD manufacturer and results provided as a statement of compliance.
3.e.2.	Reserved								
3.f	Characteristic motion vibrations. The following tests with recorded results and an SOC are required for characteristic motion vibrations, which can be sensed at the flight deck where applicable by airplane type.	None.	Ground and flight.					X	The recorded test results for characteristic buffets should allow the comparison of relative amplitude versus frequency. See also paragraph 6.e. of this Attachment.
3.f.1.	Thrust effect with brakes set.	The FSTD test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency "spikes"	Ground.	Test must be conducted at maximum possible thrust with brakes set.				X	

		being present within ± 2 Hz of the airplane data.							
3.f.2.	Buffet with landing gear extended.	The FSTD test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency "spikes" being present within ± 2 Hz of the airplane data.	Flight.	Test condition must be for a normal operational speed and not at the gear limiting speed.				X	
3.f.3.	Buffet with flaps extended.	The FSTD test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency "spikes" being present within ± 2 Hz of the airplane data.	Flight.	Test condition must be at a normal operational speed and not at the flap limiting speed.				X	
3.f.4.	Buffet with speedbrakes deployed.	The FSTD test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency "spikes" being present within ± 2 Hz of the airplane data.	Flight.	Test condition must be at a typical speed for a representative buffet.				X	
3.f.5.	Stall buffet	The FSTD test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency "spikes" being present within ± 2 Hz of the airplane data.	Cruise (High Altitude), Second Segment Climb, and Approach or Landing	Tests must be conducted for an angle of attack range between the buffet threshold of perception to the pilot and the stall angle of attack. Post stall characteristics are not required.			X	X	If stabilized flight data between buffet threshold of perception and the stall angle of attack are not available, PSD analysis should be conducted for a time span between initial buffet and the stall angle of attack. Test required only for FSTDs qualified for full stall training tasks or for those aircraft which exhibit stall buffet before the activation of the stall warning system.
3.f.6.	Buffet at high airspeeds or high Mach.	The FSTD test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency "spikes" being present within ± 2 Hz of the airplane data.	Flight.					X	Test condition should be for high-speed maneuver buffet/wind-up-turn or alternatively Mach buffet.

3.f.7.	In-flight vibrations for propeller driven airplanes.	The FSTD test results must exhibit the overall appearance and trends of the airplane data, with at least three (3) of the predominant frequency "spikes" being present within ± 2 Hz of the airplane data.	Flight (clean configuration).					**X**	Test should be conducted to be representative of in-flight vibrations for propeller-driven airplanes.
4. Visual System.									
4.a.	**Visual scene quality**								
4.a.1.	Continuous collimated cross-cockpit visual field of view.	Cross-cockpit, collimated visual display providing each pilot with a minimum of 176° horizontal and 36° vertical continuous field of view.	Not applicable.	Required as part of MQTG but not required as part of continuing evaluations.			**X**	**X**	Field of view should be measured using a visual test pattern filling the entire visual scene (all channels) consisting of a matrix of black and white 5° squares. Installed alignment should be confirmed in an SOC (this would generally consist of results from acceptance testing).
	Continuous collimated cross-cockpit visual field of view.	Continuous collimated field-of-view providing at least 45° horizontal and 30° vertical field-of-view for each pilot seat. Both pilot seat visual systems must be operable simultaneously.	Not applicable.	Required as part of MQTG but not required as part of continuing evaluations.	**X**	**X**			A vertical field-of-view of 30° may be insufficient to meet visual ground segment requirements.
4.a.2.	System geometry	5° even angular spacing within ±1° as measured from either pilot eye point and within 1.5° for adjacent squares.	Not applicable.	The angular spacing of any chosen 5° square and the relative spacing of adjacent squares must be within the stated tolerances.	**X**	**X**	**X**	**X**	The purpose of this test is to evaluate local linearity of the displayed image at either pilot eye point. System geometry should be measured using a visual test pattern filling the entire visual scene (all channels) with a matrix of black and white 5° squares with light points at the intersections. For continuing qualification testing, the use of an optical checking device is encouraged. This device should typically consist of a hand-held go/no go gauge to check that the relative positioning is maintained.

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4.a.3	Surface resolution (object detection).	Not greater than 2 arc minutes.	Not applicable.	An SOC is required and must include the relevant calculations and an explanation of those calculations. This requirement is applicable to any level of simulator equipped with a daylight visual system.			X	X	Resolution will be demonstrated by a test of objects shown to occupy the required visual angle in each visual display used on a scene from the pilot's eyepoint. The object will subtend 2 arc minutes to the eye. This may be demonstrated using threshold bars for a horizontal test. A vertical test should also be demonstrated.
4.a.4	Light point size.	Not greater than 5 arc minutes.	Not applicable.	An SOC is required and must include the relevant calculations and an explanation of those calculations. This requirement is applicable to any level of simulator equipped with a daylight visual system.			X	X	Light point size should be measured using a test pattern consisting of a centrally located single row of white light points displayed as both a horizontal and vertical row. It should be possible to move the light points relative to the eyepoint in all axes. At a point where modulation is just discernible in each visual channel, a calculation should be made to determine the light spacing.
4.a.5	Raster surface contrast ratio.	Not less than 5:1.	Not applicable.	This requirement is applicable to any level of simulator equipped with a daylight visual system.			X	X	Surface contrast ratio should be measured using a raster drawn test pattern filling the entire visual scene (all channels). The test pattern should consist of black and white squares, 5° per square, with a white square in the center of each channel. Measurement should be made on the center bright square for each channel using a 1° spot photometer. This value should have a minimum brightness of 7 cd/m^2 (2 ft-lamberts). Measure any adjacent dark squares.

									The contrast ratio is the bright square value divided by the dark square value. *Note 1. — During contrast ratio testing, FSTD aft-cab and flight deck ambient light levels should be as low as possible.* *Note 2. — Measurements should be taken at the center of squares to avoid light spill into the measurement device.*
4.a.6	Light point contrast ratio.	Not less than 25:1.	Not applicable.	An SOC is required and must include the relevant calculations.			X	X	Light point contrast ratio should be measured using a test pattern demonstrating an area of greater than 1° area filled with white light points and should be compared to the adjacent background. *Note. — Light point modulation should be just discernible on calligraphic systems but will not be discernable on raster systems.* Measurements of the background should be taken such that the bright square is just out of the light meter FOV. *Note. — During contrast ratio testing, FSTD aft-cab and flight deck ambient light levels should be as low as practical.*
	Light point contrast ratio.	Not less than 10:1.	Not applicable.		X	X			
4.a.7	Light point brightness.	Not less than 20 cd/m^2 (5.8 ft-lamberts).	Not applicable.				X	X	Light points should be displayed as a matrix creating a square. On calligraphic systems the light points should just merge. On raster systems the light points should overlap such that the square is continuous

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									(individual light points will not be visible).
4.a.8	Surface brightness.	Not less than 20 cd/m^2 (5.8 ft-lamberts) on the display.	Not applicable.	This requirement is applicable to any level of simulator equipped with a daylight visual system.			X	X	Surface brightness should be measured on a white raster, measuring the brightness using the 1° spot photometer. Light points are not acceptable. Use of calligraphic capabilities to enhance raster brightness is acceptable.
4.a.9	Black level and sequential contrast.	Black intensity: Background brightness – Black polygon brightness < 0.015 cd/m^2 (0.004 ft-lamberts). Sequential contrast: Maximum brightness – (Background brightness – Black polygon brightness) > 2,000:1.	Not applicable.		X	X	X	X	All projectors should be turned off and the cockpit environment made as dark as possible. A background reading should be taken of the remaining ambient light on the screen. The projectors should then be turned on and a black polygon displayed. A second reading should then be taken and the difference between this and the ambient level recorded. A full brightness white polygon should then be measured for the sequential contrast test. This test is generally only required for **light valve projectors**.
4.a.10	Motion blur.	When a pattern is rotated about the eyepoint at 10°/s, the smallest detectable gap must be 4 arc min or less.	Not applicable.		X	X	X	X	A test pattern consists of an array of 5 peak white squares with black gaps between them of decreasing width. The range of black gap widths should at least extend above and below the required detectable gap, and be in steps of 1 arc min. The pattern is rotated at the required rate. Two arrays of squares should be provided, one rotating in

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									heading and the other in pitch, to provide testing in both axes. A series of stationary numbers identifies the gap number. *Note.— This test can be limited by the display technology. Where this is the case the responsible Flight Standards office should be consulted on the limitations.* This test is generally only required for **light valve projectors**.
4.a.11	Speckle test.	Speckle contrast must be < 10%.	Not applicable.	An SOC is required describing the test method.	X	X	X	X	This test is generally only required for **laser projectors**.
4.b	**Head-Up Display (HUD)**								
4.b.1	Static Alignment.	Static alignment with displayed image. HUD bore sight must align with the center of the displayed image spherical pattern. Tolerance +/- 6 arc min.	**N/A**				X	X	Alignment requirement applies to any HUD system in use or both simultaneously if they are used simultaneously for training.
4.b.2	System display.	All functionality in all flight modes must be demonstrated.	**N/A**				X	X	A statement of the system capabilities should be provided and the capabilities demonstrated
4.b.3	HUD attitude versus FSTD attitude indicator (pitch and roll of horizon).	Pitch and roll align with aircraft instruments.	Flight.				X	X	
4.c	**Enhanced Flight Vision System (EFVS)**								
4.c.1	Registration test.	Alignment between EFVS display and out of the window image must represent the alignment typical of the aircraft and system type.	Takeoff point and on approach at 200 ft.				X	X	*Note.— The effects of the alignment tolerance in 4.b.1 should be taken into account.*
4.c.2	EFVS RVR and visibility calibration.	The scene represents the EFVS view at 350 m (1,200 ft) and 1,609 m	Flight.				X	X	Infra-red scene representative of both 350 m (1,200 ft), and 1,609 m (1 sm) RVR.

		(1 sm) RVR including correct light intensity.							Visual scene may be removed.
4.c.3	Thermal crossover.	Demonstrate thermal crossover effects during day to night transition.	Day and night.				X	X	The scene will correctly represent the thermal characteristics of the scene during a day to night transition.
4.d	**Visual ground segment**								
4.d.1	Visual ground segment (VGS).	Near end: the correct number of approach lights within the computed VGS must be visible. Far end: ±20% of the computed VGS. The threshold lights computed to be visible must be visible in the FSTD.	Trimmed in the landing configuration at 30 m (100 ft) wheel height above touchdown zone on glide slope at an RVR setting of 300 m (1,000 ft) or 350 m (1,200 ft).	This test is designed to assess items impacting the accuracy of the visual scene presented to a pilot at DH on an ILS approach. These items include: 1) RVR/Visibility; 2) glide slope (G/S) and localizer modeling accuracy (location and slope) for an ILS; 3) for a given weight, configuration and speed representative of a point within the airplane's operational envelope for a normal approach and landing; and 4) Radio altimeter. *Note. — If non-homogeneous fog is used, the vertical variation in horizontal visibility should be described and included in the slant range visibility calculation used in the VGS computation.*	X	X	X	X	
4.e	**Visual System Capacity**								
4.e.1	System capacity – Day mode.	Not less than: 10,000 visible textured surfaces, 6,000 light points, 16 moving models.	Not applicable.				X	X	Demonstrated through use of a visual scene rendered with the same image generator modes used to produce scenes for training. The required surfaces, light points, and moving models should be displayed simultaneously.
4.e.2	System capacity – Twilight/night mode.	Not less than: 10,000 visible textured surfaces, 15,000 light points, 16 moving models.	Not applicable.				X	X	Demonstrated through use of a visual scene rendered with the same image generator modes used to produce scenes for training. The required surfaces, light points, and moving models should be displayed simultaneously.

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5. Sound System. The sponsor will not be required to repeat the airplane tests (i.e., tests 5.a.1. through 5.a.8. (or 5.b.1. through 5.b.9.) and 5.c., as appropriate) during continuing qualification evaluations if frequency response and background noise test results are within tolerance when compared to the initial qualification evaluation results, and the sponsor shows that no software changes have occurred that will affect the airplane test results. If the frequency response test method is chosen and fails, the sponsor may elect to fix the frequency response problem and repeat the test or the sponsor may elect to repeat the airplane tests. If the airplane tests are repeated during continuing qualification evaluations, the results may be compared against initial qualification evaluation results or airplane master data. All tests in this section must be presented using an unweighted 1/3-octave band format from band 17 to 42 (50 Hz to 16 kHz). A minimum 20 second average must be taken at the location corresponding to the airplane data set. The airplane and flight simulator results must be produced using comparable data analysis techniques.									
5.a.	**Turbo-jet airplanes.**								All tests in this section should be presented using an unweighted 1/3-octave band format from at least band 17 to 42 (50 Hz to 16 kHz). A measurement of minimum 20 s should be taken at the location corresponding to the approved data set. The approved data set and FSTD results should be produced using comparable data analysis techniques. Refer to paragraph 7 of this Attachment
5.a.1.	Ready for engine start.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to engine start. The APU should be on if appropriate.				**X**	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.a.2.	All engines at idle.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial	Ground.	Normal condition prior to takeoff.				**X**	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct.

		evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.							Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.a.3.	All engines at maximum allowable thrust with brakes set.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to takeoff.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.a.4.	Climb	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	En-route climb.	Medium altitude.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.a.5.	Cruise	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the	Cruise.	Normal cruise configuration.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct.

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		average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.							Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.a.6.	Speed brake/spoilers extended (as appropriate).	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Cruise.	Normal and constant speed brake deflection for descent at a constant airspeed and power setting.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.a.7	Initial approach.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Approach.	Constant airspeed, gear up, flaps/slats as appropriate.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.a.8	Final approach.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between	Landing.	Constant airspeed, gear down, landing configuration flaps.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct.

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		initial and recurrent evaluation results cannot exceed 2 dB.							Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.b	**Propeller-driven airplanes**								All tests in this section should be presented using an unweighted 1/3-octave band format from at least band 17 to 42 (50 Hz to 16 kHz). A measurement of minimum 20 s should be taken at the location corresponding to the approved data set. The approved data set and FSTD results should be produced using comparable data analysis techniques. Refer to paragraph 3.7 of this Appendix.
5.b.1.	Ready for engine start.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to engine start. The APU should be on if appropriate.				**X**	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.b.2	All propellers feathered, if applicable.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when	Ground.	Normal condition prior to takeoff.				**X**	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data,

		compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.							providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.b.3.	Ground idle or equivalent.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to takeoff.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.b.4	Flight idle or equivalent.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to takeoff.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.b.5	All engines at maximum allowable power with brakes set.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial	Ground.	Normal condition prior to takeoff.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data,

		evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.							providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.b.6	Climb.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	En-route climb.	Medium altitude.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.b.7	Cruise	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Cruise.	Normal cruise configuration.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.b.8	Initial approach.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the	Approach.	Constant airspeed, gear up, flaps extended as appropriate, RPM as per operating manual.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct.

		average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.							Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.b.9	Final approach.	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Landing.	Constant airspeed, gear down, landing configuration flaps, RPM as per operating manual.				X	For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations.
5.c.	**Special cases.**	Initial evaluation: ± 5 dB per 1/3 octave band. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	As appropriate.					X	This applies to special steady-state cases identified as particularly significant to the pilot, important in training, or unique to a specific airplane type or model. For initial evaluation, it is acceptable to have some 1/3 octave bands out of ± 5 dB tolerance but not more than 2 that are consecutive and in any case within ± 7 dB from approved reference data, providing that the overall trend is correct. Where initial evaluation employs approved subjective tuning to develop the approved reference standard, recurrent evaluation tolerances should be used during recurrent evaluations
5.d	**FSTD background noise**	Initial evaluation: background noise levels must fall below the sound levels described		Results of the background noise at initial qualification must be included in the QTG document and approved by the responsible Flight Standards office. The measurements are to be				X	The simulated sound will be evaluated to ensure that the background noise does not interfere with training.

		in Paragraph 7.c (5) of this Attachment. Recurrent evaluation: ±3 dB per 1/3 octave band compared to initial evaluation.		made with the simulation running, the sound muted and a dead cockpit.					Refer to paragraph 7 of this Attachment. This test should be presented using an unweighted 1/3 octave band format from band 17 to 42 (50 Hz to 16 kHz).
5.e	**Frequency response**	Initial evaluation: not applicable. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground (static with all systems switched off)					X	Only required if the results are to be used during continuing qualification evaluations in lieu of airplane tests. The results must be approved by the responsible Flight Standards office during the initial qualification. This test should be presented using an unweighted 1/3 octave band format from band 17 to 42 (50 Hz to 16 kHz).
6	**SYSTEMS INTEGRATION**								
6.a.	**System response time**								
6.a.1	Transport delay.	Motion system and instrument response: 100 ms (or less) after airplane response. Visual system response: 120 ms (or less) after airplane response.	Pitch, roll and yaw.				X	X	One separate test is required in each axis. Where EFVS systems are installed, the EFVS response should be within + or - 30 ms from visual system response, and not before motion system response. *Note.— The delay from the airplane EFVS electronic elements should be added to the 30 ms tolerance before comparison with visual system reference.*
	Transport delay.	300 milliseconds or less after controller movement.	Pitch, roll and yaw.		X	X			

BEGIN INFORMATION

3. GENERAL

a. If relevant winds are present in the objective data, the wind vector should be clearly noted as part of the data presentation, expressed in conventional terminology, and related to the runway being used for test near the ground.

b. The reader is encouraged to review the Airplane Flight Simulator Evaluation Handbook, Volumes I and II, published by the Royal Aeronautical Society, London, UK, and AC 25–7, as amended, Flight Test Guide for Certification of Transport Category Airplanes, and AC 23–8, as amended, Flight Test

Guide for Certification of Part 23 Airplanes, for references and examples regarding flight testing requirements and techniques.

4. CONTROL DYNAMICS

a. General. The characteristics of an airplane flight control system have a major effect on handling qualities. A significant consideration in pilot acceptability of an airplane is the ''feel'' provided through the flight controls. Considerable effort is expended on airplane feel system design so that pilots will be comfortable and will consider the airplane desirable to fly. In order for an FFS to be representative, it should ''feel'' like the airplane being simulated. Compliance with this requirement is determined by comparing a recording of the control feel dynamics of the FFS to actual airplane measurements in the takeoff, cruise and landing configurations.

(1) Recordings such as free response to an impulse or step function are classically used to estimate the dynamic properties of electromechanical systems. In any case, it is only possible to estimate the dynamic properties as a result of being able to estimate true inputs and responses. Therefore, it is imperative that the best possible data be collected since close matching of the FFS control loading system to the airplane system is essential. The required dynamic control tests are described in Table A2A of this attachment.

(2) For initial and upgrade evaluations, the QPS requires that control dynamics characteristics be measured and recorded directly from the flight controls (Handling Qualities—Table A2A). This procedure is usually accomplished by measuring the free response of the controls using a step or impulse input to excite the system. The procedure should be accomplished in the takeoff, cruise and landing flight conditions and configurations.

(3) For airplanes with irreversible control systems, measurements may be obtained on the ground if proper pitot-static inputs are provided to represent airspeeds typical of those encountered in flight. Likewise, it may be shown that for some airplanes, takeoff, cruise, and landing configurations have like effects. Thus, one may suffice for another. In either case, engineering validation or airplane manufacturer rationale should be submitted as justification for ground tests or for eliminating a configuration. For FFSs requiring static and dynamic tests at the controls, special test fixtures will not be required during initial and upgrade evaluations if the QTG shows both test fixture results and the results of an alternate approach (e.g., computer plots that were produced concurrently and show satisfactory agreement). Repeat of the alternate method during the initial evaluation satisfies this test requirement.

b. Control Dynamics Evaluation. The dynamic properties of control systems are often stated in terms of frequency, damping and a number of other classical measurements. In order to establish a consistent means of validating test results for FFS control loading, criteria are needed that will clearly define the measurement interpretation and the applied tolerances. Criteria are needed for underdamped, critically damped and overdamped systems. In the case of an underdamped system with very light damping, the system may be quantified in terms of frequency and damping. In critically damped or overdamped systems, the frequency and damping are not readily measured from a response time history. Therefore, the following suggested measurements may be used:

(1) For Level C and D simulators. Tests to verify that control feel dynamics represent the airplane should show that the dynamic damping cycles (free response of the controls) match those of the airplane within specified tolerances. The Flight Standards Service recognizes that several different testing methods may be used to verify the control feel dynamic response. The responsible Flight Standards office will consider the merits of testing methods based on reliability and consistency. One acceptable method of evaluating the response and the tolerance to be applied is described below for the underdamped and critically damped cases. A sponsor using this method to comply with the QPS requirements should perform the tests as follows:

(a) Underdamped response. Two measurements are required for the period, the time to first zero crossing (in case a rate limit is present) and the subsequent frequency of oscillation. It is necessary to measure cycles on an individual basis in case there are non-uniform periods in the response. Each period will be independently compared to the respective period of the airplane control system and, consequently, will enjoy the full tolerance specified for that period. The damping tolerance will be applied to overshoots on an individual basis. Care should be taken when applying the tolerance to small overshoots since the significance of such overshoots becomes questionable. Only those overshoots larger than 5 per cent of the total initial displacement should be considered. The residual band, labeled $T(A_d)$ on Figure A2A is ±5 percent of the initial displacement amplitude A_d from the steady state value of the oscillation. Only oscillations outside the residual band are considered significant. When comparing FFS data to airplane data, the process should begin by overlaying or aligning the FFS and airplane steady state values and then comparing amplitudes of oscillation peaks, the time of the first zero crossing and individual periods of oscillation. The FFS should show the same number of significant overshoots to within one when compared against the airplane data. The procedure for evaluating the response is illustrated in Figure A2A.

(b) Critically damped and overdamped response. Due to the nature of critically damped and overdamped responses (no overshoots), the time to reach 90 percent of the steady state (neutral point) value should be the same as the airplane within ±10 percent. Figure A2B illustrates the procedure.

(c) Special considerations. Control systems that exhibit characteristics other than classical overdamped or underdamped responses should meet specified tolerances. In addition, special consideration should be given to ensure that significant trends are maintained.

(2) Tolerances.

(a) The following table summarizes the tolerances, T, for underdamped systems, and ''n'' is the sequential period of a full cycle of oscillation. See Figure A2A of this attachment for an illustration of the referenced measurements.

$T(P_0)$	±10% of P_0.
$T(P_1)$	±20% of P_1.
$T(P_2)$	±30% of P_2.
$T(P_n)$	±10(n + 1)% of P_n.
$T(A_n)$	±10% of A_1.
$T(A_d)$	±5% of A_d = residual band.

Significant overshoots, First overshoot and ±1 subsequent overshoots.

(b) The following tolerance applies to critically damped and overdamped systems only. See Figure A2B for an illustration of the reference measurements:

$T(P_0)$	±10% of P_0

END INFORMATION

BEGIN QPS REQUIREMENT

c. Alternative method for control dynamics evaluation.

(1) An alternative means for validating control dynamics for aircraft with hydraulically powered flight controls and artificial feel systems is by the measurement of control force and rate of movement. For each axis of pitch, roll, and yaw, the control must be forced to its maximum extreme position for the following distinct rates. These tests are conducted under normal flight and ground conditions.

(a) Static test—Slowly move the control so that a full sweep is achieved within 95 to 105 seconds. A full sweep is defined as movement of the controller from neutral to the stop, usually aft or right stop, then to the opposite stop, then to the neutral position.

(b) Slow dynamic test—Achieve a full sweep within 8–12 seconds.

(c) Fast dynamic test—Achieve a full sweep within 3–5 seconds.

NOTE: Dynamic sweeps may be limited to forces not exceeding 100 lbs. (44.5 daN).

(d) Tolerances

(i) Static test; see Table A2A, FFS Objective Tests, Entries 2.a.1., 2.a.2., and 2.a.3.

(ii) Dynamic test—±2 lbs (0.9 daN) or ±10% on dynamic increment above static test.

END QPS REQUIREMENT

BEGIN INFORMATION

d. The FAA is open to alternative means such as the one described above. The alternatives should be justified and appropriate to the application. For example, the method described here may not apply to all manufacturers' systems and certainly not to aircraft with reversible control systems. Each case is considered on its own merit on an ad hoc basis. If the FAA finds that alternative methods do not result in satisfactory performance, more conventionally accepted methods will have to be used.

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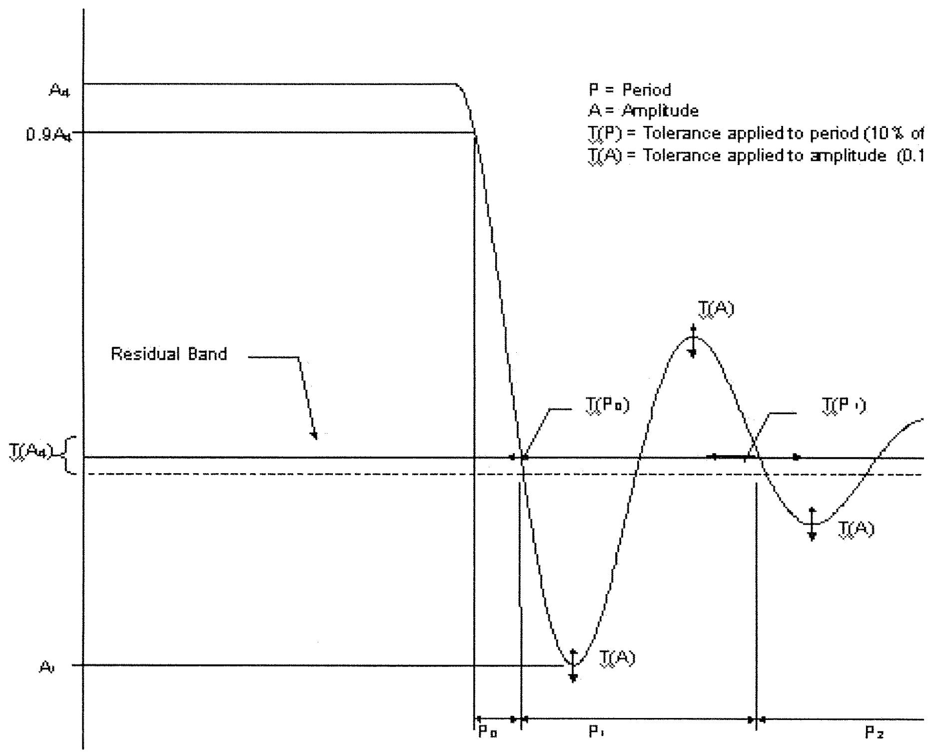

Figure A2A
Underdamped Step Response

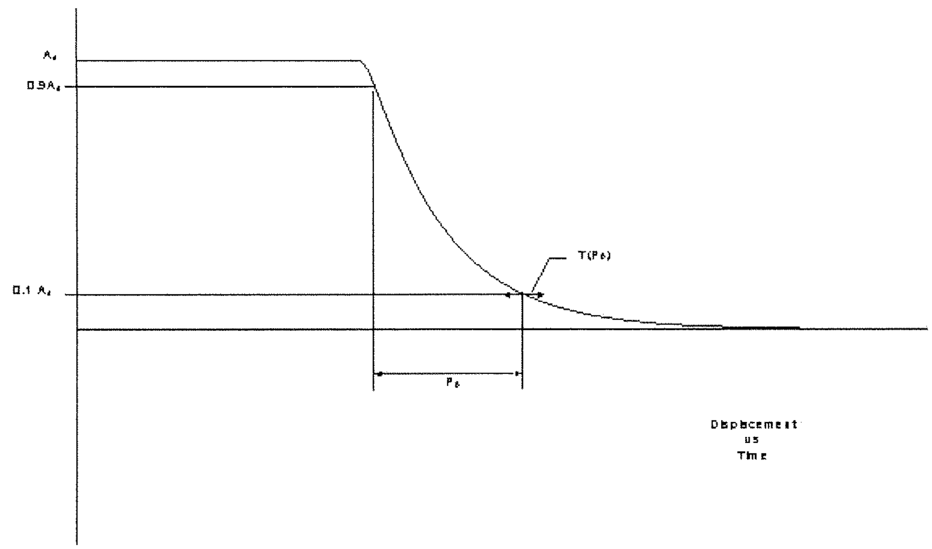

Figure A2B
Critically and Overdamped Step Response

5. GROUND EFFECT

a. For an FFS to be used for take-off and landing (not applicable to Level A simulators in that the landing maneuver may not be credited in a Level A simulator) it should reproduce the aerodynamic changes that occur in ground effect. The parameters chosen for FFS validation should indicate these changes.

(1) A dedicated test should be provided that will validate the aerodynamic ground effect characteristics.

(2) The organization performing the flight tests may select appropriate test methods and procedures to validate ground effect. However, the flight tests should be performed with enough duration near the ground to sufficiently validate the ground-effect model.

b. The responsible Flight Standards office will consider the merits of testing methods based on reliability and consistency. Acceptable methods of validating ground effect are described below. If other methods are proposed, rationale should be provided to conclude that the tests performed validate the ground-effect model. A sponsor using the methods described below to comply with the QPS requirements should perform the tests as follows:

(1) Level fly-bys. The level fly-bys should be conducted at a minimum of three altitudes within the ground effect, including one at no more than 10% of the wingspan above the ground, one each at approximately 30% and 50% of the wingspan where height refers to main gear tire above the ground. In addition, one level-flight trim condition should be conducted out of ground effect (e.g., at 150% of wingspan).

(2) Shallow approach landing. The shallow approach landing should be performed at a glide slope of approximately one degree with negligible pilot activity until flare.

c. The lateral-directional characteristics are also altered by ground effect. For example, because of changes in lift, roll damping is affected. The change in roll damping will affect other dynamic modes usually evaluated for FFS validation. In fact, Dutch roll dynamics, spiral stability, and roll-rate for a given lateral control input are altered by ground effect. Steady heading sideslips will also be affected. These effects should be accounted for in the FFS modeling. Several tests such as crosswind landing, one engine inoperative landing, and engine failure on take-off serve to validate lateral-directional ground effect since portions of these tests are accomplished as the aircraft is descending through heights above the runway at which ground effect is an important factor.

6. MOTION SYSTEM

a. General.

(1) Pilots use continuous information signals to regulate the state of the airplane. In concert with the instruments and outside-world visual information, whole-body motion feedback is essential in assisting the pilot to control the airplane dynamics, particularly in the presence of external disturbances. The motion system should meet basic objective performance criteria, and should be subjectively tuned at the pilot's seat position to represent the linear and angular accelerations of the airplane during a prescribed minimum set of maneuvers and conditions. The response of the motion cueing system should also be repeatable.

(2) The Motion System tests in Section 3 of Table A2A are intended to qualify the FFS motion cueing system from a mechanical performance standpoint. Additionally, the list of motion effects provides a representative sample of dynamic conditions that should be present in the flight simulator. An additional list of representative, training-critical maneuvers, selected from Section 1 (Performance tests), and Section 2 (Handling Qualities tests), in Table A2A, that should be recorded during initial qualification (but without tolerance) to indicate the flight simulator motion cueing performance signature have been identified (reference Section 3.e). These tests are intended to help improve the overall standard of FFS motion cueing.

b. Motion System Checks. The intent of test 3a, Frequency Response, and test 3b, Turn-Around Check, as described in the Table of Objective Tests, are to demonstrate the performance of the motion system hardware, and to check the integrity of the motion set-up with regard to calibration and wear. These tests are independent of the motion cueing software and should be considered robotic tests.

c. Motion System Repeatability. The intent of this test is to ensure that the motion system software and motion system hardware have not degraded or changed over time. This diagnostic test should be completed during continuing qualification checks in lieu of the robotic tests. This will allow an improved ability to determine changes in the software or determine degradation in the hardware. The following information delineates the methodology that should be used for this test.

(1) Input: The inputs should be such that rotational accelerations, rotational rates, and linear accelerations are inserted before the transfer from airplane center of gravity to pilot reference point with a minimum amplitude of 5 deg/sec/sec, 10 deg/sec and 0.3 g, respectively, to provide adequate analysis of the output.

(2) Recommended output:

(a) Actual platform linear accelerations; the output will comprise accelerations due to both the linear and rotational motion acceleration;

(b) Motion actuators position.

d. Objective Motion Cueing Test—Frequency Domain

(1) Background. This test quantifies the response of the motion cueing system from the output of the flight model to the motion platform response. Other motion tests, such as the motion system frequency response, concentrate on the mechanical performance of the motion system hardware alone. The intent of this test is to provide quantitative frequency response records of the entire motion system for specified degree-of-freedom transfer relationships over a range of frequencies. This range should be representative of the manual control range for that particular aircraft type and the simulator as set up during qualification. The measurements of this test should include the combined influence of the motion cueing algorithm, the motion platform dynamics, and the transport delay associated with the motion cueing and control system implementation. Specified frequency responses describing the ability of the FSTD to reproduce aircraft translations and rotations, as well as the cross-coupling relations, are required as part of these measurements. When simulating forward aircraft acceleration, the simulator is accelerated momentarily in the forward direction to provide the onset cueing. This is considered the direct transfer relation. The simulator is simultaneously tilted nose-up due to the low-pass filter in order to generate a sustained specific force. The tilt associated with the generation of the sustained specific force, and the angular rates and angular accelerations associated with the initiation of the sustained specific force, are considered cross-coupling relations. The specific force is required for the perception of the aircraft sustained specific force, while the angular rates and accelerations do not occur in the aircraft and should be minimized.

(2) Frequency response test. This test requires the frequency response to be measured for the motion cueing system. Reference sinusoidal signals are inserted at the pilot reference position prior to the motion cueing computations. The response of the motion platform in the corresponding degree-of-freedom (the direct transfer relations), as well as the motions resulting from cross-coupling (the cross-coupling relations), are recorded. These are the tests that are important to

pilot motion cueing and are general tests applicable to all types of airplanes.

(3) This test is only required to be run once for the initial qualification of the FSTD and will not be required for continuing qualification purposes. The FAA will accept test results provided by the FSTD manufacturer as part of a Statement of Compliance confirming that the objective motion cueing tests were used to assist in the tuning of the FSTD's motion cueing algorithms.

e. Motion Vibrations.

(1) Presentation of results. The characteristic motion vibrations may be used to verify that the flight simulator can reproduce the frequency content of the airplane when flown in specific conditions. The test results should be presented as a Power Spectral Density (PSD) plot with frequencies on the horizontal axis and amplitude on the vertical axis. The airplane data and flight simulator data should be presented in the same format with the same scaling. The algorithms used for generating the flight simulator data should be the same as those used for the airplane data. If they are not the same then the algorithms used for the flight simulator data should be proven to be sufficiently comparable. As a minimum, the results along the dominant axes should be presented and a rationale for not presenting the other axes should be provided.

(2) Interpretation of results. The overall trend of the PSD plot should be considered while focusing on the dominant frequencies. Less emphasis should be placed on the differences at the high frequency and low amplitude portions of the PSD plot. During the analysis, certain structural components of the flight simulator have resonant frequencies that are filtered and may not appear in the PSD plot. If filtering is required, the notch filter bandwidth should be limited to 1 Hz to ensure that the buffet feel is not adversely affected. In addition, a rationale should be provided to explain that the characteristic motion vibration is not being adversely affected by the filtering. The amplitude should match airplane data as described below. However, if the PSD plot was altered for subjective reasons, a rationale should be provided to justify the change. If the plot is on a logarithmic scale, it may be difficult to interpret the amplitude of the buffet in terms of acceleration. For example, a 1×10^{-3} g-rms^2/Hz would describe a heavy buffet and may be seen in the deep stall regime. Alternatively, a 1×10^{-6} g-rms^2/Hz buffet is almost not perceivable; but may represent a flap buffet at low speed. The previous two examples differ in magnitude by 1000. On a PSD plot this represents three decades (one decade is a change in order of magnitude of 10; and two decades is a change in order of magnitude of 100).

NOTE: In the example, ''g-rms^2 is the mathematical expression for ''g's root mean squared.''

7. SOUND SYSTEM

a. General. The total sound environment in the airplane is very complex, and changes with atmospheric conditions, airplane configuration, airspeed, altitude, and power settings. Flight deck sounds are an important component of the flight deck operational environment and provide valuable information to the flight crew. These aural cues can either assist the crew (as an indication of an abnormal situation), or hinder the crew (as a distraction or nuisance). For effective training, the flight simulator should provide flight deck sounds that are perceptible to the pilot during normal and abnormal operations, and comparable to those of the airplane. The flight simulator operator should carefully evaluate background noises in the location where the device will be installed. To demonstrate compliance with the sound requirements, the objective or validation tests in this attachment were selected to provide a representative sample of normal static conditions typically experienced by a pilot.

b. Alternate propulsion. For FFS with multiple propulsion configurations, any condition listed in Table A2A of this attachment should be presented for evaluation as part of the QTG if identified by the airplane manufacturer or other data supplier as significantly different due to a change in propulsion system (engine or propeller).

c. Data and Data Collection System.

(1) Information provided to the flight simulator manufacturer should be presented in the format suggested by the International Air Transport Association (IATA) ''Flight Simulator Design and Performance Data Requirements,'' as amended. This information should contain calibration and frequency response data.

(2) The system used to perform the tests listed in Table A2A should comply with the following standards:

(a) The specifications for octave, half octave, and third octave band filter sets may be found in American National Standards Institute (ANSI) S1.11–1986;

(b) Measurement microphones should be type WS2 or better, as described in International Electrotechnical Commission (IEC) 1094–4–1995.

(3) Headsets. If headsets are used during normal operation of the airplane they should also be used during the flight simulator evaluation.

(4) Playback equipment. Playback equipment and recordings of the QTG conditions should be provided during initial evaluations.

(5) Background noise.

(a) Background noise is the noise in the flight simulator that is not associated with the airplane, but is caused by the flight simulator's cooling and hydraulic systems and extraneous noise from other locations in the building. Background noise can seriously impact the correct simulation of airplane sounds and should be kept below the airplane sounds. In some cases, the sound level of the simulation can be increased to compensate for the background noise. However, this approach is limited by the specified tolerances and by the subjective acceptability of the sound environment to the evaluation pilot.

(b) The acceptability of the background noise levels is dependent upon the normal sound levels in the airplane being represented. Background noise levels that fall below the lines defined by the following points, may be acceptable:

(i) 70 dB @ 50 Hz;

(ii) 55 dB @ 1000 Hz;

(iii) 30 dB @ 16 kHz

(NOTE: These limits are for unweighted ⅓ octave band sound levels. Meeting these limits for background noise does not ensure an acceptable flight simulator. Airplane sounds that fall below this limit require careful review and may require lower limits on background noise.)

(6) Validation testing. Deficiencies in airplane recordings should be considered when applying the specified tolerances to ensure that the simulation is representative of the airplane. Examples of typical deficiencies are:

(a) Variation of data between tail numbers;

(b) Frequency response of microphones;

(c) Repeatability of the measurements.

TABLE A2B—EXAMPLE OF CONTINUING QUALIFICATION FREQUENCY RESPONSE TEST TOLERANCE

Band center frequency	Initial results (dBSPL)	Continuing qualification results (dBSPL)	Absolute difference
50	75.0	73.8	1.2
63	75.9	75.6	0.3
80	77.1	76.5	0.6
100	78.0	78.3	0.3
125	81.9	81.3	0.6
160	79.8	80.1	0.3
200	83.1	84.9	1.8
250	78.6	78.9	0.3
315	79.5	78.3	1.2
400	80.1	79.5	0.6
500	80.7	79.8	0.9
630	81.9	80.4	1.5
800	73.2	74.1	0.9
1000	79.2	80.1	0.9
1250	80.7	82.8	2.1
1600	81.6	78.6	3.0
2000	76.2	74.4	1.8
2500	79.5	80.7	1.2
3150	80.1	77.1	3.0
4000	78.9	78.6	0.3
5000	80.1	77.1	3.0
6300	80.7	80.4	0.3
8000	84.3	85.5	1.2
10000	81.3	79.8	1.5
12500	80.7	80.1	0.6
16000	71.1	71.1	0.0
Average			1.1

8. ADDITIONAL INFORMATION ABOUT FLIGHT SIMULATOR QUALIFICATION FOR NEW OR DERIVATIVE AIRPLANES

a. Typically, an airplane manufacturer's approved final data for performance, handling qualities, systems or avionics is not available until well after a new or derivative airplane has entered service. However, flight crew training and certification often begins several months prior to the entry of the first airplane into service. Consequently, it may be necessary to use preliminary data provided by the airplane manufacturer for interim qualification of flight simulators.

b. In these cases, the responsible Flight Standards office may accept certain partially validated preliminary airplane and systems data, and early release (''red label'') avionics data in order to permit the necessary program schedule for training, certification, and service introduction.

c. Simulator sponsors seeking qualification based on preliminary data should consult the responsible Flight Standards office to make special arrangements for using preliminary data for flight simulator qualification. The sponsor should also consult the airplane and flight simulator manufacturers to develop a data plan and flight simulator qualification plan.

d. The procedure to be followed to gain the responsible Flight Standards office acceptance of preliminary data will vary from case to case and between airplane manufacturers. Each airplane manufacturer's new airplane development and test program is designed to suit the needs of the particular project and may not contain the same events or sequence of events as another manufacturer's program, or even the same manufacturer's program for a different airplane. Therefore, there cannot be a prescribed invariable procedure for acceptance of preliminary data, but instead there should be a statement describing the final sequence of events, data sources, and validation procedures agreed by the simulator sponsor, the airplane manufacturer, the flight simulator manufacturer, and the responsible Flight Standards office.

NOTE: A description of airplane manufacturer-provided data needed for flight simulator modeling and validation is to be found in the IATA Document ''Flight Simulator Design and Performance Data Requirements,'' as amended.

e. The preliminary data should be the manufacturer's best representation of the airplane, with assurance that the final data will not significantly deviate from the preliminary estimates. Data derived from these predictive or preliminary techniques should be validated against available sources including, at least, the following:

(1) Manufacturer's engineering report. The report should explain the predictive method used and illustrate past success of the method on similar projects. For example, the manufacturer could show the application of the method to an earlier airplane model or predict the characteristics of an earlier model and compare the results to final data for that model.

(2) Early flight test results. This data is often derived from airplane certification tests, and should be used to maximum advantage for early flight simulator validation. Certain critical tests that would normally be done early in the airplane certification program should be included to validate essential pilot training and certification maneuvers. These include cases where a pilot is expected to cope with an airplane failure mode or an engine failure. Flight test data that will be available early in the flight test program will depend on the airplane manufacturer's flight test program design and may not be the same in each case. The flight test program of the airplane manufacturer should include provisions for generation of very early flight test results for flight simulator validation.

f. The use of preliminary data is not indefinite. The airplane manufacturer's final data should be available within 12 months after the airplane's first entry into service or as agreed by the responsible Flight Standards office, the simulator sponsor, and the airplane manufacturer. When applying for interim qualification using preliminary data, the simulator sponsor and the responsible Flight Standards office should agree on the update program. This includes specifying that the final data update will be installed in the flight simulator within a period of 12 months following the final data release, unless special conditions exist and a different schedule is acceptable. The flight simulator performance and handling validation would then be based on data derived from flight tests or from other approved sources. Initial airplane systems data should be updated after engineering tests. Final airplane systems data should also be used for flight simulator programming and validation.

g. Flight simulator avionics should stay essentially in step with airplane avionics (hardware and software) updates. The permitted time lapse between airplane and flight simulator updates should be minimal. It may depend on the magnitude of the update and whether the QTG and pilot training and certification are affected. Differences in airplane and flight simulator avionics versions and the resulting effects on flight simulator qualification should be agreed between the simulator sponsor and the responsible Flight Standards office. Consultation with the flight simulator manufacturer is desirable throughout the qualification process.

h. The following describes an example of the design data and sources that might be used in the development of an interim qualification plan.

(1) The plan should consist of the development of a QTG based upon a mix of flight test and engineering simulation data. For data collected from specific airplane flight tests or other flights, the required design model or data changes necessary to support an acceptable Proof of Match (POM) should be generated by the airplane manufacturer.

(2) For proper validation of the two sets of data, the airplane manufacturer should compare their simulation model responses against the flight test data, when driven by the same control inputs and subjected to the same atmospheric conditions as recorded in the flight test. The model responses should result from a simulation where the following systems are run in an integrated fashion and are consistent with the design data released to the flight simulator manufacturer:

(a) Propulsion;
(b) Aerodynamics;
(c) Mass properties;
(d) Flight controls;
(e) Stability augmentation; and
(f) Brakes/landing gear.

i. A qualified test pilot should be used to assess handling qualities and performance evaluations for the qualification of flight simulators of new airplane types.

END INFORMATION

BEGIN QPS REQUIREMENT

9. ENGINEERING SIMULATOR—VALIDATION DATA

a. When a fully validated simulation (i.e., validated with flight test results) is modified due to changes to the simulated airplane configuration, the airplane manufacturer or other acceptable data supplier must coordinate with the responsible Flight Standards office if they propose to supply validation data from an ''audited'' engineering simulator/simulation to selectively supplement flight test data. The responsible Flight Standards office must be provided an opportunity to audit the engineering simulation

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or the engineering simulator used to generate the validation data. Validation data from an audited engineering simulation may be used for changes that are incremental in nature. Manufacturers or other data suppliers must be able to demonstrate that the predicted changes in aircraft performance are based on acceptable aeronautical principles with proven success history and valid outcomes. This must include comparisons of predicted and flight test validated data.

b. Airplane manufacturers or other acceptable data suppliers seeking to use an engineering simulator for simulation validation data as an alternative to flight-test derived validation data, must contact the responsible Flight Standards office and provide the following:

(1) A description of the proposed aircraft changes, a description of the proposed simulation model changes, and the use of an integral configuration management process, including a description of the actual simulation model modifications that includes a step-by-step description leading from the original model(s) to the current model(s).

(2) A schedule for review by the responsible Flight Standards office of the proposed plan and the subsequent validation data to establish acceptability of the proposal.

(3) Validation data from an audited engineering simulator/simulation to supplement specific segments of the flight test data.

c. To be qualified to supply engineering simulator validation data, for aerodynamic, engine, flight control, or ground handling models, an airplane manufacturer or other acceptable data supplier must:

(1) Be able to verify their ability able to:

(a) Develop and implement high fidelity simulation models; and

(b) Predict the handling and performance characteristics of an airplane with sufficient accuracy to avoid additional flight test activities for those handling and performance characteristics.

(2) Have an engineering simulator that:

(a) Is a physical entity, complete with a flight deck representative of the simulated class of airplane;

(b) Has controls sufficient for manual flight;

(c) Has models that run in an integrated manner;

(d) Has fully flight-test validated simulation models as the original or baseline simulation models;

(e) Has an out-of-the-flight deck visual system;

(f) Has actual avionics boxes interchangeable with the equivalent software simulations to support validation of released software;

(g) Uses the same models as released to the training community (which are also used to produce stand-alone proof-of-match and checkout documents);

(h) Is used to support airplane development and certification; and

(i) Has been found to be a high fidelity representation of the airplane by the manufacturer's pilots (or other acceptable data supplier), certificate holders, and the responsible Flight Standards office.

(3) Use the engineering simulator/simulation to produce a representative set of integrated proof-of-match cases.

(4) Use a configuration control system covering hardware and software for the operating components of the engineering simulator/simulation.

(5) Demonstrate that the predicted effects of the change(s) are within the provisions of sub-paragraph "a" of this section, and confirm that additional flight test data are not required.

d. Additional Requirements for Validation Data

(1) When used to provide validation data, an engineering simulator must meet the simulator standards currently applicable to training simulators except for the data package.

(2) The data package used must be:

(a) Comprised of the engineering predictions derived from the airplane design, development, or certification process;

(b) Based on acceptable aeronautical principles with proven success history and valid outcomes for aerodynamics, engine operations, avionics operations, flight control applications, or ground handling;

(c) Verified with existing flight-test data; and

(d) Applicable to the configuration of a production airplane, as opposed to a flight-test airplane.

(3) Where engineering simulator data are used as part of a QTG, an essential match must exist between the training simulator and the validation data.

(4) Training flight simulator(s) using these baseline and modified simulation models must be qualified to at least internationally recognized standards, such as contained in the ICAO Document 9625, the "Manual of Criteria for the Qualification of Flight Simulators."

END QPS REQUIREMENT

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10. [RESERVED]

11. VALIDATION TEST TOLERANCES

BEGIN INFORMATION

a. Non-Flight-Test Tolerances

(1) If engineering simulator data or other non-flight-test data are used as an allowable

form of reference validation data for the objective tests listed in Table A2A of this attachment, the data provider must supply a well-documented mathematical model and testing procedure that enables a replication of the engineering simulation results within 40% of the corresponding flight test tolerances.

b. Background

(1) The tolerances listed in Table A2A of this attachment are designed to measure the quality of the match using flight-test data as a reference.

(2) Good engineering judgment should be applied to all tolerances in any test. A test is failed when the results clearly fall outside of the prescribed tolerance(s).

(3) Engineering simulator data are acceptable because the same simulation models used to produce the reference data are also used to test the flight training simulator (i.e., the two sets of results should be "essentially" similar).

(4) The results from the two sources may differ for the following reasons:

(a) Hardware (avionics units and flight controls);

(b) Iteration rates;

(c) Execution order;

(d) Integration methods;

(e) Processor architecture;

(f) Digital drift, including:

(i) Interpolation methods;

(ii) Data handling differences; and

(iii) Auto-test trim tolerances.

(5) The tolerance limit between the reference data and the flight simulator results is generally 40 percent of the corresponding 'flight-test' tolerances. However, there may be cases where the simulator models used are of higher fidelity, or the manner in which they are cascaded in the integrated testing loop have the effect of a higher fidelity, than those supplied by the data provider. Under these circumstances, it is possible that an error greater than 40 percent may be generated. An error greater than 40 percent may be acceptable if simulator sponsor can provide an adequate explanation.

(6) Guidelines are needed for the application of tolerances to engineering-simulator-generated validation data because:

(a) Flight-test data are often not available due to technical reasons;

(b) Alternative technical solutions are being advanced; and

(c) High costs.

12. VALIDATION DATA ROADMAP

a. Airplane manufacturers or other data suppliers should supply a validation data roadmap (VDR) document as part of the data package. A VDR document contains guidance material from the airplane validation data supplier recommending the best possible sources of data to be used as validation data in the QTG. A VDR is of special value when requesting interim qualification, qualification of simulators for airplanes certificated prior to 1992, and qualification of alternate engine or avionics fits. A sponsor seeking to have a device qualified in accordance with the standards contained in this QPS appendix should submit a VDR to the responsible Flight Standards office as early as possible in the planning stages. The responsible Flight Standards office is the final authority to approve the data to be used as validation material for the QTG.

b. The VDR should identify (in matrix format) sources of data for all required tests. It should also provide guidance regarding the validity of these data for a specific engine type, thrust rating configuration, and the revision levels of all avionics affecting airplane handling qualities and performance. The VDR should include rationale or explanation in cases where data or parameters are missing, engineering simulation data are to be used, flight test methods require explanation, or there is any deviation from data requirements. Additionally, the document should refer to other appropriate sources of validation data (e.g., sound and vibration data documents).

c. The Sample Validation Data Roadmap (VDR) for airplanes, shown in Table A2C, depicts a generic roadmap matrix identifying sources of validation data for an abbreviated list of tests. This document is merely a sample and does not provide actual data. A complete matrix should address all test conditions and provide actual data and data sources.

d. Two examples of rationale pages are presented in Appendix F of the IATA "Flight Simulator Design and Performance Data Requirements." These illustrate the type of airplane and avionics configuration information and descriptive engineering rationale used to describe data anomalies or provide an acceptable basis for using alternative data for QTG validation requirements.

END INFORMATION

Table A2C - Sample Validation Data Roadmap for Airplanes

ICAO or IATA #	Test Description	CCA Mode	Validation Source: Aircraft Flight Test Data	Validation Source: Engineering Simulator Data (DEF-73 Engines)	Validation Document: Aerodynamics POM Doc.#xxx123, Rev. A	Validation Document: Flight Controls POM Doc.#xxx456, NEW	Validation Document: Ground Handling POM Doc. #xxx789, Rev. B	Validation Document: Propulsion POM Doc. #321, Rev. C	Validation Document: Integrated POM Doc. #xxx654, Rev. A	Validation Document: Appendix to this VDR Doc. #xxx987, NEW	Comments
Notes: 1. Only one page is shown; and some test conditions were deleted for brevity. 2. Relevant regulatory material should be consulted and all applicable tests addressed. 3. Validation source, document and comments provided herein are for reference only and do not constitute approval for use. 4. CCA mode must be described for each test condition. 5. If more than one aircraft type (e.g., derivative and baseline) are used as validation data more columns may be necessary.											*Legend:* D71 = Engine Type (Thrust Rating of 71.5K) D73 = Engine Type (Thrust Rating of 73K) Bold upper case = primary validation source. Lower case, within parentheses = alternative validation source. R = Rationale included in the data package Appendix.
1.a.1.	Minimum Radius Turn.		**X**				**D71**				
1.a.2.	Rate of Turn vs. Nosewheel Angle (2 speeds).		**X**				**D71**				
1.b.1.	Ground Acceleration Time and Distance.		**X**				(d73)		**D73**		Primary data contained in IPOM.
1.b.2.	Minimum Control Speed, Ground (Vmcg).		(x)	**X**	(d71)					**D73**	See engineering rationale for test data in VDR.
1.b.3.	Minimum Unstick Speed (Vmu).		**X**		**D71**						
1.b.4.	Normal Takeoff.		**X**		(d73)				**D73**		Primary data contained in IPOM.
1.b.5.	Critical Engine Failure on Takeoff.		**X**		(d71)					**D73**	Alternative engine thrust rating flight test data in VDR.
1.b.6.	Crosswind Takeoff.		**X**		(d71)					**D73**	Alternative engine thrust rating flight test data in VDR.
1.b.7.	Rejected Takeoff.		**X**		**D71**					**R**	Test procedure anomaly; see rationale.
1.b.8.	Dynamic Engine Failure After Takeoff.			**X**						**D73**	No flight test data available; see rationale.
1.c.1.	Normal Climb – All Engines.		**X**		(d71)				**D71**		Primary data contained in IPOM.
1.c.2.	Climb – Engine-out, Second Segment.		**X**		(d71)					**D73**	Alternative engine thrust rating flight test data in VDR.
1.c.3.	Climb – Engine-out, Enroute.		**X**		(d71)					**D73**	AFM data available (73K).
1.c.4.	Engine-out, Approach Climb.		**X**		**D71**						
1.c.5.a.	Level Flight Acceleration.		(x)	**X**	(d73)					**D73**	Eng sim data w/ modified EEC accel rate in VDR.
1.c.5.b.	Level Flight Deceleration.		(x)	**X**	(d73)					**D73**	Eng sim data w/ modified EEC accel rate in VDR.
1.d.1.	Cruise Performance.		**X**		**D71**						
1.e.1.a.	Stopping Time & Distance (Wheel brakes / Light weight).			**X**	**D71**					(d73)	No flight test data available; see rationale.
1.e.1.b.	Stopping Time & Distance (Wheel brakes/ Med. weight).		**X**	(x)	**D71**					(d73)	
1.e.1.c.	Stopping Time & Distance (Wheel brakes / Heavy weight).		**X**	(x)	**D71**					(d73)	
1.e.2.a.	Stopping Time & Distance (Reverse thrust / Light weight).		**X**	(x)	**D71**					(d73)	
1.e.2.b.	Stopping Time & Distance (Reverse thrust / Med. Weight).			**X**	(d71)					**D73**	No flight test data available; see rationale.

BEGIN INFORMATION

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13. ACCEPTANCE GUIDELINES FOR ALTERNATIVE ENGINES DATA.

a. Background

(1) For a new airplane type, the majority of flight validation data are collected on the first airplane configuration with a ''baseline'' engine type. These data are then used to validate all flight simulators representing that airplane type.

(2) Additional flight test validation data may be needed for flight simulators representing an airplane with engines of a different type than the baseline, or for engines with thrust rating that is different from previously validated configurations.

(3) When a flight simulator with alternate engines is to be qualified, the QTG should contain tests against flight test validation data for selected cases where engine differences are expected to be significant.

b. Approval Guidelines For Validating Alternate Engine Applications

(1) The following guidelines apply to flight simulators representing airplanes with alternate engine applications or with more than one engine type or thrust rating.

(2) Validation tests can be segmented into two groups, those that are dependent on engine type or thrust rating and those that are not.

(3) For tests that are independent of engine type or thrust rating, the QTG can be based on validation data from any engine application. Tests in this category should be designated as independent of engine type or thrust rating.

(4) For tests that are affected by engine type, the QTG should contain selected engine-specific flight test data sufficient to validate that particular airplane-engine configuration. These effects may be due to engine dynamic characteristics, thrust levels or engine-related airplane configuration changes. This category is primarily characterized by variations between different engine manufacturers' products, but also includes differences due to significant engine design changes from a previously flight-validated configuration within a single engine type. See Table A2D, Alternate Engine Validation Flight Tests in this section for a list of acceptable tests.

(5) Alternate engine validation data should be based on flight test data, except as noted in sub-paragraphs 13.c.(1) and (2), or where other data are specifically allowed (e.g., engineering simulator/simulation data). If certification of the flight characteristics of the airplane with a new thrust rating (regardless of percentage change) does require certification flight testing with a comprehensive stability and control flight instrumentation package, then the conditions described in Table A2D in this section should be obtained from flight testing and presented in the QTG. Flight test data, other than throttle calibration data, are not required if the new thrust rating is certified on the airplane without need for a comprehensive stability and control flight instrumentation package.

(6) As a supplement to the engine-specific flight tests listed in Table A2D and baseline engine-independent tests, additional engine-specific engineering validation data should be provided in the QTG, as appropriate, to facilitate running the entire QTG with the alternate engine configuration. The sponsor and the responsible Flight Standards office should agree in advance on the specific validation tests to be supported by engineering simulation data.

(7) A matrix or VDR should be provided with the QTG indicating the appropriate validation data source for each test.

(8) The flight test conditions in Table A2D are appropriate and should be sufficient to validate implementation of alternate engines in a flight simulator.

END INFORMATION

BEGIN QPS REQUIREMENT

c. Test Requirements

(1) The QTG must contain selected engine-specific flight test data sufficient to validate the alternative thrust level when:

(a) the engine type is the same, but the thrust rating exceeds that of a previously flight-test validated configuration by five percent (5%) or more; or

(b) the engine type is the same, but the thrust rating is less than the lowest previously flight-test validated rating by fifteen percent (15%) or more. See Table A2D for a list of acceptable tests.

(2) Flight test data is not required if the thrust increase is greater than 5%, but flight tests have confirmed that the thrust increase does not change the airplane's flight characteristics.

(3) Throttle calibration data (i.e., commanded power setting parameter versus throttle position) must be provided to validate all alternate engine types and engine thrust ratings that are higher or lower than a previously validated engine. Data from a test airplane or engineering test bench with the correct engine controller (both hardware and software) are required.

END QPS REQUIREMENT

BEGIN QPS REQUIREMENT

TABLE A2D—ALTERNATIVE ENGINE VALIDATION FLIGHT TESTS

Entry No.	Test description		Alternative engine type	Alternative thrust rating [2]
1.b.1., 1.b.4.	Normal take-off/ground acceleration time and distance		X	X
1.b.2.	V_{mcg}, if performed for airplane certification		X	X
1.b.5.	Engine-out take-off	Either test may be performed.	X	
1.b.8.	Dynamic engine failure after take-off.			
1.b.7.	Rejected take-off if performed for airplane certification		X	
1.d.1.	Cruise performance		X	
1.f.1., 1.f.2.	Engine acceleration and deceleration		X	X
2.a.7.	Throttle calibration [1]		X	X
2.c.1.	Power change dynamics (acceleration)		X	X
2.d.1.	V_{mca} if performed for airplane certification		X	X
2.d.5.	Engine inoperative trim		X	X
2.e.1.	Normal landing		X	

[1] Must be provided for all changes in engine type or thrust rating; see paragraph 13.c.(3).
[2] See paragraphs 13.c.(1) through 13.c.(3), for a definition of applicable thrust ratings.

END QPS REQUIREMENT

BEGIN INFORMATION

14. ACCEPTANCE GUIDELINES FOR ALTERNATIVE AVIONICS (FLIGHT-RELATED COMPUTERS AND CONTROLLERS)

a. Background

(1) For a new airplane type, the majority of flight validation data are collected on the first airplane configuration with a ''baseline'' flight-related avionics ship-set; (see subparagraph b.(2) of this section). These data are then used to validate all flight simulators representing that airplane type.

(2) Additional validation data may be required for flight simulators representing an airplane with avionics of a different hardware design than the baseline, or a different software revision than previously validated configurations.

(3) When a flight simulator with additional or alternate avionics configurations is to be qualified, the QTG should contain tests against validation data for selected cases where avionics differences are expected to be significant.

b. Approval Guidelines for Validating Alternate Avionics

(1) The following guidelines apply to flight simulators representing airplanes with a revised avionics configuration, or more than one avionics configuration.

(2) The baseline validation data should be based on flight test data, except where other data are specifically allowed (e.g., engineering flight simulator data).

(3) The airplane avionics can be segmented into two groups, systems or components whose functional behavior contributes to the aircraft response presented in the QTG results, and systems that do not. The following avionics are examples of contributory systems for which hardware design changes or software revisions may lead to significant differences in the aircraft response relative to the baseline avionics configuration: Flight control computers and controllers for engines, autopilot, braking system, nosewheel steering system, and high lift system. Related avionics such as stall warning and augmentation systems should also be considered.

(4) The acceptability of validation data used in the QTG for an alternative avionics fit should be determined as follows:

(a) For changes to an avionics system or component that do not affect QTG validation test response, the QTG test can be based on validation data from the previously validated avionics configuration.

(b) For an avionics change to a contributory system, where a specific test is not affected by the change (e.g., the avionics change is a Built In Test Equipment (BITE) update or a modification in a different flight phase), the QTG test can be based on validation data from the previously-validated avionics configuration. The QTG should include authoritative justification (e.g., from the airplane manufacturer or system supplier) that this avionics change does not affect the test.

(c) For an avionics change to a contributory system, the QTG may be based on validation data from the previously-validated avionics configuration if no new functionality is added and the impact of the avionics change on the airplane response is small and based on acceptable aeronautical principles with proven success history and valid outcomes. This should be supplemented with avionics-specific validation data from the airplane manufacturer's engineering simulation, generated with the revised avionics configuration. The QTG should also include an explanation of the nature of the change and its effect on the airplane response.

(d) For an avionics change to a contributory system that significantly affects some tests in the QTG or where new functionality is added, the QTG should be based on validation data from the previously validated avionics configuration and supplemental avionics-specific flight test data sufficient to validate the alternate avionics revision. Additional flight test validation data may not be needed if the avionics changes were certified without the need for testing with a comprehensive flight instrumentation package. The airplane manufacturer should coordinate flight simulator data requirements, in advance with the responsible Flight Standards office.

(5) A matrix or ''roadmap'' should be provided with the QTG indicating the appropriate validation data source for each test. The roadmap should include identification of the revision state of those contributory avionics systems that could affect specific test responses if changed.

15. TRANSPORT DELAY TESTING

a. This paragraph explains how to determine the introduced transport delay through the flight simulator system so that it does not exceed a specific time delay. The transport delay should be measured from control inputs through the interface, through each of the host computer modules and back through the interface to motion, flight instrument, and visual systems. The transport delay should not exceed the maximum allowable interval.

b. Four specific examples of transport delay are:

(1) Simulation of classic non-computer controlled aircraft;

(2) Simulation of computer controlled aircraft using real airplane black boxes;

(3) Simulation of computer controlled aircraft using software emulation of airplane boxes;

(4) Simulation using software avionics or re-hosted instruments.

c. Figure A2C illustrates the total transport delay for a non-computer-controlled airplane or the classic transport delay test. Since there are no airplane-induced delays for this case, the total transport delay is equivalent to the introduced delay.

d. Figure A2D illustrates the transport delay testing method using the real airplane controller system.

e. To obtain the induced transport delay for the motion, instrument and visual signal, the delay induced by the airplane controller should be subtracted from the total transport delay. This difference represents the introduced delay and should not exceed the standards prescribed in Table A1A.

f. Introduced transport delay is measured from the flight deck control input to the reaction of the instruments and motion and visual systems (See Figure A2C).

g. The control input may also be introduced after the airplane controller system and the introduced transport delay measured directly from the control input to the reaction of the instruments, and simulator motion and visual systems (See Figure A2D).

h. Figure A2E illustrates the transport delay testing method used on a flight simulator that uses a software emulated airplane controller system.

i. It is not possible to measure the introduced transport delay using the simulated airplane controller system architecture for the pitch, roll and yaw axes. Therefore, the signal should be measured directly from the pilot controller. The flight simulator manufacturer should measure the total transport delay and subtract the inherent delay of the actual airplane components because the real airplane controller system has an inherent delay provided by the airplane manufacturer. The flight simulator manufacturer should ensure that the introduced delay does not exceed the standards prescribed in Table A1A.

j. Special measurements for instrument signals for flight simulators using a real airplane instrument display system instead of a simulated or re-hosted display. For flight instrument systems, the total transport delay should be measured and the inherent delay of the actual airplane components subtracted to ensure that the introduced delay does not exceed the standards prescribed in Table A1A.

(1) Figure A2FA illustrates the transport delay procedure without airplane display simulation. The introduced delay consists of the delay between the control movement and the instrument change on the data bus.

(2) Figure A2FB illustrates the modified testing method required to measure introduced delay due to software avionics or re-hosted instruments. The total simulated instrument transport delay is measured and the airplane delay should be subtracted from this total. This difference represents the introduced delay and should not exceed the standards prescribed in Table A1A. The inherent delay of the airplane between the data bus and the displays is indicated in figure A2FA. The display manufacturer should provide this delay time.

k. Recorded signals. The signals recorded to conduct the transport delay calculations should be explained on a schematic block diagram. The flight simulator manufacturer should also provide an explanation of why each signal was selected and how they relate to the above descriptions.

l. Interpretation of results. Flight simulator results vary over time from test to test due to "sampling uncertainty." All flight simulators run at a specific rate where all modules are executed sequentially in the host computer. The flight controls input can occur at any time in the iteration, but these data will not be processed before the start of the new iteration. For example, a flight simulator running at 60 Hz may have a difference of as much as 16.67 msec between test results. This does not mean that the test has failed. Instead, the difference is attributed to variations in input processing. In some conditions, the host simulator and the visual system do not run at the same iteration rate, so the output of the host computer to the visual system will not always be synchronized.

m. The transport delay test should account for both daylight and night modes of operation of the visual system. In both cases, the tolerances prescribed in Table A1A must be met and the motion response should occur before the end of the first video scan containing new information.

Figure A2C
Transport Delay for simulation of classic non-computer controlled aircraft.

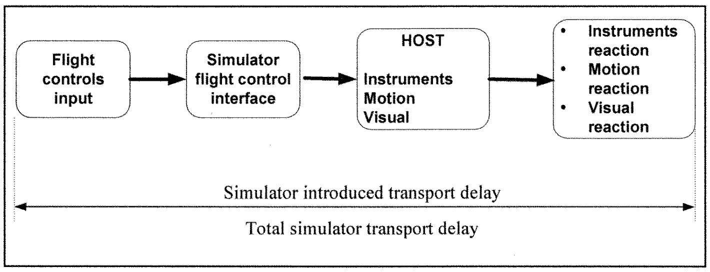


Figure A2D
Transport Delay for simulation of computer controlled aircraft using real airplane black boxes

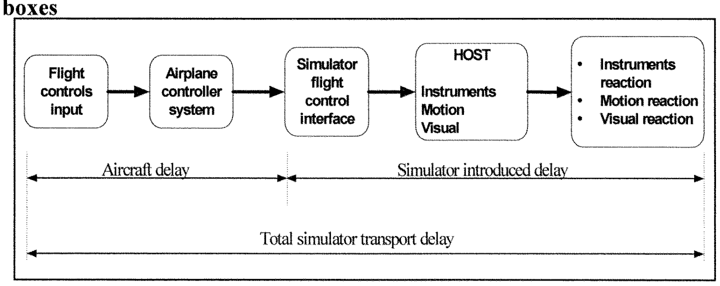


Figure A2E
Transport Delay for simulation of computer controlled aircraft using software emulation of airplane boxes

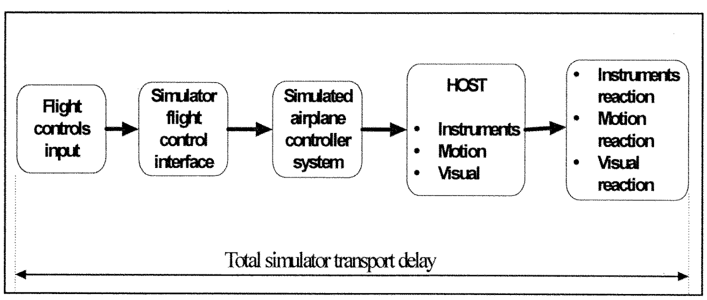
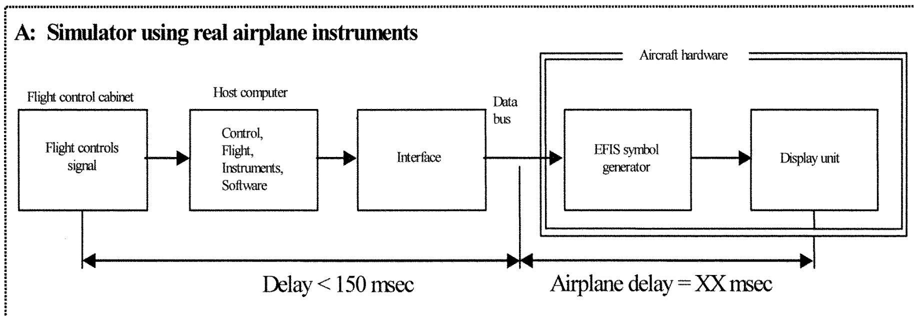
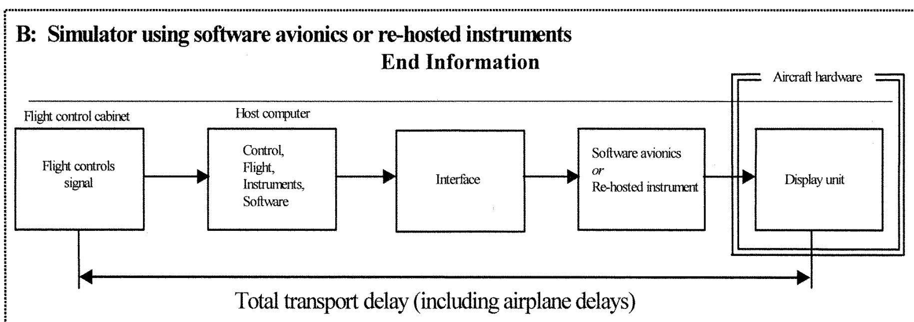


Figure A2FA and A2FB
Transport delay for simulation of airplanes using real or re-hosted instrument drivers





End Information

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16. CONTINUING QUALIFICATION EVALUATIONS—VALIDATION TEST DATA PRESENTATION

a. Background

(1) The MQTG is created during the initial evaluation of a flight simulator. This is the master document, as amended, to which flight simulator continuing qualification evaluation test results are compared.

(2) The currently accepted method of presenting continuing qualification evaluation test results is to provide flight simulator results over-plotted with reference data. Test results are carefully reviewed to determine if the test is within the specified tolerances. This can be a time consuming process, particularly when reference data exhibits rapid variations or an apparent anomaly requiring engineering judgment in the application of the tolerances. In these cases, the solution is to compare the results to the MQTG. The continuing qualification results are compared to the results in the MQTG for acceptance. The flight simulator operator and the responsible Flight Standards office should look for any change in the flight simulator performance since initial qualification.

b. Continuing Qualification Evaluation Test Results Presentation

(1) Flight simulator operators are encouraged to over-plot continuing qualification validation test results with MQTG flight simulator results recorded during the initial evaluation and as amended. Any change in a validation test will be readily apparent. In addition to plotting continuing qualification validation test and MQTG results, operators may elect to plot reference data as well.

(2) There are no suggested tolerances between flight simulator continuing qualification and MQTG validation test results. Investigation of any discrepancy between the MQTG and continuing qualification flight simulator performance is left to the discretion of the flight simulator operator and the responsible Flight Standards office.

(3) Differences between the two sets of results, other than variations attributable to repeatability issues that cannot be explained, should be investigated.

(4) The flight simulator should retain the ability to over-plot both automatic and manual validation test results with reference data.

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17. ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION: LEVEL A AND LEVEL B SIMULATORS ONLY

a. Sponsors are not required to use the alternative data sources, procedures, and instrumentation. However, a sponsor may choose to use one or more of the alternative sources, procedures, and instrumentation described in Table A2E.

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b. It has become standard practice for experienced simulator manufacturers to use modeling techniques to establish data bases for new simulator configurations while awaiting the availability of actual flight test data. The data generated from the aerodynamic modeling techniques is then compared to the flight test data when it becomes available. The results of such comparisons have become increasingly consistent, indicating that these techniques, applied with the appropriate experience, are dependable and accurate for the development of aerodynamic models for use in Level A and Level B simulators.

c. Based on this history of successful comparisons, the responsible Flight Standards office has concluded that those who are experienced in the development of aerodynamic models may use modeling techniques to alter the method for acquiring flight test data for Level A or Level B simulators.

d. The information in Table A2E (Alternative Data Sources, Procedures, and Instrumentation) is presented to describe an acceptable alternative to data sources for simulator modeling and validation and an acceptable alternative to the procedures and instrumentation traditionally used to gather such modeling and validation data.

(1) Alternative data sources that may be used for part or all of a data requirement are the Airplane Maintenance Manual, the Airplane Flight Manual (AFM), Airplane Design Data, the Type Inspection Report (TIR), Certification Data or acceptable supplemental flight test data.

(2) The sponsor should coordinate with the responsible Flight Standards office prior to using alternative data sources in a flight test or data gathering effort.

e. The responsible Flight Standards office position regarding the use of these alternative data sources, procedures, and instrumentation is based on the following presumptions:

(1) Data gathered through the alternative means does not require angle of attack (AOA) measurements or control surface position measurements for any flight test. However, AOA can be sufficiently derived if the flight test program ensures the collection of acceptable level, unaccelerated, trimmed flight data. All of the simulator time history tests that begin in level, unaccelerated, and trimmed flight, including the three basic trim tests and ''fly-by'' trims, can be a successful validation of angle of attack by comparison with flight test pitch angle. (Note: Due to the criticality of angle of attack in the development of the ground effects model, particularly critical for normal landings and landings involving cross-control input applicable to Level B simulators, stable ''fly-by'' trim data will be the acceptable norm for normal and cross-control input landing objective data for these applications.)

(2) The use of a rigorously defined and fully mature simulation controls system model that includes accurate gearing and cable stretch characteristics (where applicable), determined from actual aircraft measurements. Such a model does not require control surface position measurements in the flight test objective data in these limited applications.

f. The sponsor is urged to contact the responsible Flight Standards office for clarification of any issue regarding airplanes with reversible control systems. Table A2E is not applicable to Computer Controlled Aircraft FFSs.

g. Utilization of these alternate data sources, procedures, and instrumentation (Table A2E) does not relieve the sponsor from compliance with the balance of the information contained in this document relative to Level A or Level B FFSs.

h. The term ''inertial measurement system'' is used in the following table to include the use of a functional global positioning system (GPS).

i. Synchronized video for the use of alternative data sources, procedures, and instrumentation should have:

(1) Sufficient resolution to allow magnification of the display to make appropriate measurement and comparisons; and

(2) Sufficient size and incremental marking to allow similar measurement and comparison. The detail provided by the video should provide sufficient clarity and accuracy to measure the necessary parameter(s) to at least ½ of the tolerance authorized for

the specific test being conducted and allow an integration of the parameter(s) in question to obtain a rate of change.

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TABLE A2E—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION

QPS REQUIREMENTS The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix A are not used.				Information
Table of objective tests	Sim level		Alternative data sources, procedures, and instrumentation	Notes
Test entry number and title	A	B		
1.a.1. Performance. Taxi. Minimum Radius turn.	X	X	TIR, AFM, or Design data may be used.	
1.a.2. Performance. Taxi Rate of Turn vs. Nosewheel Steering Angle.		X	Data may be acquired by using a constant tiller position, measured with a protractor or full rudder pedal application for steady state turn, and synchronized video of heading indicator. If less than full rudder pedal is used, pedal position must be recorded..	A single procedure may not be adequate for all airplane steering systems, therefore appropriate measurement procedures must be devised and proposed for the responsible Flight Standards office concurrence.
1.b.1. Performance. Takeoff. Ground Acceleration Time and Distance.	X	X	Preliminary certification data may be used. Data may be acquired by using a stop watch, calibrated airspeed, and runway markers during a takeoff with power set before brake release. Power settings may be hand recorded. If an inertial measurement system is installed, speed and distance may be derived from acceleration measurements.	
1.b.2. Performance. Takeoff. Minimum Control Speed—ground (V_{mcg}) using aerodynamic controls only (per applicable airworthiness standard) or low speed, engine inoperative ground control characteristics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	Rapid throttle reductions at speeds near V_{mcg} may be used while recording appropriate parameters. The nosewheel must be free to caster, or equivalently freed of sideforce generation.
1.b.3. Performance. Takeoff. Minimum Unstick Speed (V_{mu}) or equivalent test to demonstrate early rotation takeoff characteristics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and the force/position measurements of flight deck controls.	
1.b.4. Performance. Takeoff. Normal Takeoff.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls. AOA can be calculated from pitch attitude and flight path.	
1.b.5. Performance. Takeoff. Critical Engine Failure during Takeoff.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	Record airplane dynamic response to engine failure and control inputs required to correct flight path.
1.b.6. Performance. Takeoff. Crosswind Takeoff.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	The "1:7 law" to 100 feet (30 meters) is an acceptable wind profile.

TABLE A2E—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION—Continued

QPS REQUIREMENTS The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix A are not used.				Information
Table of objective tests	Sim level		Alternative data sources, procedures, and instrumentation	Notes
Test entry number and title	A	B		
1.b.7. Performance. Takeoff. Rejected Takeoff.	X	X	Data may be acquired with a synchronized video of calibrated airplane instruments, thrust lever position, engine parameters, and distance (e.g., runway markers). A stop watch is required..	
1.c. 1. Performance. Climb. Normal Climb all engines operating..	X	X	Data may be acquired with a synchronized video of calibrated airplane instruments and engine power throughout the climb range.	
1.c.2. Performance. Climb. One engine Inoperative Climb.	X	X	Data may be acquired with a synchronized video of calibrated airplane instruments and engine power throughout the climb range.	
1.c.4. Performance. Climb. One Engine Inoperative Approach Climb (if operations in icing conditions are authorized).	X	X	Data may be acquired with a synchronized video of calibrated airplane instruments and engine power throughout the climb range.	
1.d.1. Cruise/Descent. Level flight acceleration..	X	X	Data may be acquired with a synchronized video of calibrated airplane instruments, thrust lever position, engine parameters, and elapsed time.	
1.d.2. Cruise/Descent. Level flight deceleration..	X	X	Data may be acquired with a synchronized video of calibrated airplane instruments, thrust lever position, engine parameters, and elapsed time.	
1.d.4. Cruise/Descent. Idle descent.	X	X	Data may be acquired with a synchronized video of calibrated airplane instruments, thrust lever position, engine parameters, and elapsed time.	
1.d.5. Cruise/Descent. Emergency Descent.	X	X	Data may be acquired with a synchronized video of calibrated airplane instruments, thrust lever position, engine parameters, and elapsed time.	
1.e.1. Performance. Stopping. Deceleration time and distance, using manual application of wheel brakes and no reverse thrust on a dry runway.	X	X	Data may be acquired during landing tests using a stop watch, runway markers, and a synchronized video of calibrated airplane instruments, thrust lever position and the pertinent parameters of engine power.	
1.e.2. Performance. Ground. Deceleration Time and Distance, using reverse thrust and no wheel brakes.	X	X	Data may be acquired during landing tests using a stop watch, runway markers, and a synchronized video of calibrated airplane instruments, thrust lever position and pertinent parameters of engine power.	
1.f.1. Performance. Engines. Acceleration.	X	X	Data may be acquired with a synchronized video recording of engine instruments and throttle position.	
1.f.2. Performance. Engines. Deceleration.	X	X	Data may be acquired with a synchronized video recording of engine instruments and throttle position.	

TABLE A2E—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION—Continued

QPS REQUIREMENTS The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix A are not used.				Information
Table of objective tests	Sim level		Alternative data sources, procedures, and instrumentation	Notes
Test entry number and title	A	B		
*2.a.1.a.*Handling Qualities. Static Control Checks. Pitch Controller Position vs. Force and Surface Position Calibration.	X	X	Surface position data may be acquired from flight data recorder (FDR) sensor or, if no FDR sensor, at selected, significant column positions (encompassing significant column position data points), acceptable to the responsible Flight Standards office, using a control surface protractor on the ground. Force data may be acquired by using a hand held force gauge at the same column position data points..	For airplanes with reversible control systems, surface position data acquisition should be accomplished with winds less than 5 kts.
2.a.2.a. Handling Qualities. Static Control Checks. Roll Controller Position vs. Force and Surface Position Calibration.	X	X	Surface position data may be acquired from flight data recorder (FDR) sensor or, if no FDR sensor, at selected, significant wheel positions (encompassing significant wheel position data points), acceptable to the responsible Flight Standards office, using a control surface protractor on the ground. Force data may be acquired by using a hand held force gauge at the same wheel position data points..	For airplanes with reversible control systems, surface position data acquisition should be accomplished with winds less than 5 kts.
*2.a.3.a.*Handling Qualities. Static Control Checks. Rudder Pedal Position vs. Force and Surface Position Calibration.	X	X	Surface position data may be acquired from flight data recorder (FDR) sensor or, if no FDR sensor, at selected, significant rudder pedal positions (encompassing significant rudder pedal position data points), acceptable to the responsible Flight Standards office, using a control surface protractor on the ground. Force data may be acquired by using a hand held force gauge at the same rudder pedal position data points..	For airplanes with reversible control systems, surface position data acquisition should be accomplished with winds less than 5 kts.
2.a.4. Handling Qualities. Static Control Checks. Nosewheel Steering Controller Force and Position.	X	X	Breakout data may be acquired with a hand held force gauge. The remainder of the force to the stops may be calculated if the force gauge and a protractor are used to measure force after breakout for at least 25% of the total displacement capability.	
2.a.5. Handling Qualities. Static Control Checks. Rudder Pedal Steering Calibration.	X	X	Data may be acquired through the use of force pads on the rudder pedals and a pedal position measurement device, together with design data for nosewheel position.	
2.a.6. Handling Qualities. Static Control Checks. Pitch Trim Indicator vs. Surface Position Calibration.	X	X	Data may be acquired through calculations.	
2.a.7. Handling qualities. Static control tests. Pitch trim rate.	X	X	Data may be acquired by using a synchronized video of pitch trim indication and elapsed time through range of trim indication.	
2.a.8. Handling Qualities. Static Control tests. Alignment of Flight deck Throttle Lever Angle vs. Selected engine parameter.	X	X	Data may be acquired through the use of a temporary throttle quadrant scale to document throttle position. Use a synchronized video to record steady state instrument readings or hand-record steady state engine performance readings.	

TABLE A2E—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION—Continued

QPS REQUIREMENTS The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix A are not used.				Information
Table of objective tests	Sim level		Alternative data sources, procedures, and instrumentation	Notes
Test entry number and title	A	B		
2.a.9. Handling qualities. Static control tests. Brake pedal position vs. force and brake system pressure calibration.	X	X	Use of design or predicted data is acceptable. Data may be acquired by measuring deflection at ''zero'' and ''maximum'' and calculating deflections between the extremes using the airplane design data curve.	
2.c.1. Handling qualities. Longitudinal control tests. Power change dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and throttle position.	
2.c.2. Handling qualities. Longitudinal control tests. Flap/slat change dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and flap/slat position.	
2.c.3. Handling qualities. Longitudinal control tests. Spoiler/speedbrake change dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and spoiler/speedbrake position.	
2.c.4. Handling qualities. Longitudinal control tests. Gear change dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and gear position.	
2.c.5. Handling qualities. Longitudinal control tests. Longitudinal trim.	X	X	Data may be acquired through use of an inertial measurement system and a synchronized video of flight deck controls position (previously calibrated to show related surface position) and the engine instrument readings.	
2.c.6. Handling qualities. Longitudinal control tests. Longitudinal maneuvering stability (stick force/g).	X	X	Data may be acquired through the use of an inertial measurement system and a synchronized video of calibrated airplane instruments; a temporary, high resolution bank angle scale affixed to the attitude indicator; and a wheel and column force measurement indication.	
2.c.7. Handling qualities. Longitudinal control tests. Longitudinal static stability.	X	X	Data may be acquired through the use of a synchronized video of airplane flight instruments and a hand held force gauge.	
2.c.8. Handling qualities. Longitudinal control tests. Stall characteristics.	X	X	Data may be acquired through a synchronized video recording of a stop watch and calibrated airplane airspeed indicator. Hand-record the flight conditions and airplane configuration.	Airspeeds may be cross checked with those in the TIR and AFM.
2.c.9. Handling qualities. Longitudinal control tests. Phugoid dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	
2.c.10. Handling qualities. Longitudinal control tests. Short period dynamics.		X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	

TABLE A2E—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION—Continued

QPS REQUIREMENTS The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix A are not used.				Information
Table of objective tests	Sim level		Alternative data sources, procedures, and instrumentation	Notes
Test entry number and title	A	B		
2.d.1. Handling qualities. Lateral directional tests. Minimum control speed, air (V_{mca} or V_{mci}), per applicable airworthiness standard or Low speed engine inoperative handling characteristics in the air.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	
2.d.2. Handling qualities. Lateral directional tests. Roll response (rate).	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck lateral controls.	May be combined with step input of flight deck roll controller test, 2.d.3.
2.d.3. Handling qualities. Lateral directional tests. Roll response to flight deck roll controller step input.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck lateral controls.	
2.d.4. Handling qualities. Lateral directional tests. Spiral stability.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments; force/position measurements of flight deck controls; and a stop watch.	
2.d.5. Handling qualities. Lateral directional tests. Engine inoperative trim.	X	X	Data may be hand recorded in-flight using high resolution scales affixed to trim controls that have been calibrated on the ground using protractors on the control/trim surfaces with winds less than 5 kts.OR Data may be acquired during second segment climb (with proper pilot control input for an engine-out condition) by using a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	Trimming during second segment climb is not a certification task and should not be conducted until a safe altitude is reached.
2.d.6. Handling qualities. Lateral directional tests. Rudder response.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of rudder pedals.	
2.d.7. Handling qualities. Lateral directional tests. Dutch roll, (yaw damper OFF).	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	
2.d.8. Handling qualities. Lateral directional tests. Steady state sideslip.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls. Ground track and wind corrected heading may be used for sideslip angle.	
2.e.1. Handling qualities. Landings. Normal landing.		X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	

TABLE A2E—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION—Continued

QPS REQUIREMENTS The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix A are not used.				Information
Table of objective tests	Sim level		Alternative data sources, procedures, and instrumentation	Notes
Test entry number and title	A	B		
2.e.3. Handling qualities. Landings. Crosswind landing.		X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	
2.e.4. Handling qualities. Landings. One engine inoperative landing.		X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and the force/position measurements of flight deck controls. Normal and lateral accelerations may be recorded in lieu of AOA and sideslip.	
2.e.5. Handling qualities. Landings. Autopilot landing (if applicable).	....	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.Normal and lateral accelerations may be recorded in lieu of AOA and sideslip.	
2.e.6. Handling qualities. Landings. All engines operating, autopilot, go around.		X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls. Normal and lateral accelerations may be recorded in lieu of AOA and sideslip.	
2.e.7. Handling qualities. Landings. One engine inoperative go around.		X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls. Normal and lateral accelerations may be recorded in lieu of AOA and sideslip.	
2.e.8. Handling qualities. Landings. Directional control (rudder effectiveness with symmetric thrust).		X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls. Normal and lateral accelerations may be recorded in lieu of AOA and sideslip.	
2.e.9. Handling qualities. Landings. Directional control (rudder effectiveness with asymmetric reverse thrust).		X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls. Normal and lateral accelerations may be recorded in lieu of AOA and sideslip.	
2.f. Handling qualities. Ground effect. Test to demonstrate ground effect.		X	Data may be acquired by using calibrated airplane instruments, an inertial measurement system, and a synchronized video of calibrated airplane instruments and force/position measurements of flight deck controls.	

END INFORMATION

ATTACHMENT 3 TO APPENDIX A TO PART 60—SIMULATOR SUBJECTIVE EVALUATION

BEGIN QPS REQUIREMENTS

1. REQUIREMENTS

a. Except for special use airport models, described as Class III, all airport models required by this part must be representations of real-world, operational airports or representations of fictional airports and must meet the requirements set out in Tables A3B or A3C of this attachment, as appropriate.

b. If fictional airports are used, the sponsor must ensure that navigational aids and all appropriate maps, charts, and other navigational reference material for the fictional airports (and surrounding areas as necessary) are compatible, complete, and accurate with respect to the visual presentation of the airport model of this fictional airport. An SOC must be submitted that addresses navigation aid installation and performance and other criteria (including obstruction clearance protection) for all instrument approaches to the fictional airports that are available in the simulator. The SOC must reference and account for information in the terminal instrument procedures manual and the construction and availability of the required maps, charts, and other navigational material. This material must be clearly marked ''for training purposes only.''

c. When the simulator is being used by an instructor or evaluator for purposes of training, checking, or testing under this chapter, only airport models classified as Class I, Class II, or Class III may be used by the instructor or evaluator. Detailed descriptions/definitions of these classifications are found in Appendix F of this part.

d. When a person sponsors an FFS maintained by a person other than a U.S. certificate holder, the sponsor is accountable for that FFS originally meeting, and continuing to meet, the criteria under which it was originally qualified and the appropriate Part 60 criteria, including the airport models that may be used by instructors or evaluators for purposes of training, checking, or testing under this chapter.

e. Neither Class II nor Class III airport visual models are required to appear on the SOQ, and the method used for keeping instructors and evaluators apprised of the airport models that meet Class II or Class III requirements on any given simulator is at the option of the sponsor, but the method used must be available for review by the TPAA.

f. When an airport model represents a real world airport and a permanent change is made to that real world airport (e.g., a new runway, an extended taxiway, a new lighting system, a runway closure) without a written extension grant from the responsible Flight Standards office (described in paragraph 1.g. of this section), an update to that airport model must be made in accordance with the following time limits:

(1) For a new airport runway, a runway extension, a new airport taxiway, a taxiway extension, or a runway/taxiway closure—within 90 days of the opening for use of the new airport runway, runway extension, new airport taxiway, or taxiway extension; or within 90 days of the closure of the runway or taxiway.

(2) For a new or modified approach light system—within 45 days of the activation of the new or modified approach light system.

(3) For other facility or structural changes on the airport (e.g., new terminal, relocation of Air Traffic Control Tower)—within 180 days of the opening of the new or changed facility or structure.

g. If a sponsor desires an extension to the time limit for an update to a visual scene or airport model or has an objection to what must be updated in the specific airport model requirement, the sponsor must provide a written extension request to the responsible Flight Standards office stating the reason for the update delay and a proposed completion date, or explain why the update is not necessary (i.e., why the identified airport change will not have an impact on flight training, testing, or checking). A copy of this request or objection must also be sent to the POI/TCPM. The responsible Flight Standards office will send the official response to the sponsor and a copy to the POI/TCPM. If there is an objection, after consultation with the appropriate POI/TCPM regarding the training, testing, or checking impact, the responsible Flight Standards office will send the official response to the sponsor and a copy to the POI/TCPM.

END QPS REQUIREMENTS

BEGIN INFORMATION

2. DISCUSSION

a. The subjective tests provide a basis for evaluating the capability of the simulator to perform over a typical utilization period; determining that the simulator accurately simulates each required maneuver, procedure, or task; and verifying correct operation of the simulator controls, instruments, and systems. The items listed in the following Tables are for simulator evaluation purposes only. They may not be used to limit or exceed the authorizations for use of a given level of simulator, as described on the SOQ, or as approved by the TPAA.

b. The tests in Table A3A, Operations Tasks, in this attachment, address pilot functions, including maneuvers and procedures (called flight tasks), and are divided by flight phases. The performance of these tasks by the responsible Flight Standards office includes an operational examination of the visual system and special effects. There are flight tasks included to address some features of advanced technology airplanes and innovative training programs. For example, ''high angle-of-attack maneuvering'' is included to provide a required alternative to ''approach to stalls'' for airplanes employing flight envelope protection functions.

c. The tests in Table A3A, Operations Tasks, and Table A3G, Instructor Operating Station of this attachment, address the overall function and control of the simulator including the various simulated environmental conditions; simulated airplane system operations (normal, abnormal, and emergency); visual system displays; and special effects necessary to meet flight crew training, evaluation, or flight experience requirements.

d. All simulated airplane systems functions will be assessed for normal and, where appropriate, alternate operations. Normal, abnormal, and emergency operations associated with a flight phase will be assessed during the evaluation of flight tasks or events within that flight phase. Simulated airplane systems are listed separately under ''Any Flight Phase'' to ensure appropriate attention to systems checks. Operational navigation systems (including inertial navigation systems, global positioning systems, or other long-range systems) and the associated electronic display systems will be evaluated if installed. The pilot will include in his report to the TPAA, the effect of the system operation and any system limitation.

e. Simulators demonstrating a satisfactory circling approach will be qualified for the circling approach maneuver and may be approved for such use by the TPAA in the sponsor's FAA-approved flight training program. To be considered satisfactory, the circling approach will be flown at maximum gross weight for landing, with minimum visibility for the airplane approach category, and must allow proper alignment with a landing runway at least 90° different from the instrument approach course while allowing the pilot to keep an identifiable portion of the airport in sight throughout the maneuver (reference—14 CFR 91.175(e)).

f. At the request of the TPAA, the responsible Flight Standards office may assess a device to determine if it is capable of simulating certain training activities in a sponsor's training program, such as a portion of a Line Oriented Flight Training (LOFT) scenario. Unless directly related to a requirement for the qualification level, the results of such an evaluation would not affect the qualification level of the simulator. However, if the responsible Flight Standards office determines that the simulator does not accurately simulate that training activity, the simulator would not be approved for that training activity.

g. The FAA intends to allow the use of Class III airport models when the sponsor provides the TPAA (or other regulatory authority) an appropriate analysis of the skills, knowledge, and abilities (SKAs) necessary for competent performance of the tasks in which this particular media element is used. The analysis should describe the ability of the FFS/visual media to provide an adequate environment in which the required SKAs are satisfactorily performed and learned. The analysis should also include the specific media element, such as the airport model.

h. The TPAA may accept Class III airport models without individual observation provided the sponsor provides the TPAA with an acceptable description of the process for determining the acceptability of a specific airport model, outlines the conditions under which such an airport model may be used, and adequately describes what restrictions will be applied to each resulting airport or landing area model. Examples of situations that may warrant Class III model designation by the TPAA include the following:

(a) Training, testing, or checking on very low visibility operations, including SMGCS operations.

(b) Instrument operations training (including instrument takeoff, departure, arrival, approach, and missed approach training, testing, or checking) using—

(i) A specific model that has been geographically ''moved'' to a different location and aligned with an instrument procedure for another airport.

(ii) A model that does not match changes made at the real-world airport (or landing area for helicopters) being modeled.

(iii) A model generated with an ''off-board'' or an ''on-board'' model development tool (by providing proper latitude/longitude reference; correct runway or landing area orientation, length, width, marking, and lighting information; and appropriate adjacent taxiway location) to generate a facsimile of a real world airport or landing area.

i. Previously qualified simulators with certain early generation Computer Generated Image (CGI) visual systems, are limited by the capability of the Image Generator or the display system used. These systems are:

(1) Early CGI visual systems that are excepted from the requirement of including runway numbers as a part of the specific runway marking requirements are:

(a) Link NVS and DNVS.

(b) Novoview 2500 and 6000.

(c) FlightSafety VITAL series up to, and including, VITAL III, but not beyond.

(d) Redifusion SP1, SP1T, and SP2.

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(2) Early CGI visual systems are excepted from the requirement of including runway numbers unless the runways are used for LOFT training sessions. These LOFT airport models require runway numbers but only for the specific runway end (one direction) used in the LOFT session. The systems required to display runway numbers only for LOFT scenes are:

(a) FlightSafety VITAL IV.

(b) Redifusion SP3 and SP3T.

(c) Link-Miles Image II.

(3) The following list of previously qualified CGI and display systems are incapable of generating blue lights. These systems are not required to have accurate taxi-way edge lighting:

(a) Redifusion SP1.

(b) FlightSafety Vital IV.

(c) Link-Miles Image II and Image IIT

(d) XKD displays (even though the XKD image generator is capable of generating blue colored lights, the display cannot accommodate that color).

END INFORMATION

Table A3A - Functions And Subjective Tests					
QPS REQUIREMENTS					
Entry Number	**Operations Tasks**	**Simulator Level**			
		A	**B**	**C**	**D**
	Tasks in this table are subject to evaluation if appropriate for the airplane simulated as indicated in the SOQ Configuration List or the level of simulator qualification involved. Items not installed or not functional on the simulator and, therefore, not appearing on the SOQ Configuration List, are not required to be listed as exceptions on the SOQ.				
1.	**Preparation For Flight**				
1.a.	**Pre-flight.** Accomplish a functions check of all switches, indicators, systems, and equipment at all crew members' and instructors' stations and determine that:				
1.a.1	The flight deck design and functions are identical to that of the airplane being simulated.	**X**	**X**	**X**	**X**
1.a.2	Reserved				
1.a.3	Reserved				
2.	**Surface Operations (pre-flight).**				
2.a.	**Engine Start**				
2.a.1.	Normal start	**X**	**X**	**X**	**X**
2.a.2.	Alternate start procedures	**X**	**X**	**X**	**X**
2.a.3.	Abnormal starts and shutdowns (e.g., hot/hung start, tail pipe fire)	**X**	**X**	**X**	**X**
2.b.	**Taxi**				
2.b.1	Pushback/powerback		**X**	**X**	**X**
2.b.2.	Thrust response	**X**	**X**	**X**	**X**
2.b.3.	Power lever friction	**X**	**X**	**X**	**X**
2.b.4.	Ground handling	**X**	**X**	**X**	**X**
2.b.5.	Nosewheel scuffing			**X**	**X**
2.b.6.	Taxi aids (e.g. taxi camera, moving map)			**X**	**X**
2.b.7.	Low visibility (taxi route, signage, lighting, markings, etc.)			**X**	**X**
2.c.	**Brake Operation**				
2.c.1.	Brake operation (normal and alternate/emergency)	**X**	**X**	**X**	**X**
2.c.2.	Brake fade (if applicable)	**X**	**X**	**X**	**X**
2.d	**Other**				
3.	**Take-off.**				
3.a.	**Normal**				
3.a.1.	Airplane/engine parameter relationships, including run-up	**X**	**X**	**X**	**X**
3.a.2.	Nosewheel and rudder steering	**X**	**X**	**X**	**X**
3.a.3.a	Crosswind (maximum demonstrated)	**X**	**X**	**X**	**X**
3.a.3.b	Gusting crosswind			**X**	**X**
3.a.4.	Special performance				
3.a.4.a	Reduced V_1	**X**	**X**	**X**	**X**
3.a.4.b	Maximum engine de-rate	**X**	**X**	**X**	**X**
3.a.4.c	Soft surface			**X**	**X**
3.a.4.d	Short field/short take-off and landing (STOL) operations	**X**	**X**	**X**	**X**

Table A3A - Functions And Subjective Tests					
QPS REQUIREMENTS					
Entry Number	Operations Tasks	Simulator Level			
		A	B	C	D
3.a.4.e	Obstacle (performance over visual obstacle)			**X**	**X**
3.a.5.	Low visibility take-off	**X**	**X**	**X**	**X**
3.a.6.	Landing gear, wing flap leading edge device operation	**X**	**X**	**X**	**X**
3.a.7.	Contaminated runway operation			**X**	**X**
3.a.8.	Other				
3.b.	Abnormal/emergency				
3.b.1.	Rejected Take-off	**X**	**X**	**X**	**X**
3.b.2.	Rejected special performance (e.g., reduced V_1, max de-rate, short field operations)	**X**	**X**	**X**	**X**
3.b.3.	Rejected take-off with contaminated runway			**X**	**X**
3.b.4.	Takeoff with a propulsion system malfunction (allowing an analysis of causes, symptoms, recognition, and the effects on aircraft performance and handling) at the following points: (i) Prior to V1 decision speed; (ii) Between V1 and Vr (rotation speed); and (iii)Between Vr and 500 feet above ground level.	**X**	**X**	**X**	**X**
3.b.5.	Flight control system failures, reconfiguration modes, manual reversion and associated handling.	**X**	**X**	**X**	**X**
3.b.6.	Other				
4.	**Climb.**				
4.a.	Normal.	**X**	**X**	**X**	**X**
4.b.	One or more engines inoperative.	**X**	**X**	**X**	**X**
4.c.	Approach climb in icing (for airplanes with icing accountability).	**X**	**X**	**X**	**X**
4.d.	Other				
5.	**Cruise.**				
5.a.	**Performance characteristics (speed vs. power, configuration, and attitude)**				
5.a.1.	Straight and level flight.	**X**	**X**	**X**	**X**
5.a.2.	Change of airspeed.	**X**	**X**	**X**	**X**
5.a.3.	High altitude handling.	**X**	**X**	**X**	**X**
5.a.4.	High Mach number handling (Mach tuck, Mach buffet) and recovery (trim change).	**X**	**X**	**X**	**X**
5.a.5.	Overspeed warning (in excess of V_{mo} or M_{mo}).	**X**	**X**	**X**	**X**
5.a.6.	High IAS handling.	**X**	**X**	**X**	**X**
5.a.7.	Other				
5.b.	**Maneuvers**				
5.b.1.	High Angle of Attack				
5.b.1.a	High angle of attack, approach to stalls, stall warning, and stall buffet (take-off, cruise, approach, and landing configuration) including reaction of the autoflight system and stall protection system.	**X**	**X**		
5.b.1.b	High angle of attack, approach to stalls, stall warning, stall buffet, and stall (take-off, cruise, approach, and landing			**X**	**X**

Table A3A - Functions And Subjective Tests					
QPS REQUIREMENTS					
Entry Number	Operations Tasks	Simulator Level			
		A	B	C	D
	configuration) including reaction of the autoflight system and stall protection system.				
5.b.2.	Slow flight			X	X
5.b.3.	Upset prevention and recovery maneuvers within the FSTD's validation envelope.			X	X
5.b.4.	Flight envelope protection (high angle of attack, bank limit, overspeed, etc.)	X	X	X	X
5.b.5.	Turns with/without speedbrake/spoilers deployed	X	X	X	X
5.b.6.	Normal and standard rate turns	X	X	X	X
5.b.7.	Steep turns	X	X	X	X
5.b.8.	Performance turn			X	X
5.b.9.	In flight engine shutdown and restart (assisted and windmill)	X	X	X	X
5.b.10.	Maneuvering with one or more engines inoperative, as appropriate	X	X	X	X
5.b.11.	Specific flight characteristics (e.g. direct lift control)	X	X	X	X
5.b.12.	Flight control system failures, reconfiguration modes, manual reversion and associated handling	X	X	X	X
5.b.13	Gliding to a forced landing			X	X
5.b.14	Visual resolution and FSTD handling and performance for the following (where applicable by aircraft type and training program):				
5.b.14.a	Terrain accuracy for forced landing area selection;			X	X
5.b.14.b	Terrain accuracy for VFR Navigation;			X	X
5.b.14.c	Eights on pylons (visual resolution);			X	X
5.b.14.d	Turns about a point; and			X	X
5.b.14.e	S-turns about a road or section line.			X	X
5.b.15	Other.				
6.	**Descent.**				
6.a.	Normal	X	X	X	X
6.b.	Maximum rate/emergency (clean and with speedbrake, etc.).	X	X	X	X
6.c.	With autopilot.	X	X	X	X
6.d.	Flight control system failures, reconfiguration modes, manual reversion and associated handling.	X	X	X	X
6.e.	Other				
7.	**Instrument Approaches And Landing.** Those instrument approach and landing tests relevant to the simulated airplane type are selected from the following list. Some tests are made with limiting wind velocities, under windshear conditions, and with relevant system failures, including the failure of the Flight Director. If Standard Operating Procedures allow use autopilot for non-precision approaches, evaluation of the autopilot will be included. Level A simulators are not authorized to credit the landing maneuver.				
7.a.	**Precision approach**				
7.a.1	CAT I published approaches.				
7.a.1.a	Manual approach with/without flight director including	X	X	X	X

Table A3A - Functions And Subjective Tests					
QPS REQUIREMENTS					
Entry Number	Operations Tasks	Simulator Level			
		A	B	C	D
	landing.				
7.a.1.b	Autopilot/autothrottle coupled approach and manual landing.	**X**	**X**	**X**	**X**
7.a.1.c	Autopilot/autothrottle coupled approach, engine(s) inoperative.	**X**	**X**	**X**	**X**
7.a.1.d	Manual approach, engine(s) inoperative.	**X**	**X**	**X**	**X**
7.a.1.e	HUD/EFVS			**X**	**X**
7.a.2	CAT II published approaches.				
7.a.2.a	Autopilot/autothrottle coupled approach to DH and landing (manual and autoland).	**X**	**X**	**X**	**X**
7.a.2.b	Autopilot/autothrottle coupled approach with one-engine-inoperative approach to DH and go-around (manual and autopilot).	**X**	**X**	**X**	**X**
7.a.2.c	HUD/EFVS			**X**	**X**
7.a.3	CAT III published approaches.				
7.a.3.a	Autopilot/autothrottle coupled approach to landing and roll-out (if applicable) guidance (manual and autoland).	**X**	**X**	**X**	**X**
7.a.3.b	Autopilot/autothrottle coupled approach to DH and go-around (manual and autopilot).	**X**	**X**	**X**	**X**
7.a.3.c	Autopilot/autothrottle coupled approach to land and roll-out (if applicable) guidance with one engine inoperative (manual and autoland).	**X**	**X**	**X**	**X**
7.a.3.d	Autopilot/autothrottle coupled approach to DH and go-around with one engine inoperative (manual and autopilot).	**X**	**X**	**X**	**X**
7.a.3.e	HUD/EFVS			**X**	**X**
7.a.4	Autopilot/autothrottle coupled approach (to a landing or to a go-around):				
7.a.4.a	With generator failure;	**X**	**X**	**X**	**X**
7.a.4.b.1	With maximum tail wind component certified or authorized;			**X**	**X**
7.a.4.b.2	With 10 knot tail wind;	**X**	**X**		
7.a.4.c.1	With maximum crosswind component demonstrated or authorized; and			**X**	**X**
7.a.4.c.2	With 10 knot crosswind.	**X**	**X**		
7.a.5	PAR approach, all engine(s) operating and with one or more engine(s) inoperative	**X**	**X**	**X**	**X**
7.a.6	MLS, GBAS, all engine(s) operating and with one or more engine(s) inoperative	**X**	**X**	**X**	**X**
7.b.	**Non-precision approach.**				
7.b.1	Surveillance radar approach, all engine(s) operating and with one or more engine(s) inoperative	**X**	**X**	**X**	**X**
7.b.2	NDB approach, all engine(s) operating and with one or more engine(s) inoperative	**X**	**X**	**X**	**X**

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Table A3A - Functions And Subjective Tests					
QPS REQUIREMENTS					
Entry Number	**Operations Tasks**	**Simulator Level**			
		A	**B**	**C**	**D**
7.b.3	VOR, VOR/DME, TACAN approach, all engines(s) operating and with one or more engine(s) inoperative	**X**	**X**	**X**	**X**
7.b.4	RNAV / RNP / GNSS (RNP at nominal and minimum authorized temperatures) approach, all engine(s) operating and with one or more engine(s) inoperative	**X**	**X**	**X**	**X**
7.b.5	ILS LLZ (LOC), LLZ back course (or LOC-BC) approach, all engine(s) operating and with one or more engine(s) inoperative	**X**	**X**	**X**	**X**
7.b.6	ILS offset localizer approach, all engine(s) operating and with one or more engine(s) inoperative	**X**	**X**	**X**	**X**
7.c	**Approach procedures with vertical guidance (APV), e.g. SBAS, flight path vector**				
7.c.1	APV/baro-VNAV approach, all engine(s) operating and with one or more engine(s) inoperative			**X**	**X**
7.c.2	Area navigation (RNAV) approach procedures based on SBAS, all engine(s) operating and with one or more engine(s) inoperative			**X**	**X**
8.	**Visual Approaches (Visual Segment) And Landings.** Flight simulators with visual systems, which permit completing a special approach procedure in accordance with applicable regulations, may be approved for that particular approach procedure.				
8.a.	Maneuvering, normal approach and landing, all engines operating with and without visual approach aid guidance	**X**	**X**	**X**	**X**
8.b.	Approach and landing with one or more engines inoperative	**X**	**X**	**X**	**X**
8.c.	Operation of landing gear, flap/slats and speedbrakes (normal and abnormal)	**X**	**X**	**X**	**X**
8.d.1	Approach and landing with crosswind (max. demonstrated)	**X**	**X**	**X**	**X**
8.d.2	Approach and landing with gusting crosswind			**X**	**X**
8.e.	Approach and landing with flight control system failures, reconfiguration modes, manual reversion and associated handling (most significant degradation which is probable)	**X**	**X**	**X**	**X**
8.e.1.	Approach and landing with trim malfunctions	**X**	**X**	**X**	**X**
8.e.1.a	Longitudinal trim malfunction	**X**	**X**	**X**	**X**
8.e.1.b	Lateral-directional trim malfunction	**X**	**X**	**X**	**X**
8.f.	Approach and landing with standby (minimum) electrical/hydraulic power	**X**	**X**	**X**	**X**
8.g.	Approach and landing from circling conditions (circling approach)	**X**	**X**	**X**	**X**
8.h.	Approach and landing from visual traffic pattern	**X**	**X**	**X**	**X**
8.i.	Approach and landing from non-precision approach	**X**	**X**	**X**	**X**
8.j.	Approach and landing from precision approach	**X**	**X**	**X**	**X**
8.k.	Other				

Table A3A - Functions And Subjective Tests					
QPS REQUIREMENTS					
Entry Number	Operations Tasks	Simulator Level			
		A	B	C	D
9.	**Missed Approach.**				
9.a.	All engines, manual and autopilot.	X	X	X	X
9.b.	Engine(s) inoperative, manual and autopilot.	X	X	X	X
9.c.	Rejected landing			X	X
9.d.	With flight control system failures, reconfiguration modes, manual reversion and associated handling	X	X	X	X
9.e.	Bounced landing recovery			X	X
10.	**Surface Operations (landing, after-landing and post-flight).**				
10.a	**Landing roll and taxi**				
10.a.1	HUD/EFVS			X	X
10.a.2.	Spoiler operation	X	X	X	X
10.a.3.	Reverse thrust operation	X	X	X	X
10.a.4.	Directional control and ground handling, both with and without reverse thrust		X	X	X
10.a.5.	Reduction of rudder effectiveness with increased reverse thrust (rear pod-mounted engines)		X	X	X
10.a.6.	Brake and anti-skid operation				
10.a.6.a	Brake and anti-skid operation with dry, patchy wet, wet on rubber residue, and patchy icy conditions			X	X
10.a.6.b	Reserved				
10.a.6.c	Brake operation	X	X		
10.a.6.d	Auto-braking system operation	X	X	X	X
10.a.7	Other				
10.b	**Engine shutdown and parking**				
10.b.1	Engine and systems operation	X	X	X	X
10.b.2	Parking brake operation	X	X	X	X
10.b.3	Other				
11.	**Any Flight Phase.**				
11.a.	**Airplane and engine systems operation (where fitted)**				
11.a.1.	Air conditioning and pressurization (ECS)	X	X	X	X
11.a.2.	De-icing/anti-icing	X	X	X	X
11.a.3.	Auxiliary power unit (APU).	X	X	X	X
11.a.4.	Communications	X	X	X	X
11.a.5.	Electrical	X	X	X	X
11.a.6.	Fire and smoke detection and suppression	X	X	X	X
11.a.7.	Flight controls (primary and secondary)	X	X	X	X
11.a.8.	Fuel and oil	X	X	X	X
11.a.9.	Hydraulic	X	X	X	X
11.a.10.	Pneumatic	X	X	X	X
11.a.11.	Landing gear	X	X	X	X
11.a.12.	Oxygen	X	X	X	X
11.a.13.	Engine	X	X	X	X

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Table A3A - Functions And Subjective Tests					
QPS REQUIREMENTS					
Entry Number	**Operations Tasks**	**Simulator Level**			
		A	**B**	**C**	**D**
11.a.14.	Airborne radar	X	X	X	X
11.a.15.	Autopilot and Flight Director	X	X	X	X
11.a.16.	Terrain awareness warning systems and collision avoidance systems (e.g. EGPWS, GPWS, TCAS)	X	X	X	X
11.a.17.	Flight control computers including stability and control augmentation	X	X	X	X
11.a.18.	Flight display systems	X	X	X	X
11.a.19.	Flight management computers	X	X	X	X
11.a.20.	Head-up displays (including EFVS, if appropriate)	X	X	X	X
11.a.21.	Navigation systems	X	X	X	X
11.a.22.	Stall warning/avoidance	X	X	X	X
11.a.23.	Wind shear avoidance/recovery guidance equipment	X	X	X	X
11.a.24.	Flight envelope protections	X	X	X	X
11.a.25.	Electronic flight bag			X	X
11.a.26.	Automatic checklists (normal, abnormal and emergency procedures)			X	X
11.a.27.	Runway alerting and advisory system			X	X
11.a.28.	Other				
11.b.	**Airborne procedures**				
11.b.1.	Holding	X	X	X	X
11.b.2.	Air hazard avoidance (traffic, weather, including visual correlation)			X	X
11.b.3.	Windshear				
11.b.3.a	Prior to take-off rotation			X	X
11.b.3.b	At lift-off			X	X
11.b.3.c	During initial climb			X	X
11.b.3.d	On final approach, below 150 m (500 ft) AGL			X	X
11.b.4.	Effects of airframe ice			X	X

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Table A3B - Functions and Subjective Tests					
QPS REQUIREMENTS					
Entry Number	For Qualification At The Stated Level Class I Airport Models	Simulator Level			
		A	B	C	D
This table specifies the minimum airport model content and functionality to qualify a simulator at the indicated level. This table applies only to the airport models required for simulator qualification; i.e., one airport model for Level A and Level B simulators; three airport models for Level C and Level D simulators.					
Begin QPS Requirements					
1.	**Functional test content requirements for Level A and Level B simulators.** The following is the minimum airport model content requirement to satisfy visual capability tests, and provides suitable visual cues to allow completion of all functions and subjective tests described in this attachment for simulators at Levels A and B.				
1.a.	A minimum of one (1) representative airport model. This model identification must be acceptable to the sponsor's TPAA, selectable from the IOS, and listed on the SOQ.	X	X		
1.b.	The fidelity of the airport model must be sufficient for the aircrew to visually identify the airport; determine the position of the simulated airplane within a night visual scene; successfully accomplish take-offs, approaches, and landings; and maneuver around the airport on the ground as necessary.	X	X		
1.c.	Runways:	X	X		
1.c.1.	Visible runway number.	X	X		
1.c.2.	Runway threshold elevations and locations must be modeled to provide sufficient correlation with airplane systems (e.g., altimeter).	X	X		
1.c.3.	Runway surface and markings.	X	X		
1.c.4.	Lighting for the runway in use including runway edge and centerline.	X	X		
1.c.5.	Lighting, visual approach aid and approach lighting of appropriate colors.	X	X		
1.c.6.	Representative taxiway lights.	X	X		
2.a.	**Additional functional test content requirements**				
2.a.1	**Airport scenes**				
2.a.1.a	A minimum of three (3) real-world airport models to be consistent with published data used for airplane operations and capable of demonstrating all the visual system features below. Each model should be in a different visual scene to permit assessment of FSTD automatic visual scene changes. The model identifications must be acceptable to the sponsor's TPAA, selectable from the IOS, and listed on the SOQ.			X	X
2.a.1.b	Reserved				
2.a.1.c	Reserved				
2.a.1.d	**Airport model content.** For circling approaches, all tests apply to the runway used for the initial approach and to the runway of intended landing. If all runways in an airport model used to meet the requirements of this	X	X	X	X

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Table A3B - Functions and Subjective Tests					
QPS REQUIREMENTS					
Entry Number	**For Qualification At The Stated Level** **Class I Airport Models**	**Simulator Level**			
		A	**B**	**C**	**D**
	attachment are not designated as "in use," then the "in use" runways must be listed on the SOQ (e.g., KORD, Rwys 9R, 14L, 22R). Models of airports with more than one runway must have all significant runways not "in-use" visually depicted for airport and runway recognition purposes. The use of white or off white light strings that identify the runway threshold, edges, and ends for twilight and night scenes are acceptable for this requirement. Rectangular surface depictions are acceptable for daylight scenes. A visual system's capabilities must be balanced between providing airport models with an accurate representation of the airport and a realistic representation of the surrounding environment. Airport model detail must be developed using airport pictures, construction drawings and maps, or other similar data, or developed in accordance with published regulatory material; however, this does not require that such models contain details that are beyond the design capability of the currently qualified visual system. Only one "primary" taxi route from parking to the runway end will be required for each "in-use" runway.				
2.a.2	**Visual scene fidelity.**				
2.a.2.a	The visual scene must correctly represent the parts of the airport and its surroundings used in the training program.	**X**	**X**	**X**	**X**
2.a.2.b	Reserved				
2.a.2.c	Reserved				
2.a.3	**Runways and taxiways.**				
2.a.3.a	Airport specific runways and taxiways.	**X**	**X**	**X**	**X**
2.a.3.b	Reserved				
2.a.3.c	Reserved				
2.a.4	If appropriate to the airport, two parallel runways and one crossing runway displayed simultaneously; at least two runways must be capable of being lit simultaneously.			**X**	**X**
2.a.5	Runway threshold elevations and locations must be modeled to provide correlation with airplane systems (e.g. HUD, GPS, compass, altimeter).			**X**	**X**
2.a.6	Slopes in runways, taxiways, and ramp areas must not cause distracting or unrealistic effects, including pilot eye-point height variation.			**X**	**X**
2.a.7	**Runway surface and markings for each "in-use" runway must include the following, if appropriate:**				
2.a.7.a	Threshold markings.	**X**	**X**	**X**	**X**
2.a.7.b	Runway numbers.	**X**	**X**	**X**	**X**
2.a.7.c	Touchdown zone markings.	**X**	**X**	**X**	**X**
2.a.7.d	Fixed distance markings.	**X**	**X**	**X**	**X**

<table>
<tr><th colspan="6">Table A3B - Functions and Subjective Tests</th></tr>
<tr><th colspan="6">QPS REQUIREMENTS</th></tr>
<tr><th rowspan="2">Entry Number</th><th rowspan="2">For Qualification At The Stated Level
Class I Airport Models</th><th colspan="4">Simulator Level</th></tr>
<tr><th>A</th><th>B</th><th>C</th><th>D</th></tr>
<tr><td>2.a.7.e</td><td>Edge markings.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.7.f</td><td>Center line markings.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.7.g</td><td>Distance remaining signs.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.7.h</td><td>Signs at intersecting runways and taxiways.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.7.i</td><td>Windsock that gives appropriate wind cues.</td><td></td><td></td><td>X</td><td>X</td></tr>
<tr><td>2.a.8</td><td colspan="5">Runway lighting of appropriate colors, directionality, behavior and spacing for the “in-use” runway including the following:</td></tr>
<tr><td>2.a.8.a</td><td>Threshold lights.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.8.b</td><td>Edge lights.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.8.c</td><td>End lights.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.8.d</td><td>Center line lights.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.8.e</td><td>Touchdown zone lights.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.8.f</td><td>Lead-off lights.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.8.g</td><td>Appropriate visual landing aid(s) for that runway.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.8.h</td><td>Appropriate approach lighting system for that runway.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.9</td><td colspan="5">Taxiway surface and markings (associated with each “in-use” runway):</td></tr>
<tr><td>2.a.9.a</td><td>Edge markings</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.9.b</td><td>Center line markings.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.9.c</td><td>Runway holding position markings.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.9.d</td><td>ILS critical area markings.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.9.e</td><td>All taxiway markings, lighting, and signage to taxi, as a minimum, from a designated parking position to a designated runway and return, after landing on the designated runway, to a designated parking position; a low visibility taxi route (e.g. surface movement guidance control system, follow-me truck, daylight taxi lights) must also be demonstrated at one airport model for those operations authorized in low visibilities. The designated runway and taxi routing must be consistent with that airport for operations in low visibilities.

The qualification of surface movement guidance control systems (SMGCS) is optional at the request of the FSTD sponsor. For the qualification of SMGCS, a demonstration model must be provided for evaluation.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td>2.a.10</td><td colspan="5">Taxiway lighting of appropriate colors, directionality, behavior and spacing (associated with each “in-use” runway):</td></tr>
<tr><td>2.a.10.a</td><td>Edge lights.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.10.b</td><td>Center line lights.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.10.c</td><td>Runway holding position and ILS critical area lights.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>2.a.11</td><td colspan="5">Required visual model correlation with other aspects of the airport environment simulation.</td></tr>
<tr><td>2.a.11.a</td><td>The airport model must be properly aligned with the navigational aids that are associated with operations at the runway “in-use”.</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
</table>

Table A3B - Functions and Subjective Tests					
QPS REQUIREMENTS					
Entry Number	For Qualification At The Stated Level Class I Airport Models	Simulator Level			
		A	B	C	D
2.a.11.b	The simulation of runway contaminants must be correlated with the displayed runway surface and lighting.				X
2.a.12	**Airport buildings, structures and lighting.**				
2.a.12.a	Buildings, structures and lighting:				
2.a.12.a.1	Airport specific buildings, structures and lighting.			X	X
2.a.12.a.2	Reserved				
2.a.12.a.3	Reserved				
2.a.12.b	At least one useable gate, set at the appropriate height (required only for those airplanes that typically operate from terminal gates).			X	X
2.a.12.c	Representative moving and static airport clutter (e.g. other airplanes, power carts, tugs, fuel trucks, additional gates).			X	X
2.a.12.d	Gate/apron markings (e.g. hazard markings, lead-in lines, gate numbering), lighting and gate docking aids or a marshaller.			X	X
2.a.13	**Terrain and obstacles.**				
2.a.13.a	Terrain and obstacles within 46 km (25 NM) of the reference airport.			X	X
2.a.13.b	Reserved				
2.a.14	**Significant, identifiable natural and cultural features and moving airborne traffic.**				
2.a.14.a	Significant, identifiable natural and cultural features within 46 km (25 NM) of the reference airport. *Note.— This refers to natural and cultural features that are typically used for pilot orientation in flight. Outlying airports not intended for landing need only provide a reasonable facsimile of runway orientation.*			X	X
2.a.14.b	Reserved				
2.a.14.c	Representative moving airborne traffic (including the capability to present air hazards – e.g. airborne traffic on a possible collision course).			X	X
2.b	**Visual scene management.**				
2.b.1	All airport runway, approach and taxiway lighting and cultural lighting intensity for any approach must be capable of being set to six (6) different intensities (0 to 5); all visual scene light points should fade into view appropriately.			X	X
2.b.2	Airport runway, approach and taxiway lighting and cultural lighting intensity for any approach must be set at an intensity representative of that used in training for the visibility set; all visual scene light points should fade into view appropriately.	X	X		
2.b.3	The directionality of strobe lights, approach lights, runway edge lights, visual landing aids, runway center line lights, threshold lights, and touchdown zone lights on the runway of intended landing must be realistically replicated.	X	X	X	X
2.c	**Visual feature recognition.**				

Table A3B - Functions and Subjective Tests					
QPS REQUIREMENTS					
Entry Number	**For Qualification At The Stated Level** **Class I Airport Models**	**Simulator Level**			
		A	**B**	**C**	**D**
	Note.— The following are the minimum distances at which runway features should be visible. Distances are measured from runway threshold to an airplane aligned with the runway on an extended 3-degree glide slope in suitable simulated meteorological conditions. For circling approaches, all tests below apply both to the runway used for the initial approach and to the runway of intended landing.				
2.c.1	Runway definition, strobe lights, approach lights, and runway edge white lights from 8 km (5 sm) of the runway threshold.	X	X	X	X
2.c.2	**Visual approach aids lights.**				
2.c.2.a	Visual approach aids lights from 8 km (5 sm) of the runway threshold.			X	X
2.c.2.b	Visual approach aids lights from 4.8 km (3 sm) of the runway threshold.	X	X		
2.c.3	Runway center line lights and taxiway definition from 4.8 km (3 sm).	X	X	X	X
2.c.4	Threshold lights and touchdown zone lights from 3.2 km (2 sm).	X	X	X	X
2.c.5	Runway markings within range of landing lights for night scenes; as required by the surface resolution test on day scenes.	X	X	X	X
2.c.6	For circling approaches, the runway of intended landing and associated lighting must fade into view in a non-distracting manner.	X	X	X	X
2.d	**Selectable airport visual scene capability for:**				
2.d.1	Night.	X	X	X	X
2.d.2	Twilight.			X	X
2.d.3	Day.			X	X
2.d.4	Dynamic effects — the capability to present multiple ground and air hazards such as another airplane crossing the active runway or converging airborne traffic; hazards should be selectable via controls at the instructor station.			X	X
2.d.5	Illusions — operational visual scenes which portray representative physical relationships known to cause landing illusions, for example short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path and unique topographic features. *Note.— Illusions may be demonstrated at a generic airport or at a specific airport.*				X
2.e	**Correlation with airplane and associated equipment.**				
2.e.1	Visual cues to relate to actual airplane responses.	X	X	X	X
2.e.2	**Visual cues during take-off, approach and landing.**				
2.e.2.a	Visual cues to assess sink rate and depth perception during landings.		X	X	X
2.e.2.b	Visual cueing sufficient to support changes in approach path by using runway perspective. Changes in visual cues during take-off, approach and landing should not distract the pilot.	X	X	X	X

Table A3B - Functions and Subjective Tests					
QPS REQUIREMENTS					
Entry Number	**For Qualification At The Stated Level** **Class I Airport Models**	**Simulator Level**			
		A	**B**	**C**	**D**
2.e.3	Accurate portrayal of environment relating to airplane attitudes.	X	X	X	X
2.e.4	The visual scene must correlate with integrated airplane systems, where fitted (e.g. terrain, traffic and weather avoidance systems and HUD/EFVS).			X	X
2.e.5	The effect of rain removal devices must be provided.			X	X
2.f	**Scene quality.**				
2.f.1	**Quantization.**				
2.f.1.a	Surfaces and textural cues must be free from apparent quantization (aliasing).			X	X
2.f.1.b	Surfaces and textural cues must not create distracting quantization (aliasing).	X	X		
2.f.2	System capable of portraying full color realistic textural cues.			X	X
2.f.3	The system light points must be free from distracting jitter, smearing or streaking.	X	X	X	X
2.f.4	System capable of providing representative focus effects that simulate rain (e.g. reduced visibility and object resolution in the out the window view as a result of rain).			X	X
2.f.5	System capable of providing light point perspective growth (e.g. relative size of runway and taxiway edge lights increase as the lights are approached).			X	X
2.g	**Environmental effects.**				
2.g.1	The displayed scene must correspond to the appropriate surface contaminants and include runway lighting reflections for wet, partially obscured lights for snow, or suitable alternative effects.			X	X
2.g.2	Special weather representations which include the sound, motion and visual effects of light, medium and heavy precipitation near a thunderstorm on take-off, approach and landings at and below an altitude of 600 m (2 000 ft) above the airport surface and within a radius of 16 km (10 sm) from the airport.			X	X
2.g.3	One airport with a snow scene to include terrain snow and snow-covered taxiways and runways.			X	X
2.g.4	In-cloud effects such as variable cloud density, speed cues and ambient changes should be provided.			X	X
2.g.5	The effect of multiple cloud layers representing few, scattered, broken and overcast conditions giving partial or complete obstruction of the ground scene.			X	X
2.g.6	Gradual break-out to ambient visibility/RVR, defined as up to 10% of the respective cloud base or top, 20 ft ≤ transition layer ≤ 200 ft; cloud effects should be checked at and below a height of 600 m (2 000 ft) above the airport and within a radius of 16 km (10 sm) from the airport. Transition effects should be complete when the IOS cloud base or top is reached when exiting and start when entering the cloud, i.e. transition effects should occur			X	X

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Table A3B - Functions and Subjective Tests					
QPS REQUIREMENTS					
Entry Number	For Qualification At The Stated Level Class I Airport Models	Simulator Level			
		A	B	C	D
	within the IOS defined cloud layer.				
2.g.7	Visibility and RVR measured in terms of distance. Visibility/RVR must be checked at and below a height of 600 m (2 000 ft) above the airport and within a radius of 16 km (10 sm) from the airport.	X	X	X	X
2.g.8	Patchy fog (sometimes referred to as patchy RVR) giving the effect of variable RVR. The lowest RVR should be that selected on the IOS, ie. variability is only greater than the IOS RVR.			X	X
2.g.9	Effects of fog on airport lighting such as halos and defocus.			X	X
2.g.10	Effect of ownship lighting in reduced visibility, such as reflected glare, to include landing lights, strobes, and beacons.			X	X
2.g.11	Wind cues to provide the effect of blowing snow or sand across a dry runway or taxiway should be selectable from the instructor station.			X	X
	End QPS Requirement				
	Begin Information				
3.	An example of being able to "combine two airport models to achieve two "in-use" runways: One runway designated as the "in use" runway in the first model of the airport, and the second runway designated as the "in use" runway in the second model of the same airport. For example, the clearance is for the ILS approach to Runway 27, Circle to Land on Runway 18 right. Two airport visual models might be used: the first with Runway 27 designated as the "in use" runway for the approach to runway 27, and the second with Runway 18 Right designated as the "in use" runway. When the pilot breaks off the ILS approach to runway 27, the instructor may change to the second airport visual model in which runway 18 Right is designated as the "in use" runway, and the pilot would make a visual approach and landing. This process is acceptable to the FAA as long as the temporary interruption due to the visual model change is not distracting to the pilot, does not cause changes in navigational radio frequencies, and does not cause undue instructor/evaluator time.				
4.	Sponsors are not required to provide every detail of a runway, but the detail that is provided should be correct within the capabilities of the system. **End Information**				

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TABLE A3C—FUNCTIONS AND SUBJECTIVE TESTS

QPS requirements					
Entry No.	Additional airport models beyond minimum required for qualification—Class II airport models	Simulator level			
		A	B	C	D
This table specifies the minimum airport model content and functionality necessary to add airport models to a simulator's model library, beyond those necessary for qualification at the stated level, without the necessity of further involvement of the responsible Flight Standards office or TPAA.					
Begin QPS Requirements					
1.	Airport model management. The following is the minimum airport model management requirements for simulators at Levels A, B, C, and D.				
1.a.	The direction of strobe lights, approach lights, runway edge lights, visual landing aids, runway centerline lights, threshold lights, and touchdown zone lights on the "in-use" runway must be replicated.	X	X	X	X
2.	Visual feature recognition. The following are the minimum distances at which runway features must be visible for simulators at Levels A, B, C, and D. Distances are measured from runway threshold to an airplane aligned with the runway on an extended 3° glide-slope in simulated meteorological conditions that recreate the minimum distances for visibility. For circling approaches, all requirements of this section apply to the runway used for the initial approach and to the runway of intended landing.				
2.a.	Runway definition, strobe lights, approach lights, and runway edge white lights from 5 sm (8 km) from the runway threshold.	X	X	X	X
2.b.	Visual Approach Aid lights (VASI or PAPI) from 5 sm (8 km) from the runway threshold			X	X
2.c.	Visual Approach Aid lights (VASI or PAPI) from 3 sm (5 km) from the runway threshold	X	X		
2.d.	Runway centerline lights and taxiway definition from 3 sm (5 km) from the runway threshold.	X	X	X	X
2.e.	Threshold lights and touchdown zone lights from 2 sm (3 km) from the runway threshold	X	X	X	X
2.f.	Runway markings within range of landing lights for night scenes and as required by the surface resolution requirements on day scenes.	X	X	X	X
2.g.	For circling approaches, the runway of intended landing and associated lighting must fade into view in a non-distracting manner.	X	X	X	X
3.	Airport model content. The following prescribes the minimum requirements for what must be provided in an airport model and identifies other aspects of the airport environment that must correspond with that model for simulators at Levels A, B, C, and D. The detail must be developed using airport pictures, construction drawings and maps, or other similar data, or developed in accordance with published regulatory material; however, this does not require that airport models contain details that are beyond the designed capability of the currently qualified visual system. For circling approaches, all requirements of this section apply to the runway used for the initial approach and to the runway of intended landing. Only one "primary" taxi route from parking to the runway end will be required for each "in-use" runway.				
3.a.	The surface and markings for each "in-use" runway:				
3.a.1.	Threshold markings	X	X	X	X
3.a.2.	Runway numbers	X	X	X	X
3.a.3.	Touchdown zone markings	X	X	X	X
3.a.4.	Fixed distance markings	X	X	X	X
3.a.5.	Edge markings	X	X	X	X
3.a.6.	Centerline stripes	X	X	X	X
3.b.	The lighting for each "in-use" runway				
3.b.1.	Threshold lights	X	X	X	X
3.b.2.	Edge lights	X	X	X	X
3.b.3.	End lights	X	X	X	X
3.b.4.	Centerline lights	X	X	X	X

TABLE A3C—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements					
Entry No.	Additional airport models beyond minimum required for qualification—Class II airport models	Simulator level			
		A	B	C	D
3.b.5.	Touchdown zone lights, if appropriate	X	X	X	X
3.b.6.	Leadoff lights, if appropriate	X	X	X	X
3.b.7.	Appropriate visual landing aid(s) for that runway	X	X	X	X
3.b.8.	Appropriate approach lighting system for that runway	X	X	X	X
3.c.	The taxiway surface and markings associated with each "in-use" runway:				
3.c.1.	Edge	X	X	X	X
3.c.2.	Centerline	X	X	X	X
3.c.3.	Runway hold lines	X	X	X	X
3.c.4.	ILS critical area markings	X	X	X	X
3.d.	The taxiway lighting associated with each "in-use" runway:				
3.d.1.	Edge			X	X
3.d.2.	Centerline	X	X	X	X
3.d.3.	Runway hold and ILS critical area lights	X	X	X	X
4.	Required model correlation with other aspects of the airport environment simulation The following are the minimum model correlation tests that must be conducted for simulators at Levels A, B, C, and D.				
4.a.	The airport model must be properly aligned with the navigational aids that are associated with operations at the "in-use" runway.	X	X	X	X
4.b.	Slopes in runways, taxiways, and ramp areas, if depicted in the visual scene, must not cause distracting or unrealistic effects.	X	X	X	X
5.	Correlation with airplane and associated equipment. The following are the minimum correlation comparisons that must be made for simulators at Levels A, B, C, and D.				
5.a.	Visual system compatibility with aerodynamic programming	X	X	X	X
5.b.	Accurate portrayal of environment relating to flight simulator attitudes	X	X	X	X
5.c.	Visual cues to assess sink rate and depth perception during landings		X	X	X
5.d.	Visual effects for each visible, own-ship, airplane external light(s)		X	X	X
6.	Scene quality. The following are the minimum scene quality tests that must be conducted for simulators at Levels A, B, C, and D.				
6.a.	Surfaces and textural cues must be free of apparent and distracting quantization (aliasing)			X	X
6.b.	Correct color and realistic textural cues			X	X
6.c.	Light points free from distracting jitter, smearing or streaking	X	X	X	X
7.	Instructor controls of the following: The following are the minimum instructor controls that must be available in simulators at Levels A, B, C, and D.				
7.a.	Environmental effects, e.g., cloud base (if used), cloud effects, cloud density, visibility in statute miles/kilometers and RVR in feet/meters.	X	X	X	X
7.b.	Airport selection	X	X	X	X
7.c.	Airport lighting including variable intensity	X	X	X	X
7.d.	Dynamic effects including ground and flight traffic			X	X

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TABLE A3C—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements					
Entry No.	Additional airport models beyond minimum required for qualification—Class II airport models	Simulator level			
		A	B	C	D
End QPS Requirements					
Begin Information					
8.	Sponsors are not required to provide every detail of a runway, but the detail that is provided must be correct within the capabilities of the system.	X	X	X	X
End Information					

Table A3D - Functions and Subjective Tests						
QPS REQUIREMENTS						INFORMATION
Entry Number	Motion System Effects	Simulator Level				Notes
		A	B	C	D	
This table specifies motion effects that are required to indicate when a flight crewmember must be able to recognize an event or situation. Where applicable, flight simulator pitch, side loading and directional control characteristics must be representative of the airplane.						
1.	**Taxiing effects such as lateral, longitudinal, and directional cues resulting from steering and braking inputs. Runway contamination with associated anti-skid and taxiway characteristics.**			X	X	
2.	**Runway rumble, oleo deflection, ground speed, uneven runway, runway/taxiway centerline light characteristics:** Procedure: After the airplane has been pre-set to the takeoff position and then released, taxi at various speeds with a smooth runway and note the general characteristics of the simulated runway rumble effects of oleo deflections. Repeat the maneuver with a runway roughness of 50%, then with maximum roughness. Note the associated motion vibrations affected by ground speed and runway roughness.		X	X	X	Different gross weights can also be selected, which may also affect the associated vibrations depending on airplane type. The associated motion effects for the above tests should also include an assessment of the effects of rolling over centerline lights, surface discontinuities of uneven runways, and various taxiway characteristics.
3.	**Buffets on the ground due to spoiler/speedbrake extension and reverse thrust:** Procedure: Perform a normal landing and use ground spoilers and reverse thrust – either individually or in combination – to	X	X	X	X	

Table A3D - Functions and Subjective Tests

QPS REQUIREMENTS						INFORMATION
Entry Number	Motion System Effects	Simulator Level				Notes
		A	B	C	D	
	decelerate the simulated airplane. Do not use wheel braking so that only the buffet due to the ground spoilers and thrust reversers is felt.					
4.	**Bumps associated with the landing gear:** Procedure: Perform a normal take-off paying special attention to the bumps that could be perceptible due to maximum oleo extension after lift-off. When the landing gear is extended or retracted, motion bumps can be felt when the gear locks into position.	X	X	X	X	
5.	**Buffet during extension and retraction of landing gear:** Procedure: Operate the landing gear. Check that the motion cues of the buffet experienced represent the actual airplane.	X	X	X	X	
6.	**Buffet in the air due to flap and spoiler/speedbrake extension:** Procedure: Perform an approach and extend the flaps and slats with airspeeds deliberately in excess of the normal approach speeds. In cruise configuration, verify the buffets associated with the spoiler/speedbrake extension. The above effects can also be verified with different combinations of spoiler/speedbrake, flap, and landing gear settings to assess the interaction effects.	X	X	X	X	

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Table A3D - Functions and Subjective Tests

QPS REQUIREMENTS						INFORMATION
Entry Number	Motion System Effects	Simulator Level				Notes
		A	B	C	D	
7.	**Buffet due to atmospheric disturbances** (e.g. buffet due to turbulence, windshear, proximity to thunderstorms, gusting winds, etc.).			X	X	
8.	**Approach to stall buffet and stall buffet (where applicable):** Procedure: Conduct an approach-to-stall with engines at idle and a deceleration of 1 knot/second. Check that the motion cues of the buffet, including the level of buffet increase with decreasing speed, are representative of the actual airplane.	X	X	X	X	For FSTDs qualified for full stall training tasks, modeling that accounts for any increase in buffet amplitude from initial buffet threshold of perception to critical angle of attack or deterrent buffet as a function of angle of attack. The stall buffet modeling should include effects of Nz, as well as Nx and Ny if relevant.
9.	**Touchdown cues for main and nose gear:** Procedure: Conduct several normal approaches with various rates of descent. Check that the motion cues for the touchdown bumps for each descent rate are representative of the actual airplane.	X	X	X	X	
10.	**Nosewheel scuffing:** Procedure: Taxi at various ground speeds and manipulate the nosewheel steering to cause yaw rates to develop that cause the		X	X	X	

Table A3D - Functions and Subjective Tests						
QPS REQUIREMENTS						INFORMATION
Entry Number	Motion System Effects	Simulator Level				Notes
		A	B	C	D	
	nosewheel to vibrate against the ground (“scuffing”). Evaluate the speed/nosewheel combination needed to produce scuffing and check that the resultant vibrations are representative of the actual airplane.					
11.	**Thrust effect with brakes set:** Procedure: Set the brakes on at the take-off point and increase the engine power until buffet is experienced. Evaluate its characteristics. Confirm that the buffet increases appropriately with increasing engine thrust.	X	X	X	X	This effect is most discernible with wing-mounted engines.
12.	**Mach and maneuver buffet:** Procedure: With the simulated airplane trimmed in 1 g flight while at high altitude, increase the engine power so that the Mach number exceeds the documented value at which Mach buffet is experienced. Check that the buffet begins at the same Mach number as it does in the airplane (for the same configuration) and that buffet levels are representative of the actual airplane. For certain airplanes, maneuver buffet can also be verified for the same effects. Maneuver buffet can occur during turning flight at conditions greater than 1 g, particularly at higher altitudes.		X	X	X	
13.	**Tire failure dynamics:**			X	X	The pilot may notice some yawing with a multiple tire

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Table A3D - Functions and Subjective Tests						
QPS REQUIREMENTS						INFORMATION
Entry Number	Motion System Effects	Simulator Level				Notes
		A	B	C	D	
	Procedure: Simulate a single tire failure and a multiple tire failure.					failure selected on the same side. This should require the use of the rudder to maintain control of the airplane. Dependent on airplane type, a single tire failure may not be noticed by the pilot and should not have any special motion effect. Sound or vibration may be associated with the actual tire losing pressure.
14.	**Engine failures, malfunction, engine, and airframe structural damage:** Procedure: The characteristics of an engine malfunction as stipulated in the malfunction definition document for the particular flight simulator must describe the special motion effects felt by the pilot. Note the associated engine instruments varying according to the nature of the malfunction and note the replication of the effects of the airframe vibration.		X	X	X	
15.	**Tail strikes, engine pod/propeller, wing strikes:** Procedure: Tail-strikes can be checked by over-rotation of the airplane at a speed below V_r while performing a takeoff. The		X	X	X	The motion effect should be felt as a noticeable bump. If the tail strike affects the airplane angular rates, the

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Table A3D - Functions and Subjective Tests

QPS REQUIREMENTS						INFORMATION
Entry Number	**Motion System Effects**	**Simulator Level**				**Notes**
		A	**B**	**C**	**D**	
	effects can also be verified during a landing. Excessive banking of the airplane during its take-off/landing roll can cause a pod strike.					cueing provided by the motion system should have an associated effect.

TABLE A3E—FUNCTIONS AND SUBJECTIVE TESTS

QPS Requirements					
Entry No.	Sound system	Simulator level			
		A	B	C	D
The following checks are performed during a normal flight profile with motion system ON.					
1.	Precipitation			X	X
2.	Rain removal equipment.			X	X
3.	Significant airplane noises perceptible to the pilot during normal operations			X	X
4.	Abnormal operations for which there are associated sound cues including, engine malfunctions, landing gear/tire malfunctions, tail and engine pod strike and pressurization malfunction.			X	X
5.	Sound of a crash when the flight simulator is landed in excess of limitations	X	X		

Table A3F - Functions and Subjective Tests

QPS REQUIREMENTS

Entry Number	Special Effects	Simulator Level A	B	C	D
This table specifies the minimum special effects necessary for the specified simulator level.					
1.	**Braking Dynamics:** Representations of the dynamics of brake failure (flight simulator pitch, side-loading, and directional control characteristics representative of the airplane), including antiskid and decreased brake efficiency due to high brake temperatures (based on airplane related data), sufficient to enable pilot identification of the problem and implementation of appropriate procedures.			X	X
2.	**Effects of Airframe and Engine Icing:** **Required only for those airplanes authorized for operations in known icing conditions.** Procedure: With the simulator airborne, autopilot on and auto-throttles off, engine and airfoil anti-ice/de-ice systems deactivated; activate icing conditions at a rate that allows monitoring of simulator and systems response. Icing recognition will typically include airspeed decay, change in simulator pitch attitude, change in engine performance indications (other than due to airspeed changes), and change in data from pitot/static system. Activate heating, anti-ice, or de-ice systems independently. Recognition will include proper effects of these systems, eventually returning the simulated airplane to normal flight. See Table A1A, section 2.j. and Attachment 7 for additional requirements.			X	X

TABLE A3G—FUNCTIONS AND SUBJECTIVE TESTS

QPS Requirements					
Entry No.	Special effects	Simulator level			
		A	B	C	D
Functions in this table are subject to evaluation only if appropriate for the airplane and/or the system is installed on the specific simulator.					
1.	Simulator Power Switch(es)	X	X	X	X
2.	Airplane conditions				
2.a.	Gross weight, center of gravity, fuel loading and allocation	X	X	X	X
2.b.	Airplane systems status	X	X	X	X
2.c.	Ground crew functions (e.g., ext. power, push back)	X	X	X	X
3.	Airports				
3.a.	Number and selection	X	X	X	X
3.b.	Runway selection	X	X	X	X
3.c.	Runway surface condition (e.g., rough, smooth, icy, wet)	X	X		
3.d.	Preset positions (e.g., ramp, gate, #1 for takeoff, takeoff position, over FAF)	X	X	X	X
3.e.	Lighting controls	X	X	X	X
4.	Environmental controls				
4.a	Visibility (statute miles (kilometers))	X	X	X	X
4.b.	Runway visual range (in feet (meters))	X	X	X	X
4.c.	Temperature	X	X	X	X
4.d.	Climate conditions (e.g., ice, snow, rain)	X	X	X	X
4.e.	Wind speed and direction	X	X	X	X
4.f.	Windshear	X	X		
4.g.	Clouds (base and tops)	X	X	X	X
5.	Airplane system malfunctions (Inserting and deleting malfunctions into the simulator)	X	X	X	X
6.	Locks, Freezes, and Repositioning				
6.a.	Problem (all) freeze/release	X	X	X	X
6.b.	Position (geographic) freeze/release	X	X	X	X
6.c.	Repositioning (locations, freezes, and releases)	X	X	X	X
6.d.	Ground speed control	X	X	X	X
7.	Remote IOS	X	X	X	X
8.	Sound Controls. On/off/adjustment	X	X	X	X
9.	Motion/Control Loading System				
9.a.	On/off/emergency stop	X	X	X	X
10.	Observer Seats/Stations. Position/Adjustment/Positive restraint system	X	X	X	X

BEGIN INFORMATION

1. INTRODUCTION

a. The following is an example test schedule for an Initial/Upgrade evaluation that covers the majority of the requirements set out in the Functions and Subjective test requirements. It is not intended that the schedule be followed line by line, rather, the example should be used as a guide for preparing a schedule that is tailored to the airplane, sponsor, and training task.

b. Functions and subjective tests should be planned. This information has been organized as a reference document with the considerations, methods, and evaluation notes for each individual aspect of the simulator task presented as an individual item. In this way the evaluator can design his or her own test plan, using the appropriate sections to provide guidance on method and evaluation criteria. Two aspects should be present in any test plan structure:

(1) An evaluation of the simulator to determine that it replicates the aircraft and performs reliably for an uninterrupted period equivalent to the length of a typical training session.

(2) The simulator should be capable of operating reliably after the use of training device functions such as repositions or malfunctions.

c. A detailed understanding of the training task will naturally lead to a list of objectives that the simulator should meet. This list will form the basis of the test plan. Additionally, once the test plan has been formulated, the initial conditions and the evaluation criteria should be established. The evaluator should consider all factors that may have an influence on the characteristics observed during particular training tasks in order to make the test plan successful.

2. EVENTS

a. Initial Conditions

(1) Airport.
(2) QNH.
(3) Temperature.
(4) Wind/Crosswind.
(5) Zero Fuel Weight /Fuel/Gross Weight /Center of Gravity.

b. Initial Checks

(1) Documentation of Simulator.
(a) Simulator Acceptance Test Manuals.
(b) Simulator Approval Test Guide.
(c) Technical Logbook Open Item List.
(d) Daily Functional Pre-flight Check.
(2) Documentation of User/Carrier Flight Logs.
(a) Simulator Operating/Instructor Manual.
(b) Difference List (Aircraft/Simulator).
(c) Flight Crew Operating Manuals.
(d) Performance Data for Different Fields.
(e) Crew Training Manual.
(f) Normal/Abnormal/Emergency Checklists.
(3) Simulator External Checks.
(a) Appearance and Cleanliness.
(b) Stairway/Access Bridge.
(c) Emergency Rope Ladders.
(d) ''Motion On''/''Flight in Progress'' Lights.
(4) Simulator Internal Checks.
(a) Cleaning/Disinfecting Towels (for cleaning oxygen masks).
(b) Flight deck Layout (compare with difference list).
(5) Equipment.
(a) Quick Donning Oxygen Masks.
(b) Head Sets.
(c) Smoke Goggles.
(d) Sun Visors.
(e) Escape Rope.
(f) Chart Holders.
(g) Flashlights.
(h) Fire Extinguisher (inspection date).
(i) Crash Axe.
(j) Gear Pins.

c. Power Supply and APU Start Checks

(1) Batteries and Static Inverter.
(2) APU Start with Battery.
(3) APU Shutdown using Fire Handle.
(4) External Power Connection.
(5) APU Start with External Power.
(6) Abnormal APU Start/Operation.

d. Flight deck Checks

(1) Flight deck Preparation Checks.
(2) FMC Programming.
(3) Communications and Navigational Aids Checks.

e. Engine Start

(1) Before Start Checks.
(2) Battery start with Ground Air Supply Unit.
(3) Engine Crossbleed Start.
(4) Normal Engine Start.
(5) Abnormal Engine Starts.
(6) Engine Idle Readings.
(7) After Start Checks.

f. Taxi Checks

(1) Pushback/Powerback.
(2) Taxi Checks.
(3) Ground Handling Check:
(a) Power required to initiate ground roll.
(b) Thrust response.
(c) Nosewheel and Pedal Steering.
(d) Nosewheel Scuffing.
(e) Perform 180 degree turns.
(f) Brakes Response and Differential Braking using Normal, Alternate and Emergency.
(g) Brake Systems.
(h) Eye height and fore/aft position.
(4) Runway Roughness.

g. Visual Scene—Ground Assessment. Select 3 different airport models and perform the following checks with Day, Dusk and Night selected, as appropriate:

(1) Visual Controls.

(a) Daylight, Dusk, Night Scene Controls.

(b) Flight deck ''Daylight'' ambient lighting.

(c) Environment Light Controls.

(d) Runway Light Controls.

(e) Taxiway Light Controls.

(2) Airport Model Content.

(a) Ramp area for buildings, gates, airbridges, maintenance ground equipment, parked aircraft.

(b) Daylight shadows, night time light pools.

(c) Taxiways for correct markings, taxiway/runway, marker boards, CAT I and II/III hold points, taxiway shape/grass areas, taxiway light (positions and colors).

(d) Runways for correct markings, lead-off lights, boards, runway slope, runway light positions, and colors, directionality of runway lights.

(e) Airport environment for correct terrain and significant features.

(f) Visual scene quantization (aliasing), color, and occulting levels.

(3) Ground Traffic Selection.

(4) Environment Effects.

(a) Low cloud scene.

(i) Rain:

(A) Runway surface scene.

(B) Windshield wiper—operation and sound.

(ii) Hail:

(A) Runway surface scene.

(B) Windshield wiper—operation and sound.

(b) Lightning/thunder.

(c) Snow/ice runway surface scene.

(d) Fog.

h. Takeoff. Select one or several of the following test cases:

(1) T/O Configuration Warnings.

(2) Engine Takeoff Readings.

(3) Rejected Takeoff (Dry/Wet/Icy Runway) and check the following:

(a) Autobrake function.

(b) Anti-skid operation.

(c) Motion/visual effects during deceleration.

(d) Record stopping distance (use runway plot or runway lights remaining).

Continue taxiing along the runway while applying brakes and check the following:

(e) Center line lights alternating red/white for 2000 feet/600 meters.

(f) Center line lights all red for 1000 feet/300 meters.

(g) Runway end, red stop bars.

(h) Braking fade effect.

(i) Brake temperature indications.

(4) Engine Failure between VI and V2.

(5) Normal Takeoff:

(a) During ground roll check the following:

(i) Runway rumble.

(ii) Acceleration cues.

(iii) Groundspeed effects.

(iv) Engine sounds.

(v) Nosewheel and rudder pedal steering.

(b) During and after rotation, check the following:

(i) Rotation characteristics.

(ii) Column force during rotation.

(iii) Gear uplock sounds/bumps.

(iv) Effect of slat/flap retraction during climbout.

(6) Crosswind Takeoff (check the following):

(a) Tendency to turn into or out of the wind.

(b) Tendency to lift upwind wing as airspeed increases.

(7) Windshear during Takeoff (check the following):

(a) Controllable during windshear encounter.

(b) Performance adequate when using correct techniques.

(c) Windshear Indications satisfactory.

(d) Motion cues satisfactory (particularly turbulence).

(8) Normal Takeoff with Control Malfunction.

(9) Low Visibility T/O (check the following):

(a) Visual cues.

(b) Flying by reference to instruments.

(c) SID Guidance on LNAV.

i. Climb Performance. Select one or several of the following test cases:

(1) Normal Climb—Climb while maintaining recommended speed profile and note fuel, distance and time.

(2) Single Engine Climb—Trim aircraft in a zero wheel climb at V2.

NOTE: Up to 5° bank towards the operating engine(s) is permissible. Climb for 3 minutes and note fuel, distance, and time. Increase speed toward en route climb speed and retract flaps. Climb for 3 minutes and note fuel, distance, and time.

j. Systems Operation During Climb.

Check normal operation and malfunctions as appropriate for the following systems:

(1) Air conditioning/Pressurization/Ventilation.

(2) Autoflight.

(3) Communications.

(4) Electrical.

(5) Fuel.

(6) Icing Systems.

(7) Indicating and Recording Systems.

(8) Navigation/FMS.

(9) Pneumatics.

k. Cruise Checks. Select one or several of the following test cases:

(1) Cruise Performance.

(2) High Speed/High Altitude Handling (check the following):

(a) Overspeed warning.

(b) High Speed buffet.

(c) Aircraft control satisfactory.

(d) Envelope limiting functions on Computer Controlled Aircraft.

Reduce airspeed to below level flight buffet onset speed, start a turn, and check the following:

(e) High Speed buffet increases with G loading.

Reduce throttles to idle and start descent, deploy the speedbrake, and check the following:

(f) Speedbrake indications.

(g) Symmetrical deployment.

(h) Airframe buffet.

(i) Aircraft response hands off.

(3) Yaw Damper Operation. Switch off yaw dampers and autopilot. Initiate a Dutch roll and check the following:

(a) Aircraft dynamics.

(b) Simulator motion effects.

Switch on yaw dampers, re-initiate a Dutch roll and check the following:

(c) Damped aircraft dynamics.

(4) APU Operation.

(5) Engine Gravity Feed.

(6) Engine Shutdown and Driftdown Check: FMC operation Aircraft performance.

(7) Engine Relight.

l. Descent. Select one of the following test cases:

(1) Normal Descent. Descend while maintaining recommended speed profile and note fuel, distance and time.

(2) Cabin Depressurization/Emergency Descent.

m. Medium Altitude Checks. Select one or several of the following test cases:

(1) High Angle of Attack/Stall. Trim the aircraft at 1.4 Vs, establish 1 kt/sec^2 deceleration rate, and check the following—

(a) System displays/operation satisfactory.

(b) Handling characteristics satisfactory.

(c) Stall and Stick shaker speed.

(d) Buffet characteristics and onset speed.

(e) Envelope limiting functions on Computer Controlled Aircraft.

Recover to straight and level flight and check the following:

(f) Handling characteristics satisfactory.

(2) Turning Flight. Roll aircraft to left, establish a 30° to 45° bank angle, and check the following:

(a) Stick force required, satisfactory.

(b) Wheel requirement to maintain bank angle.

(c) Slip ball response, satisfactory.

(d) Time to turn 180°.

Roll aircraft from 45° bank one way to 45° bank the opposite direction while maintaining altitude and airspeed—check the following:

(e) Controllability during maneuver.

(3) Degraded flight controls.

(4) Holding Procedure (check the following:)

(a) FMC operation.

(b) Autopilot auto thrust performance.

(5) Storm Selection (check the following:)

(a) Weather radar controls.

(b) Weather radar operation.

(c) Visual scene corresponds with WXR pattern.

(Fly through storm center, and check the following:)

(d) Aircraft enters cloud.

(e) Aircraft encounters representative turbulence.

(f) Rain/hail sound effects evident.

As aircraft leaves storm area, check the following:

(g) Storm effects disappear.

(6) TCAS (check the following:)

(a) Traffic appears on visual display.

(b) Traffic appears on TCAS display(s).

As conflicting traffic approaches, take relevant avoiding action, and check the following:

(c) Visual and TCAS system displays.

n. Approach and Landing. Select one or several of the following test cases while monitoring flight control and hydraulic systems for normal operation and with malfunctions selected:

(1) Flaps/Gear Normal Operation. Check the following:

(a) Time for extension/retraction.

(b) Buffet characteristics.

(2) Normal Visual Approach and Landing.

Fly a normal visual approach and landing—check the following:

(a) Aircraft handling.

(b) Spoiler operation.

(c) Reverse thrust operation.

(d) Directional control on the ground.

(e) Touchdown cues for main and nosewheel.

(f) Visual cues.

(g) Motion cues.

(h) Sound cues.

(i) Brake and anti-skid operation.

(3) Flaps/Gear Abnormal Operation or with hydraulic malfunctions.

(4) Abnormal Wing Flaps/Slats Landing.

(5) Manual Landing with Control Malfunction.

(a) Aircraft handling.

(b) Radio aids and instruments.

(c) Airport model content and cues.

(d) Motion cues.

(e) Sound cues.

(6) Non-precision Approach—All Engines Operating.

(a) Aircraft handling.

(b) Radio Aids and instruments.

(c) Airport model content and cues.

(d) Motion cues.

(e) Sound cues.

(7) Circling Approach.

(a) Aircraft handling.

(c) Radio Aids and instruments.

(d) Airport model content and cues.

(e) Motion cues.

(f) Sound cues.

(8) Non-precision Approach—One Engine Inoperative.

(a) Aircraft handling.
(b) Radio Aids and instruments.
(c) Airport model content and cues.
(d) Motion cues.
(e) Sound cues.
(9) One Engine Inoperative Go-around.
(a) Aircraft handling.
(b) Radio Aids and instruments.
(c) Airport model content and cues.
(d) Motion cues.
(e) Sound cues.
(10) CAT I Approach and Landing with raw-data ILS.
(a) Aircraft handling.
(b) Radio Aids and instruments.
(c) Airport model content and cues.
(d) Motion cues.
(e) Sound cues.
(11) CAT I Approach and Landing with Limiting Crosswind.
(a) Aircraft handling.
(b) Radio Aids and instruments.
(c) Airport model content and cues.
(d) Motion cues.
(e) Sound cues.
(12) CAT I Approach with Windshear. Check the following:
(a) Controllable during windshear encounter.
(b) Performance adequate when using correct techniques.
(c) Windshear indications/warnings.
(d) Motion cues (particularly turbulence).
(13) CAT II Approach and Automatic Go-Around.
(14) CAT III Approach and Landing—System Malfunctions.
(15) CAT III Approach and Landing—1 Engine Inoperative.
(16) GPWS evaluation.

o. Visual Scene—In-Flight Assessment.

Select three (3) different visual models and perform the following checks with ''day,'' ''dusk,'' and ''night'' (as appropriate) selected. Reposition the aircraft at or below 2000 feet within 10 nm of the airfield. Fly the aircraft around the airport environment and assess control of the visual system and evaluate the Airport model content as described below:

(1) Visual Controls.
(a) Daylight, Dusk, Night Scene Controls.
(b) Environment Light Controls.
(c) Runway Light Controls.
(d) Taxiway Light Controls.
(e) Approach Light Controls.
(2) Airport model Content.
(a) Airport environment for correct terrain and significant features.
(b) Runways for correct markings, runway slope, directionality of runway lights.
(c) Visual scene for quantization (aliasing), color, and occulting.

Reposition the aircraft to a long, final approach for an ''ILS runway.'' Select flight freeze when the aircraft is 5-statute miles (sm)/8-kilometers (km) out and on the glide slope. Check the following:

(3) Airport model content.
(a) Airfield features.
(b) Approach lights.
(c) Runway definition.
(d) Runway definition.
(e) Runway edge lights and VASI lights.
(f) Strobe lights.

Release flight freeze. Continue flying the approach with NP engaged. Select flight freeze when aircraft is 3 sm/5 km out and on the glide slope. Check the following:

(4) Airport model Content.
(a) Runway centerline light.
(b) Taxiway definition and lights.

Release flight freeze and continue flying the approach with A/P engaged. Select flight freeze when aircraft is 2 sm/3 km out and on the glide slope. Check the following:

(5) Airport model content.
(a) Runway threshold lights.
(b) Touchdown zone lights.

At 200 ft radio altitude and still on glide slope, select Flight Freeze. Check the following:

(6) Airport model content.
(a) Runway markings.

Set the weather to Category I conditions and check the following:

(7) Airport model content.
(a) Visual ground segment.

Set the weather to Category II conditions, release Flight Freeze, re-select Flight Freeze at 100 feet radio altitude, and check the following:

(8) Airport model content.
(a) Visual ground segment.

Select night/dusk (twilight) conditions and check the following:

(9) Airport model content.
(a) Runway markings visible within landing light lobes.

Set the weather to Category III conditions, release Flight Freeze, re-select Flight Freeze at 50 feet radio altitude and check the following:

(10) Airport model content.
(a) Visual ground segment.

Set WX to a typical ''missed approach? weather condition, release Flight Freeze, re-select Flight Freeze at 15 feet radio altitude, and check the following:

(11) Airport model content.
(a) Visual ground segment.

When on the ground, stop the aircraft. Set 0 feet RVR, ensure strobe/beacon tights are switched on and check the following:

(12) Airport model content.
(a) Visual effect of strobe and beacon.

Reposition to final approach, set weather to ''Clear,'' continue approach for an automatic landing, and check the following:

(13) Airport model content.
(a) Visual cues during flare to assess sink rate.

(b) Visual cues during flare to assess Depth perception.

(c) Flight deck height above ground.

After Landing Operations.

(1) After Landing Checks.

(2) Taxi back to gate. Check the following:

(a) Visual model satisfactory.

(b) Parking brake operation satisfactory.

(3) Shutdown Checks.

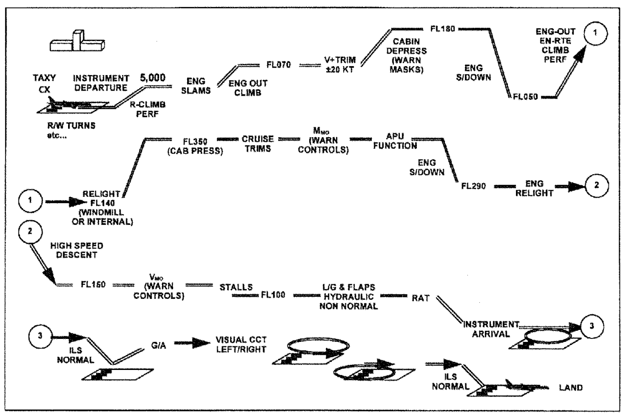
q. Crash Function.

(1) Gear-up Crash.

(2) Excessive rate of descent Crash.

(3) Excessive bank angle Crash.

Typical Subjective Continuing Qualification Evaluation Profile (2 hours)



End Information

Attachment 4 to Appendix A to Part 60--

SAMPLE DOCUMENTS

Table of Contents

Attachment 4 to Appendix A to Part 60—
Figure A4B – Sample Letter , Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FSTD Information Form
INFORMATION

Date: _____					
Section 1. FSTD Information and Characteristics					
Sponsor Name:	_____	**FSTD Location:**			
Address:	_____ _____	**Physical Address:**	_____ _____		
City:	_____	**City:**	_____		
State:	_____	**State:**	_____		
Country:	_____	**Country:**	_____		
ZIP:	_____	**ZIP:**	_____		
Manager	_____				
Sponsor ID No: (Four Letter FAA Designator)	_____	**Nearest Airport:** (Airport Designator)	_____		
Type of Evaluation Requested:	☐ Initial ☐ Upgrade ☐ Continuing Qualification ☐ Special ☐ Reinstatement				
Aircraft Make/model/series:	_____				
Initial Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY	**Manufacturer's Identification or Serial Number**	_______________		
Upgrade Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY	☐ **eMQTG**			
Qualification Basis:_______________	☐ **A**	☐ **B**	☐ **Interim C**	☐ **C**	☐ **D**
	☐ **6**	☐ **7**	☐ **Provisional Status**		
Other Technical Information:					
FAA FSTD ID No: (If Applicable)	_____	**FSTD Manufacturer:**	_____		
Convertible FSTD:	☐Yes:	**Date of Manufacture:**	_____ MM/DD/YYYY		
Related FAA ID No. (If Applicable)	_____ _____ _____	**Sponsor FSTD ID No:** __________			
Engine model(s) and data revision: __________		**Source of aerodynamic model:** __________			
FMS identification and revision level: __________		**Source of aerodynamic coefficient data:** __________			
Visual system manufacturer/model: __________		**Aerodynamic data revision number:** __________			
Flight control data revision: __________		**Visual system display:** __________			
Mot ion system manufacturer/type: __________		**FSTD computer(s) identification:** __________			
National Aviation Authority (NAA): (If Applicable)	__________				
NAA FSTD ID No:	__________	**Last NAA Evaluation Date:**	__________		
NAA Qualification Level:	__________				
NAA Qualification Basis:	_____				
Visual System Manufacturer and Type:	__________	**FSTD Seats Available:** __________	**Motion System Manufacturer and Type:**	__________:	

Attachment 4 to Appendix A to Part 60—
Figure A4B – Sample Letter , Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FSTD Information Form
INFORMATION

Aircraft Equipment:	Engine Type(s):	Flight Instrumentation:	Engine Instrumentation:
	____ ____	☐ EFIS ☐ HUD ☐ HGS ☐ EFVS ☐ TCAS ☐ GPWS ☐ Plain View ☐ GPS ☐ FMS Type: __ ☐ WX Radar ☐ Other: __	☐ EICAS ☐ FADEC ☐ Other: __

Airport Models:	3.6.1 ____ Airport Designator	3.6.2____ Airport Designator	3.6.3 ____ Airport Designator
Circle to Land:	3. 7.1 ____ Airport Designator	3. 7.2____ Approach	3. 7.3 ____ Landing Runway
Visual Ground Segment	3.8.1 ____ Airport Designator	3.8 .2____ Approach	3. 8.3 ____ Landing Runway

Section 2. Supplementary Information

FAA Training Program Approval Authority:		☐ POI ☐ TCPM ☐ Other: ____	
Name:	________	**Office:**	________
Tel:	________	**Fax:**	________
Email:	________		
FSTD Scheduling Person:			
Name:	________		
Address 1:	________	**Address 2**	________
City:	________	**State:**	________
ZIP:	________	**Email:**	________
Tel:	________	**Fax:**	________
FSTD Technical Contact:			
Name:	________		
Address 1:	________	**Address 2**	________
City:	________	**State:**	________
ZIP:	________	**Email:**	________
Tel:	________	**Fax:**	________

Section 3. Training, Testing and Checking Considerations

Area/Function/Maneuver	Requested	Remarks
Private Pilot - Training / Checks: (142)	☐	________
Commercial Pilot - Training /Checks:(142)	☐	________
Multi-Engine Rating - Training / Checks (142)	☐	________
Instrument Rating -Training / Checks (142)	☐	________
Type Rating - Training / Checks (135/121/142)	☐	________
Proficiency Checks (135/121/142)	☐	________

Attachment 4 to Appendix A to Part 60—
Figure A4B – Sample Letter , Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FSTD Information Form
INFORMATION

CAT I: (RVR 2400/1800 ft. DH200 ft)	☐	_________
CAT II: (RVR 1200 ft. DH 100 ft)	☐	_________
CAT III * (lowest minimum) _________ RVR _________ ft. * State CAT III (≤ 700 ft.), CAT IIIb (≤ 150 ft.), or CAT IIIc (0 ft.)	☐	_________
Circling Approach	☐	_________
Windshear Training:	☐	_________
Windshear Training IAW 121.409(d) (121 Turbojets Only)	☐	_________
Generic Unusual Attitudes and Recoveries within the Normal Flight Envelope	☐	_________
Specific Unusual Attitudes Recoveries	☐	_________
Auto-coupled Approach/Auto Go Around	☐	_________
Auto-land / Roll Out Guidance	☐	_________
TCAS/ACAS I / II	☐	_________
WX-Radar	☐	_________
HUD	☐	_________
HGS	☐	_________
EFVS	☐	_________
Future Air Navigation Systems	☐	_________
GPWS / EGPWS	☐	_________
ETOPS Capability	☐	_________
GPS	☐	_________
SMGCS	☐	_________
Helicopter Slope Landings	☐	_________
Helicopter External Load Operations	☐	_________
Helicopter Pinnacle Approach to Landings	☐	_________
Helicopter Night Vision Maneuvers	☐	_________
Helicopter Category A Takeoffs	☐	_________

VerDate Sep<11>2014 14:00 Mar 14, 2024 Jkt 262047 PO 00000 Frm 00157 Fmt 8010 Sfmt 8006 Q:\14\14V2.TXT PC31
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ER09MY08.010</GPH>

Attachment 4 to Appendix A to Part 60—Figure A4C – Sample Letter of Compliance

Date _______

RE: Request for Initial/Upgrade Evaluation Date

This is to advise you of our intent to request an (initial or upgrade) evaluation of our (FFS Manufacturer), (Aircraft Type/Level) Full Flight Simulator (FFS), (FAA ID Number, if previously qualified), located in (City, State) at the (Facility) on (Proposed Evaluation Date). (The proposed evaluation date shall not be more than 180 days following the date of this letter.) The FFS will be sponsored by (Name of Training Center/Air Carrier), FAA Designator (4 Letter Code). The FFS will be sponsored as follows: (Select One)

☐ The FFS will be used within the sponsor's FAA approved training program and placed on the sponsor's Training/Operations Specifications.

☐ The FFS will be used for dry lease only.

We agree to provide the formal request for the evaluation to your staff as follows: (check one)

☐ For QTG tests run at the factory, not later, than 45 days prior to the proposed evaluation date with the additional "l/3 on-site" tests provided not later than 14 days prior to the proposed evaluation date.

☐ For QTG tests run on-site, not later than 30 days prior to the proposed evaluation date.

We understand that the formal request will contain the following documents:

1. Sponsor's Letter of Request (*Company Compliance Letter*).
2. Principal Operations Inspector (POI) or Training Center Program Manager's (TCPM) endorsement.
3. Complete QTG.

If we are unable to meet the above requirements, we understand this may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation.

(The sponsor should add additional comments as necessary).

Please contact (Name Telephone and Fax Number of Sponsor's Contact) to confirm the date for this initial evaluation. We understand a member of your National Simulator Program staff will respond to this request within 14 days.

A copy of this letter of intent has been provided to (Name), the Principal Operations Inspector (POI) and/or Training Center Program Manager (TCPM).

Sincerely,

Attachment: FFS Information Form
cc: POI/TCPM

INFORMATION

(Date)

Mr. (Name of Training Program Approval Authority):
(Name of responsible Flight Standards office)
(Address)
(City/State/Zip)

Dear Mr. (Name of TPAA):

RE: Letter of Compliance

(Operator Sponsor Name) requests evaluation of our (Aircraft Type) FFS for Level (__) qualification. The (FFS Manufacturer Name) FFS with (Visual System Manufacturer Name/Model) system is fully defined on the FFS Information page of the accompanying Qualification Test Guide (QTG). We have completed the tests of the FFS and certify that it meets all applicable requirements of FAR parts 121, 125, or 135), and the guidance of (AC 120-40B or 14 CFR Part 60). Appropriate hardware and software configuration control procedures have been established. Our Pilot(s), (Name(s)), who are qualified on (Aircraft Type) aircraft have assessed the FFS and have found that it conforms to the (Operator/Sponsor) (Aircraft Type) flight deck configuration and that the simulated systems and subsystems function equivalently to those in the aircraft. The above named pilot(s) have also assessed the performance and the flying qualities of the FFS and find that it represents the respective aircraft.

(Added Comments may be placed here)

Sincerely,
(Sponsor Representative)

ATTACHMENT 4 TO APPENDIX A TO PART 60—FIGURE A4D—SAMPLE QUALIFICATION TEST GUIDE COVER PAGE

INFORMATION

SPONSOR NAME
SPONSOR ADDRESS

FAA QUALIFICATION TEST GUIDE
(SPECIFIC AIRPLANE MODEL)
for example
Stratos BA797-320A
(Type of Simulator)
(Simulator Identification Including Manufacturer, Serial Number, Visual System Used)
(Simulator Level)
(Qualification Performance Standard Used)
(Simulator Location)

FAA Initial Evaluation
Date: ______________

____________________________ Date: ____________
(Sponsor)

____________________________ Date: ____________
FAA

ATTACHMENT 4 TO APPENDIX A TO PART 60—FIGURE A4E—SAMPLE STATEMENT OF QUALIFICATION—CERTIFICATE

INFORMATION

Federal Aviation Administration

Certificate of Qualification

This is to certify that representatives of the FAA
Completed an evaluation of the

Go-Fast Airlines

Farnsworth Z-100 Full Flight Simulator

FAA Identification Number 999

And pursuant to 14 CFR Part 60 found it to meet its original qualification basis, AC 120-40B (MM/DD/YY)

The Master Qualification Test Guide and the attached
Configuration List and Restrictions List
Provide the Qualification Basis for this device to operate at

Level D

Until April 30, 2010
Unless sooner rescinded or extended by the FAA

March 15, 2009
(date)

B. Williamson
(for the FAA)

Attachment 4 to Appendix A to Part 60—
Figure A4F – Sample Statement of Qualification; Configuration List
INFORMATION

STATEMENT OF QUALIFICATION CONFIGURATION LIST

Date: _____					
Section 1. FSTD Information and Characteristics					
Sponsor Name:	_____	**FSTD Location:**			
Address:	_____ _____	**Physical Address:**	_____ _____		
City:	_____	**City:**	_____		
State:	_____	**State:**	_____		
Country:	_____	**Country:**	_____		
ZIP:	_____	**ZIP:**	_____		
Manager	_____				
Sponsor ID No: (Four Letter FAA Designator)	_____	**Nearest Airport:** (Airport Designator)	_____		
Type of Evaluation Requested:	☐ **Initial** ☐ **Upgrade** ☐ **Continuing Qualification** ☐ **Special** ☐ **Reinstatement**				
Aircraft Make/model/series:	_____				
Initial Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY	**Manufacturer's Identification or Serial Number**	_____________		
Upgrade Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY	☐ **eMQTG**			
Qualification Basis:_____________	☐ **A**	☐ **B**	☐ **Interim C**	☐ **C**	☐ **D**
	☐ **6**	☐ **7**	☐ **Provisional Status**		
Other Technical Information:					
FAA FSTD ID No: (If Applicable)	_____	**FSTD Manufacturer:**	_____		
Convertible FSTD:	☐**Yes:**	**Date of Manufacture:**	_____ MM/DD/YYYY		
Related FAA ID No. (If Applicable)	_____ _____ _____	**Sponsor FSTD ID No:** _________			
Engine model(s) and data revision: _________		**Source of aerodynamic model:** _________			
FMS identification and revision level: _________		**Source of aerodynamic coefficient data:** _________			
Visual system manufacturer/model: _________		**Aerodynamic data revision number:** _________			
Flight control data revision: _________		**Visual system display:** _________			
Mot ion system manufacturer/type: _________		**FSTD computer(s) identification:** _________			
National Aviation Authority (NAA): (If Applicable)	_________				
NAA FSTD ID No:	_________	**Last NAA Evaluation Date:**	_________		
NAA Qualification Level:	_________				
NAA Qualification Basis:	_____				

Attachment 4 to Appendix A to Part 60—
Figure A4F – Sample Statement of Qualification; Configuration List

INFORMATION

Visual System Manufacturer and Type:	_____	FSTD Seats Available: _____	Motion System Manufacturer and Type:	_____:

Aircraft Equipment:	Engine Type(s): ____ ____	Flight Instrumentation: ☐ EFIS ☐ HUD ☐ HGS ☐ EFVS ☐ TCAS ☐ GPWS ☐ Plain View ☐ GPS ☐ FMS Type: __ ☐ WX Radar ☐ Other: __	Engine Instrumentation: ☐ EICAS ☐ FADEC ☐ Other: __

Airport Models:	3.6.1 ____ Airport Designator	3.6.2____ Airport Designator	3.6.3 ____ Airport Designator
Circle to Land:	3. 7.1 ____ Airport Designator	3. 7.2____ Approach	3. 7.3 ____ Landing Runway
Visual Ground Segment	3.8.1 ____ Airport Designator	3.8 .2____ Approach	3. 8.3 ____ Landing Runway

Section 2. Supplementary Information

FAA Training Program Approval Authority:		☐ POI ☐ TCPM ☐ Other: _____	
Name:	_____	Office:	_____
Tel:	_____	Fax:	_____
Email:	_____		
FSTD Scheduling Person:			
Name:	_____		
Address 1:	_____	Address 2	_____
City:	_____	State:	_____
ZIP:	_____	Email:	_____
Tel:	_____	Fax:	_____
FSTD Technical Contact:			
Name:	_____		
Address 1:	_____	Address 2	_____
City:	_____	State:	_____
ZIP:	_____	Email:	_____
Tel:	_____	Fax:	_____

Section 3. Training, Testing and Checking Considerations

Area/Function/Maneuver	Requested	Remarks
Private Pilot - Training / Checks: (142)	☐	_____
Commercial Pilot - Training /Checks:(142)	☐	_____
Multi-Engine Rating - Training / Checks (142)	☐	_____
Instrument Rating -Training / Checks (142)	☐	_____
Type Rating - Training / Checks (135/121/142)	☐	_____

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Attachment 4 to Appendix A to Part 60—
Figure A4F – Sample Statement of Qualification; Configuration List
INFORMATION

Proficiency Checks (135/121/142)	☐	_________
CAT I: (RVR 2400/1800 ft. DH200 ft)	☐	_________
CAT II: (RVR 1200 ft. DH 100 ft)	☐	_________
CAT III * (lowest minimum) _________ RVR _________ ft. * State CAT III (≤ 700 ft.), CAT IIIb (≤ 150 ft.), or CAT IIIc (0 ft.)	☐	_________
Circling Approach	☐	_________
Windshear Training:	☐	_________
Windshear Training IAW 121.409(d) (121 Turbojets Only)	☐	_________
Generic Unusual Attitudes and Recoveries within the Normal Flight Envelope	☐	_________
Specific Unusual Attitudes Recoveries	☐	_________
Auto-coupled Approach/Auto Go Around	☐	_________
Auto-land / Roll Out Guidance	☐	_________
TCAS/ACAS I / II	☐	_________
WX-Radar	☐	_________
HUD	☐	_________
HGS	☐	_________
EFVS	☐	_________
Future Air Navigation Systems	☐	_________
GPWS / EGPWS	☐	_________
ETOPS Capability	☐	_________
GPS	☐	_________
SMGCS	☐	_________
Helicopter Slope Landings	☐	_________
Helicopter External Load Operations	☐	_________
Helicopter Pinnacle Approach to Landings	☐	_________
Helicopter Night Vision Maneuvers	☐	_________
Helicopter Category A Takeoffs	☐	_________

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Attachment 4 to Appendix A to Part 60—
Figure A4G – Sample Statement of Qualification – List of Qualified Tasks
INFORMATION

STATEMENT of QUALIFICATION
List of Qualified Tasks

Go Fast Airline Training -- Farnsworth Z-100 -- Level D -- FAA ID# 999

The FFS is qualified to perform all of the Maneuvers, Procedures, Tasks, and Functions Listed in Appendix A, Attachment 1, Table A1B, Minimum FFS Requirements In Effect on [mm/dd/yyyy] except for the following listed Tasks or Functions.

Qualified for all tasks in Table A1B, for which the sponsor has requested qualification, except for the following: 3.e(1)(i) NDB approach 3.f. Recovery from Unusual Attitudes 4.3. Circling Approach
Additional tasks for which this FFS is qualified (i.e., in addition to the list in Table A1B) 1. Enhanced Visual System 2. Windshear Training IAW Section 121.409(d).
The airport visual models evaluated for qualification at this level are: 1. Atlanta Hartsfield International Airport (KATL) 2. Miami International Airport (KMIA) 3. Dallas/Ft. Worth Regional Airport (KDFW)

ATTACHMENT 4 TO APPENDIX A TO PART 60—FIGURE A4H [RESERVED]

Attachment 4 to Appendix A to Part 60—
Figure A4I – Sample MQTG Index of Effective FFS Directives
INFORMATION

Index of Effective FSTD Directives Filed in this Section			
Number	**Effective Date**	**Date of Notification**	**Details**

Continue as Necessary....

ATTACHMENT 5 TO APPENDIX A TO PART 60—SIMULATOR QUALIFICATION REQUIREMENTS FOR WINDSHEAR TRAINING PROGRAM USE

BEGIN QPS REQUIREMENTS

1. APPLICABILITY

This attachment applies to all simulators, regardless of qualification level, that are used to satisfy the training requirements of an FAA-approved low-altitude windshear flight training program, or any FAA-approved training program that addresses windshear encounters.

2. STATEMENT OF COMPLIANCE AND CAPABILITY (SOC)

a. The sponsor must submit an SOC confirming that the aerodynamic model is based on flight test data supplied by the airplane manufacturer or other approved data provider. The SOC must also confirm that any change to environmental wind parameters, including variances in those parameters for windshear conditions, once inserted for computation, result in the correct simulated performance. This statement must also include examples of environmental wind parameters currently evaluated in the simulator (such as crosswind takeoffs, crosswind approaches, and crosswind landings).

b. For simulators without windshear warning, caution, or guidance hardware in the original equipment, the SOC must also state that the simulation of the added hardware and/or software, including associated flight deck displays and annunciations, replicates the system(s) installed in the airplane. The statement must be accompanied by a block diagram depicting the input and output signal flow, and comparing the signal flow to the equipment installed in the airplane.

3. MODELS

The windshear models installed in the simulator software used for the qualification evaluation must do the following:

a. Provide cues necessary for recognizing windshear onset and potential performance degradation requiring a pilot to initiate recovery procedures. The cues must include all of the following, as appropriate for the portion of the flight envelope:

(1) Rapid airspeed change of at least ±15 knots (kts).

(2) Stagnation of airspeed during the takeoff roll.

(3) Rapid vertical speed change of at least ±500 feet per minute (fpm).

(4) Rapid pitch change of at least ±5°.

b. Be adjustable in intensity (or other parameter to achieve an intensity effect) to at least two (2) levels so that upon encountering the windshear the pilot may identify its presence and apply the recommended procedures for escape from such a windshear.

(1) If the intensity is lesser, the performance capability of the simulated airplane in the windshear permits the pilot to maintain a satisfactory flightpath; and

(2) If the intensity is greater, the performance capability of the simulated airplane in the windshear does not permit the pilot to maintain a satisfactory flightpath (crash). Note: The means used to accomplish the ''nonsurvivable'' scenario of paragraph 3.b.(2) of this attachment, that involve operational elements of the simulated airplane, must reflect the dispatch limitations of the airplane.

c. Be available for use in the FAA-approved windshear flight training program.

4. DEMONSTRATIONS

a. The sponsor must identify one survivable takeoff windshear training model and one survivable approach windshear training model. The wind components of the survivable models must be presented in graphical format so that all components of the windshear are shown, including initiation point, variance in magnitude, and time or distance correlations. The simulator must be operated at the same gross weight, airplane configuration, and initial airspeed during the takeoff demonstration (through calm air and through the first selected survivable windshear), and at the same gross weight, airplane configuration, and initial airspeed during the approach demonstration (through calm air and through the second selected survivable windshear).

b. In each of these four situations, at an ''initiation point'' (i.e., where windshear onset is or should be recognized), the recommended procedures for windshear recovery are applied and the results are recorded as specified in paragraph 5 of this attachment.

c. These recordings are made without inserting programmed random turbulence. Turbulence that results from the windshear model is to be expected, and no attempt may be made to neutralize turbulence from this source.

d. The definition of the models and the results of the demonstrations of all four?(4) cases described in paragraph 4.a of this attachment, must be made a part of the MQTG.

5. RECORDING PARAMETERS

a. In each of the four MQTG cases, an electronic recording (time history) must be made of the following parameters:

(1) Indicated or calibrated airspeed.

(2) Indicated vertical speed.

(3) Pitch attitude.

(4) Indicated or radio altitude.

(5) Angle of attack.

(6) Elevator position.

(7) Engine data (thrust, N1, or throttle position).

(8) Wind magnitudes (simple windshear model assumed).

b. These recordings must be initiated at least 10 seconds prior to the initiation point, and continued until recovery is complete or ground contact is made.

6. EQUIPMENT INSTALLATION AND OPERATION

All windshear warning, caution, or guidance hardware installed in the simulator must operate as it operates in the airplane. For example, if a rapidly changing wind speed and/or direction would have caused a windshear warning in the airplane, the simulator must respond equivalently without instructor/evaluator intervention.

7. QUALIFICATION TEST GUIDE

a. All QTG material must be forwarded to the responsible Flight Standards office.

b. A simulator windshear evaluation will be scheduled in accordance with normal procedures. Continuing qualification evaluation schedules will be used to the maximum extent possible.

c. During the on-site evaluation, the evaluator will ask the operator to run the performance tests and record the results. The results of these on-site tests will be compared to those results previously approved and placed in the QTG or MQTG, as appropriate.

d. QTGs for new (or MQTGs for upgraded) simulators must contain or reference the information described in paragraphs 2, 3, 4, and 5 of this attachment.

END QPS REQUIREMENTS

BEGIN INFORMATION

8. SUBJECTIVE EVALUATION

The responsible Flight Standards office will fly the simulator in at least two of the available windshear scenarios to subjectively evaluate simulator performance as it encounters the programmed windshear conditions.

a. One scenario will include parameters that enable the pilot to maintain a satisfactory flightpath.

b. One scenario will include parameters that will not enable the pilot to maintain a satisfactory flightpath (crash).

c. Other scenarios may be examined at the responsible Flight Standards office's discretion.

9. QUALIFICATION BASIS

The addition of windshear programming to a simulator in order to comply with the qualification for required windshear training does not change the original qualification basis of the simulator.

10. DEMONSTRATION REPEATABILITY

For the purposes of demonstration repeatability, it is recommended that the simulator be flown by means of the simulator's autodrive function (for those simulators that have autodrive capability) during the demonstrations.

END INFORMATION

ATTACHMENT 6 TO APPENDIX A TO PART 60—FSTD DIRECTIVES APPLICABLE TO AIRPLANE FLIGHT SIMULATORS

FLIGHT SIMULATION TRAINING DEVICE (FSTD) DIRECTIVE

FSTD Directive 1. Applicable to all Full Flight Simulators (FFS), regardless of the original qualification basis and qualification date (original or upgrade), having Class II or Class III airport models available.

Agency: Federal Aviation Administration (FAA), DOT.

Action: This is a retroactive requirement to have all Class II or Class III airport models meet current requirements.

Summary: Notwithstanding the authorization listed in paragraph 13b in Appendices A and C of this part, this FSTD Directive requires each certificate holder to ensure that by May 30, 2009, except for the airport model(s) used to qualify the simulator at the designated level, each airport model used by the certificate holder's instructors or evaluators for training, checking, or testing under this chapter in an FFS, meets the definition of a Class II or Class III airport model as defined in 14CFR part 60. The completion of this requirement will not require a report, and the method used for keeping instructors and evaluators apprised of the airport models that meet Class II or Class III requirements on any given simulator is at the option of the certificate holder whose employees are using the FFS, but the method used must be available for review by the TPAA for that certificate holder.

Dates: FSTD Directive 1 becomes effective on May 30, 2008.

SPECIFIC REQUIREMENTS:

1. Part 60 requires that each FSTD be:

a. Sponsored by a person holding or applying for an FAA operating certificate under Part 119, Part 141, or Part 142, or holding or applying for an FAA-approved training program under Part 63, Appendix C, for flight engineers, and

b. Evaluated and issued an SOQ for a specific FSTD level.

2. FFSs also require the installation of a visual system that is capable of providing an out-of-the-flight-deck view of airport models. However, historically these airport models were not routinely evaluated or required to meet any standardized criteria. This has led to qualified simulators containing airport models being used to meet FAA-approved training, testing, or checking requirements with potentially incorrect or inappropriate visual references.

3. To prevent this from occurring in the future, by May 30, 2009, except for the airport model(s) used to qualify the simulator at the designated level, each certificate holder must assure that each airport model used for training, testing, or checking under this chapter in a qualified FFS meets the definition of a Class II or Class III airport model as defined in Appendix F of this part.

4. These references describe the requirements for visual scene management and the minimum distances from which runway or landing area features must be visible for all levels of simulator. The airport model must provide, for each ''in-use runway'' or ''in-use landing area,'' runway or landing area surface and markings, runway or landing area lighting, taxiway surface and markings, and taxiway lighting. Additional requirements include correlation of the v airport models with other aspects of the airport environment, correlation of the aircraft and associated equipment, scene quality assessment features, and the control of these models the instructor must be able to exercise.

5. For circling approaches, all requirements of this section apply to the runway used for the initial approach and to the runway of intended landing.

6. The details in these models must be developed using airport pictures, construction drawings and maps, or other similar data, or developed in accordance with published regulatory material. However, this FSTD DIRECTIVE 1 does not require that airport models contain details that are beyond the initially designed capability of the visual system, as currently qualified. The recognized limitations to visual systems are as follows:

a. Visual systems not required to have runway numbers as a part of the specific runway marking requirements are:

(1) Link NVS and DNVS.

(2) Novoview 2500 and 6000.

(3) FlightSafety VITAL series up to, and including, VITAL III, but not beyond.

(4) Redifusion SP1, SP1T, and SP2.

b. Visual systems required to display runway numbers only for LOFT scenes are:

(1) FlightSafety VITAL IV.

(2) Redifusion SP3 and SP3T.

(3) Link-Miles Image II.

c. Visual systems not required to have accurate taxiway edge lighting are:

(1) Redifusion SP1.

(2) FlightSafety Vital IV.

(3) Link-Miles Image II and Image IIT

(4) XKD displays (even though the XKD image generator is capable of generating blue colored lights, the display cannot accommodate that color).

7. A copy of this Directive must be filed in the MQTG in the designated FSTD Directive Section, and its inclusion must be annotated on the Index of Effective FSTD Directives chart. See Attachment 4, Appendices A through D for a sample MQTG Index of Effective FSTD Directives chart.

FLIGHT SIMULATION TRAINING DEVICE (FSTD) DIRECTIVE

FSTD Directive 2. Applicable to all airplane Full Flight Simulators (FFS), regardless of the original qualification basis and qualification date (original or upgrade), used to conduct full stall training, upset recovery training, airborne icing training, and other flight training tasks as described in this Directive.

Agency: Federal Aviation Administration (FAA), DOT.

Action: This is a retroactive requirement for any FSTD being used to obtain training, testing, or checking credit in an FAA approved flight training program for the specific training maneuvers as defined in this Directive.

Summary: Notwithstanding the authorization listed in paragraph 13b in Appendix A of this Part, this FSTD Directive requires that each FSTD sponsor conduct additional subjective and objective testing, conduct required modifications, and apply for additional FSTD qualification under §60.16 to support continued qualification of the following flight training tasks where training, testing, or checking credit is being sought in a selected FSTD being used in an FAA approved flight training program:

a. Recognition of and Recovery from a Full Stall

b. Upset Prevention and Recovery

c. Engine and Airframe Icing

d. Takeoff and Landing with Gusting Crosswinds

e. Recovery from a Bounced Landing

The FSTD sponsor may elect to apply for additional qualification for any, all, or none of the above defined training tasks for a particular FSTD. After March 12, 2019, any FSTD used to conduct the above training tasks must be evaluated and issued additional qualification by the responsible Flight Standards office as defined in this Directive.

Dates: FSTD Directive No. 2 becomes effective on May 31, 2016.

SPECIFIC REQUIREMENTS

1. Part 60 requires that each FSTD be:

a. Sponsored by a person holding or applying for an FAA operating certificate under Part 119, Part 141, or Part 142, or holding or applying for an FAA-approved training program under Part 63, Appendix C, for flight engineers, and

b. Evaluated and issued a Statement of Qualification (SOQ) for a specific FSTD level.

2. The evaluation criteria contained in this Directive is intended to address specific training tasks that require additional evaluation to ensure adequate FSTD fidelity.

3. The requirements described in this Directive define additional qualification criteria for specific training tasks that are applicable only to those FSTDs that will be utilized to obtain training, testing, or checking credit in an FAA approved flight training program. In order to obtain additional qualification for the tasks described in this Directive, FSTD sponsors must request additional qualification in accordance with §60.16 and the requirements of this Directive. FSTDs that are found to meet the requirements of this Directive will have their Statement of Qualification (SOQ) amended to reflect the additional training tasks that the FSTD has been qualified to conduct. The additional qualification requirements as defined in this Directive are divided into the following training tasks:

a. Section I—Additional Qualification Requirements for Full Stall Training Tasks

b. Section II—Additional Qualification Requirements for Upset Prevention and Recovery Training Tasks

c. Section III—Additional Qualification Requirements for Engine and Airframe Icing Training Tasks

d. Section IV—Additional Qualification Requirements for Takeoff and Landing in Gusting Crosswinds

e. Section V—Additional Qualification Requirements for Bounced Landing Recovery Training Tasks

4. A copy of this Directive (along with all required Statements of Compliance and objective test results) must be filed in the MQTG in the designated FSTD Directive Section, and its inclusion must be annotated on the Index of Effective FSTD Directives chart. See Attachment 4, Appendix A for a sample MQTG Index of Effective FSTD Directives chart.

SECTION I—EVALUATION REQUIREMENTS FOR FULL STALL TRAINING TASKS

1. This section applies to previously qualified Level C and Level D FSTDs being used to obtain credit for stall training maneuvers beyond the first indication of a stall (such as

stall warning system activation, stick shaker, etc.) in an FAA approved training program.

2. The evaluation requirements in this Directive are intended to validate FSTD fidelity at angles of attack sufficient to identify the stall, to demonstrate aircraft performance degradation in the stall, and to demonstrate recovery techniques from a fully stalled flight condition.

3. After March 12, 2019, any FSTD being used to obtain credit for full stall training maneuvers in an FAA approved training program must be evaluated and issued additional qualification in accordance with this Directive and the following sections of Appendix A of this Part:

a. Table A1A, General Requirements, Section 2.m. (High Angle of Attack Modeling)

b. Table A1A, General Requirements, Section 3.f. (Stick Pusher System) [where applicable]

c. Table A2A, Objective Testing Requirements, Test 2.a.10 (Stick Pusher Force Calibration) [where applicable]

d. Table A2A, Objective Testing Requirements, Test 2.c.8.a (Stall Characteristics)

e. Table A2A, Objective Testing Requirements, Test 3.f.5 (Characteristic Motion Vibrations—Stall Buffet) [See paragraph 4 of this section for applicability on previously qualified FSTDs]

f. Table A3A, Functions and Subjective Testing Requirements, Test 5.b.1.b. (High Angle of Attack Maneuvers)

g. Attachment 7, Additional Simulator Qualification Requirements for Stall, Upset Prevention and Recovery, and Engine and Airframe Icing Training Tasks (High Angle of Attack Model Evaluation)

4. For FSTDs initially qualified before May 31, 2016, including FSTDs that are initially qualified under the grace period conditions as defined in § 60.15(c):

a. Objective testing for stall characteristics (Table A2A, test 2.c.8.a.) will only be required for the (wings level) second segment climb and approach or landing flight conditions. In lieu of objective testing for the high altitude cruise and turning flight stall conditions, these maneuvers may be subjectively evaluated by a qualified subject matter expert (SME) pilot and addressed in the required statement of compliance.

b. Where existing flight test validation data in the FSTD's Master Qualification Test Guide (MQTG) is missing required parameters or is otherwise unsuitable to fully meet the objective testing requirements of this Directive, the FAA may accept alternate sources of validation, including subjective validation by an SME pilot with direct experience in the stall characteristics of the aircraft.

c. Objective testing for characteristic motion vibrations (Stall buffet—Table A2A, test 3.f.5) is not required where the FSTD's stall buffets have been subjectively evaluated by an SME pilot. For previously qualified Level D FSTDs that currently have objective stall buffet tests in their approved MQTG, the results of these existing tests must be provided to the FAA with the updated stall and stall buffet models in place.

d. As described in Attachment 7 of this Appendix, the FAA may accept a statement of compliance from the data provider which confirms the stall characteristics have been subjectively evaluated by an SME pilot on an engineering simulator or development simulator that is acceptable to the FAA. Where this evaluation takes place on an engineering or development simulator, additional objective "proof-of-match" testing for all flight conditions as described in tests 2.c.8.a. and 3.f.5.will be required to verify the implementation of the stall model and stall buffets on the training FSTD.

5. Where qualification is being sought to conduct full stall training tasks in accordance with this Directive, the FSTD Sponsor must conduct the required evaluations and modifications as prescribed in this Directive and report compliance to the responsible Flight Standards office in accordance with § 60.23 using the standardized FSTD Sponsor Notification Form. At a minimum, this form must be accompanied with the following information:

a. A description of any modifications to the FSTD (in accordance with § 60.23) necessary to meet the requirements of this Directive.

b. Statements of Compliance (High Angle of Attack Modeling/Stick Pusher System)—See Table A1A, Section 2.m., 3.f., and Attachment 7

c. Statement of Compliance (SME Pilot Evaluation)—See Table A1A, Section 2.m. and Attachment 7

d. Copies of the required objective test results as described above in sections 3.c., 3.d., and 3.e.

6. The responsible Flight Standards office will review each submission to determine if the requirements of this Directive have been met and respond to the FSTD Sponsor as described in § 60.23(c). Additional responsible Flight Standards office conducted FSTD evaluations may be required before the modified FSTD is placed into service. This response, along with any noted restrictions, will serve as interim qualification for full stall training tasks until such time that a permanent change is made to the Statement of Qualification (SOQ) at the FSTD's next scheduled evaluation.

SECTION II—EVALUATION REQUIREMENTS FOR UPSET PREVENTION AND RECOVERY TRAINING TASKS

1. This section applies to previously qualified FSTDs being used to obtain training, testing, or checking credits for upset prevention and recovery training tasks (UPRT) as defined in Appendix A, Table A1A, Section 2.n. of this part. Additionally, FSTDs being used for unusual attitude training maneuvers that are intended to exceed the parameters of an aircraft upset must also be evaluated and qualified for UPRT under this section. These parameters include pitch attitudes greater than 25 degrees nose up; pitch attitudes greater than 10 degrees nose down, and bank angles greater than 45 degrees.

2. The requirements contained in this section are intended to define minimum standards for evaluating an FSTD for use in upset prevention and recovery training maneuvers that may exceed an aircraft's normal flight envelope. These standards include the evaluation of qualified training maneuvers against the FSTD's validation envelope and providing the instructor with minimum feedback tools for the purpose of determining if a training maneuver is conducted within FSTD validation limits and the aircraft's operating limits.

3. This Directive contains additional subjective testing that exceeds the evaluation requirements of previously qualified FSTDs. Where aerodynamic modeling data or validation data is not available or insufficient to meet the requirements of this Directive, the responsible Flight Standards office may limit additional qualification to certain upset prevention and recovery maneuvers where adequate data exists.

4. After March 12, 2019, any FSTD being used to obtain training, testing, or checking credit for upset prevention and recovery training tasks in an FAA approved flight training program must be evaluated and issued additional qualification in accordance with this Directive and the following sections of Appendix A of this part:

a. Table A1A, General Requirements, Section 2.n. (Upset Prevention and Recovery)
b. Table A3A, Functions and Subjective Testing, Test 5.b.3. (Upset Prevention and Recovery Maneuvers)
c. Attachment 7, Additional Simulator Qualification Requirements for Stall, Upset Prevention and Recovery, and Engine and Airframe Icing Training Tasks (Upset Prevention and Recovery Training Maneuver Evaluation)

5. Where qualification is being sought to conduct upset prevention and recovery training tasks in accordance with this Directive, the FSTD Sponsor must conduct the required evaluations and modifications as prescribed in this Directive and report compliance to the responsible Flight Standards office in accordance with §60.23 using the standardized FSTD Sponsor Notification Form. At a minimum, this form must be accompanied with the following information:

a. A description of any modifications to the FSTD (in accordance with §60.23) necessary to meet the requirements of this Directive.
b. Statement of Compliance (FSTD Validation Envelope)—See Table A1A, Section 2.n. and Attachment 7
c. A confirmation statement that the modified FSTD has been subjectively evaluated by a qualified pilot as described in §60.16(a)(1)(iii).

6. The responsible Flight Standards office will review each submission to determine if the requirements of this Directive have been met and respond to the FSTD Sponsor as described in §60.23(c). Additional responsible Flight Standards office conducted FSTD evaluations may be required before the modified FSTD is placed into service. This response, along with any noted restrictions, will serve as an interim qualification for upset prevention and recovery training tasks until such time that a permanent change is made to the Statement of Qualification (SOQ) at the FSTD's next scheduled evaluation.

SECTION III—EVALUATION REQUIREMENTS FOR ENGINE AND AIRFRAME ICING TRAINING TASKS

1. This section applies to previously qualified Level C and Level D FSTDs being used to obtain training, testing, or checking credits in maneuvers that demonstrate the effects of engine and airframe ice accretion.

2. The requirements in this section are intended to supersede and improve upon existing Level C and Level D FSTD evaluation requirements on the effects of engine and airframe icing. The requirements define a minimum level of fidelity required to adequately simulate the aircraft specific aerodynamic characteristics of an in-flight encounter with engine and airframe ice accretion as necessary to accomplish training objectives.

3. This Directive contains additional subjective testing that exceeds the evaluation requirements of previously qualified FSTDs. Where aerodynamic modeling data is not available or insufficient to meet the requirements of this Directive, the responsible Flight Standards office may limit qualified engine and airframe icing maneuvers where sufficient aerodynamic modeling data exists.

4. After March 12, 2019, any FSTD being used to conduct training tasks that demonstrate the effects of engine and airframe icing must be evaluated and issued additional qualification in accordance with this Directive and the following sections of Appendix A of this part:

a. Table A1A, General Requirements, Section 2.j. (Engine and Airframe Icing)

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b. Attachment 7, Additional Simulator Qualification Requirements for Stall, Upset Prevention and Recovery, and Engine and Airframe Icing Training Tasks (Engine and Airframe Icing Evaluation; Paragraphs 1, 2, and 3). Objective demonstration tests of engine and airframe icing effects (Attachment 2, Table A2A, test 2.i. of this Appendix) are not required for previously qualified FSTDs.

5. Where continued qualification is being sought to conduct engine and airframe icing training tasks in accordance with this Directive, the FSTD Sponsor must conduct the required evaluations and modifications as prescribed in this Directive and report compliance to the responsible Flight Standards office in accordance with §60.23 using the standardized FSTD Sponsor Notification Form. At a minimum, this form must be accompanied with the following information:

a. A description of any modifications to the FSTD (in accordance with §60.23) necessary to meet the requirements of this Directive;
b. Statement of Compliance (Ice Accretion Model)—See Table A1A, Section 2.j., and Attachment 7; and
c. A confirmation statement that the modified FSTD has been subjectively evaluated by a qualified pilot as described in §60.16(a)(1)(iii).

6. The responsible Flight Standards office will review each submission to determine if the requirements of this Directive have been met and respond to the FSTD Sponsor as described in §60.23(c). Additional responsible Flight Standards office conducted FSTD evaluations may be required before the modified FSTD is placed into service. This response, along with any noted restrictions, will serve as an interim update to the FSTD's Statement of Qualification (SOQ) until such time that a permanent change is made to the SOQ at the FSTD's next scheduled evaluation.

SECTION IV—EVALUATION REQUIREMENTS FOR TAKEOFF AND LANDING IN GUSTING CROSSWIND

1. This section applies to previously qualified FSTDs that will be used to obtain training, testing, or checking credits in takeoff and landing tasks in gusting crosswinds as part of an FAA approved training program. The requirements of this Directive are applicable only to those Level B and higher FSTDs that are qualified to conduct takeoff and landing training tasks.

2. The requirements in this section introduce new minimum simulator requirements for gusting crosswinds during takeoff and landing training tasks as well as additional subjective testing that exceeds the evaluation requirements of previously qualified FSTDs.

3. After March 12, 2019, any FSTD that is used to conduct gusting crosswind takeoff and landing training tasks must be evaluated and issued additional qualification in accordance with this Directive and the following sections of Appendix A of this part:

a. Table A1A, General Requirements, Section 2.d.3. (Ground Handling Characteristics);
b. Table A3A, Functions and Subjective Testing Requirements, test 3.a.3 (Takeoff, Crosswind—Maximum Demonstrated and Gusting Crosswind); and
c. Table A3A, Functions and Subjective Testing Requirements, test 8.d. (Approach and landing with crosswind—Maximum Demonstrated and Gusting Crosswind).

4. Where qualification is being sought to conduct gusting crosswind training tasks in accordance with this Directive, the FSTD Sponsor must conduct the required evaluations and modifications as prescribed in this Directive and report compliance to the responsible Flight Standards office in accordance with §60.23 using the standardized FSTD Sponsor Notification Form. At a minimum, this form must be accompanied with the following information:

a. A description of any modifications to the FSTD (in accordance with §60.23) necessary to meet the requirements of this Directive.
b. Statement of Compliance (Gusting Crosswind Profiles)—See Table A1A, Section 2.d.3.
c. A confirmation statement that the modified FSTD has been subjectively evaluated by a qualified pilot as described in §60.16(a)(1)(iii).

5. The responsible Flight Standards office will review each submission to determine if the requirements of this Directive have been met and respond to the FSTD Sponsor as described in §60.23(c). Additional responsible Flight Standards office conducted FSTD evaluations may be required before the modified FSTD is placed into service. This response, along with any noted restrictions, will serve as an interim qualification for gusting crosswind training tasks until such time that a permanent change is made to the Statement of Qualification (SOQ) at the FSTD's next scheduled evaluation.

SECTION V—EVALUATION REQUIREMENTS FOR BOUNCED LANDING RECOVERY TRAINING TASKS

1. This section applies to previously qualified FSTDs that will be used to obtain training, testing, or checking credits in bounced landing recovery as part of an FAA approved training program. The requirements of this Directive are applicable only to those Level B and higher FSTDs that are qualified to conduct takeoff and landing training tasks.

2. The evaluation requirements in this section are intended to introduce new evaluation requirements for bounced landing recovery training tasks and contains additional

subjective testing that exceeds the evaluation requirements of previously qualified FSTDs.

3. After March 12, 2019, any FSTD that is used to conduct bounced landing training tasks must be evaluated and issued additional qualification in accordance with this Directive and the following sections of Appendix A of this Part:

a. Table A1A, General Requirements, Section 2.d.2. (Ground Reaction Characteristics)

b. Table A3A, Functions and Subjective Testing Requirements, test 9.e. (Missed Approach—Bounced Landing)

4. Where qualification is being sought to conduct bounced landing training tasks in accordance with this Directive, the FSTD Sponsor must conduct the required evaluations and modifications as prescribed in this Directive and report compliance to the responsible Flight Standards office in accordance with §60.23 using the standardized FSTD Sponsor Notification Form. At a minimum, this form must be accompanied with the following information:

a. A description of any modifications to the FSTD (in accordance with §60.23) necessary to meet the requirements of this Directive; and

b. A confirmation statement that the modified FSTD has been subjectively evaluated by a qualified pilot as described in §60.16(a)(1)(iii).

5. The responsible Flight Standards office will review each submission to determine if the requirements of this Directive have been met and respond to the FSTD Sponsor as described in §60.23(c). Additional responsible Flight Standards office conducted FSTD evaluations may be required before the modified FSTD is placed into service. This response, along with any noted restrictions, will serve as an interim qualification for bounced landing recovery training tasks until such time that a permanent change is made to the Statement of Qualification (SOQ) at the FSTD's next scheduled evaluation.

Attachment 7 to Appendix A to Part 60—Additional Simulator Qualification Requirements for Stall, Upset Prevention and Recovery, and Engine and Airframe Icing Training Tasks

Begin QPS Requirements

A. High Angle of Attack Model Evaluation (Table A1A, Section 2.m.)

1. Applicability: This attachment applies to all simulators that are used to satisfy training requirements for stall maneuvers that are conducted at angles of attack beyond the activation of the stall warning system. This attachment is not applicable for those FSTDs that are only qualified for approach to stall maneuvers where recovery is initiated at the first indication of the stall. The material in this section is intended to supplement the general requirements, objective testing requirements, and subjective testing requirements contained within Tables A1A, A2A, and A3A, respectively.

2. General Requirements: The requirements for high angle of attack modeling are intended to evaluate the recognition cues and performance and handling qualities of a developing stall through the stall identification angle-of-attack and recovery. Strict time-history-based evaluations against flight test data may not adequately validate the aerodynamic model in an unsteady and potentially unstable flight regime, such as stalled flight. As a result, the objective testing requirements defined in Table A2A do not prescribe strict tolerances on any parameter at angles of attack beyond the stall identification angle of attack. In lieu of mandating such objective tolerances, a Statement of Compliance (SOC) will be required to define the source data and methods used to develop the stall aerodynamic model.

3. Fidelity Requirements: The requirements defined for the evaluation of full stall training maneuvers are intended to provide the following levels of fidelity:

a. Airplane type specific recognition cues of the first indication of the stall (such as the stall warning system or aerodynamic stall buffet);

b. Airplane type specific recognition cues of an impending aerodynamic stall; and

c. Recognition cues and handling qualities from the stall break through recovery that are sufficiently exemplar of the airplane being simulated to allow successful completion of the stall recovery training tasks.

For the purposes of stall maneuver evaluation, the term ''exemplar'' is defined as a level of fidelity that is type specific of the simulated airplane to the extent that the training objectives can be satisfactorily accomplished.

4. Statement of Compliance (Aerodynamic Model): At a minimum, the following must be addressed in the SOC:

a. Source Data and Modeling Methods: The SOC must identify the sources of data used to develop the aerodynamic model. These data sources may be from the airplane original equipment manufacturer (OEM), the original FSTD manufacturer/data provider, or other data provider acceptable to the FAA. Of particular interest is a mapping of test points in the form of alpha/beta envelope plot for a minimum of flaps up and flaps down aircraft configurations. For the flight test data, a list of the types of maneuvers used to define the aerodynamic model for angle of attack ranges greater than the first indication of stall must be provided per flap setting. In cases where it is impractical to develop and validate a stall model with flight-test data (*e.g.*, due to safety concerns involving the collection of flight test data past a certain angle of attack), the data provider is expected to make a reasonable attempt to develop a stall model through the required angle of attack range using analytical methods and empirical data (*e.g.*, wind-tunnel data);

b. Validity Range: The FSTD sponsor must declare the range of angle of attack and sideslip where the aerodynamic model remains valid for training. For stall recovery training tasks, satisfactory aerodynamic model fidelity must be shown through at least 10 degrees beyond the stall identification angle of attack. For the purposes of determining this validity range, the stall identification angle of attack is defined as the angle of attack where the pilot is given a clear and distinctive indication to cease any further increase in angle of attack where one or more of the following characteristics occur:

i. No further increase in pitch occurs when the pitch control is held at the full aft stop for 2 seconds, leading to an inability to arrest descent rate;

ii. An uncommanded nose down pitch that cannot be readily arrested, which may be accompanied by an uncommanded rolling motion;

iii. Buffeting of a magnitude and severity that is a strong and effective deterrent to further increase in angle of attack; and

iv. Activation of a stick pusher.

The model validity range must also be capable of simulating the airplane dynamics as a result of a pilot initially resisting the stick pusher in training. For aircraft equipped with a stall envelope protection system, the model validity range must extend to 10 degrees of angle of attack beyond the stall identification angle of attack with the protection systems disabled or otherwise degraded (such as a degraded flight control mode as a result of a pitot/static system failure).

c. Model Characteristics: Within the declared range of model validity, the SOC must address, and the aerodynamic model must incorporate, the following stall characteristics where applicable by aircraft type:

i. Degradation in static/dynamic lateral-directional stability;

ii. Degradation in control response (pitch, roll, yaw);

iii. Uncommanded roll acceleration or roll-off requiring significant control deflection to counter;

iv. Apparent randomness or non-repeatability;

v. Changes in pitch stability;

vi. Stall hysteresis;

vii. Mach effects;

viii. Stall buffet; and

ix. Angle of attack rate effects.

An overview of the methodology used to address these features must be provided.

5. Statement of Compliance (Subject Matter Expert Pilot Evaluation): The sponsor must provide an SOC that confirms the FSTD has been subjectively evaluated by a subject matter expert (SME) pilot who is knowledgeable of the aircraft's stall characteristics. In order to qualify as an acceptable SME to evaluate the FSTD's stall characteristics, the SME must meet the following requirements:

a. Has held a type rating/qualification in the aircraft being simulated;

b. Has direct experience in conducting stall maneuvers in an aircraft that shares the same type rating as the make, model, and series of the simulated aircraft. This stall experience must include hands on manipulation of the controls at angles of attack sufficient to identify the stall (*e.g.*, deterrent buffet, stick pusher activation, etc.) through recovery to stable flight;

c. Where the SME's stall experience is on an airplane of a different make, model, and series within the same type rating, differences in aircraft specific stall recognition cues and handling characteristics must be addressed using available documentation. This documentation may include aircraft operating manuals, aircraft manufacturer flight test reports, or other documentation that describes the stall characteristics of the aircraft; and

d. Must be familiar with the intended stall training maneuvers to be conducted in the FSTD (*e.g.*, general aircraft configurations, stall entry methods, etc.) and the cues necessary to accomplish the required training objectives. The purpose of this requirement is to ensure that the stall model has been sufficiently evaluated in those general aircraft configurations and stall entry methods that will likely be conducted in training.

This SOC will only be required once at the time the FSTD is initially qualified for stall training tasks as long as the FSTD's stall model remains unmodified from what was originally evaluated and qualified. Where an FSTD shares common aerodynamic and flight control models with that of an engineering simulator or development simulator that is acceptable to the FAA, the FAA will accept an SOC from the data provider that confirms the stall characteristics have been subjectively assessed by an SME pilot on the engineering or development simulator.

An FSTD sponsor may submit a request to the Administrator for approval of a deviation from the SME pilot experience requirements in this paragraph. This request for deviation must include the following information:

a. An assessment of pilot availability that demonstrates that a suitably qualified pilot meeting the experience requirements of this section cannot be practically located; and
b. Alternative methods to subjectively evaluate the FSTD's capability to provide the stall recognition cues and handling characteristics needed to accomplish the training objectives.

B. Upset Prevention and Recovery Training (UPRT) Maneuver Evaluation (Table A1A, Section 2.n.)

1. Applicability: This attachment applies to all simulators that are used to satisfy training requirements for upset prevention and recovery training (UPRT) maneuvers. For the purposes of this attachment (as defined in the Airplane Upset Recovery Training Aid), an aircraft upset is generally defined as an airplane unintentionally exceeding the following parameters normally experienced in line operations or training:
a. Pitch attitude greater than 25 degrees nose up;
b. Pitch attitude greater than 10 degrees nose down;
c. Bank angles greater than 45 degrees; and
d. Within the above parameters, but flying at airspeeds inappropriate for the conditions.

FSTDs that will be used to conduct training maneuvers where the FSTD is either repositioned into an aircraft upset condition or an artificial stimulus (such as weather phenomena or system failures) is applied that is intended to result in a flightcrew entering an aircraft upset condition must be evaluated and qualified in accordance with this section.

2. General Requirements: The general requirement for UPRT qualification in Table A1A defines three basic elements required for qualifying an FSTD for UPRT maneuvers:
a. FSTD Training Envelope: Valid UPRT should be conducted within the high and moderate confidence regions of the FSTD validation envelope as defined in paragraph 3 below.
b. Instructor Feedback: Provides the instructor/evaluator with a minimum set of feedback tools to properly evaluate the trainee's performance in accomplishing an upset recovery training task.
c. Upset Scenarios: Where dynamic upset scenarios or aircraft system malfunctions are used to stimulate the FSTD into an aircraft upset condition, specific guidance must be available to the instructor on the IOS that describes how the upset scenario is driven along with any malfunction or degradation in FSTD functionality that is required to stimulate the upset.

3. FSTD Validation Envelope: For the purposes of this attachment, the term "flight envelope" refers to the entire domain in which the FSTD is capable of being flown with a degree of confidence that the FSTD responds similarly to the airplane. This envelope can be further divided into three subdivisions (see Appendix 3–D of the *Airplane Upset Recovery Training Aid*):
a. Flight test validated region: This is the region of the flight envelope which has been validated with flight test data, typically by comparing the performance of the FSTD against the flight test data through tests incorporated in the QTG and other flight test data utilized to further extend the model beyond the minimum requirements. Within this region, there is high confidence that the simulator responds similarly to the aircraft. Note that this region is not strictly limited to what has been tested in the QTG; as long as the aerodynamics mathematical model has been conformed to the flight test results, that portion of the mathematical model can be considered to be within the flight test validated region.
b. Wind tunnel and/or analytical region: This is the region of the flight envelope for which the FSTD has not been compared to flight test data, but for which there has been wind tunnel testing or the use of other reliable predictive methods (typically by the aircraft manufacturer) to define the aerodynamic model. Any extensions to the aerodynamic model that have been evaluated in accordance with the definition of an exemplar stall model (as described in the stall maneuver evaluation section) must be clearly indicated. Within this region, there is moderate confidence that the simulator will respond similarly to the aircraft.
c. Extrapolated: This is the region extrapolated beyond the flight test validated and wind tunnel/analytical regions. The extrapolation may be a linear extrapolation, a holding of the last value before the extrapolation began, or some other set of values. Whether this extrapolated data is provided by the aircraft or simulator manufacturer, it is a "best guess" only. Within this region, there is low confidence that the simulator will respond similarly to the aircraft. Brief excursions into this region may still retain a moderate confidence level in FSTD fidelity; however, the instructor should be aware that the FSTD's response may deviate from the actual aircraft.

4. Instructor Feedback Mechanism: For the instructor/evaluator to provide feedback to the student during UPRT maneuver training, additional information must be accessible that indicates the fidelity of the simulation, the magnitude of trainee's flight control inputs, and aircraft operational limits that could potentially affect the successful completion of the maneuver(s). At a minimum,

the following must be available to the instructor/evaluator:

a. FSTD Validation Envelope: The FSTD must employ a method to display the FSTD's expected fidelity with respect to the FSTD validation envelope. This may be displayed as an angle of attack vs sideslip (alpha/beta) envelope cross-plot on the Instructor Operating System (IOS) or other alternate method to clearly convey the FSTD's fidelity level during the maneuver. The cross-plot or other alternative method must display the relevant validity regions for flaps up and flaps down at a minimum. This validation envelope must be derived by the aerodynamic data provider or derived using information and data sources provided by the original aerodynamic data provider.

b. Flight Control Inputs: The FSTD must employ a method for the instructor/evaluator to assess the trainee's flight control inputs during the upset recovery maneuver. Additional parameters, such as cockpit control forces (forces applied by the pilot to the controls) and the flight control law mode for fly-by-wire aircraft, must be portrayed in this feedback mechanism as well. For passive sidesticks, whose displacement is the flight control input, the force applied by the pilot to the controls does not need to be displayed. This tool must include a time history or other equivalent method of recording flight control positions.

c. Aircraft Operational Limits: The FSTD must employ a method to provide the instructor/evaluator with real-time information concerning the aircraft operating limits. The simulated aircraft's parameters must be displayed dynamically in real-time and also provided in a time history or equivalent format. At a minimum, the following parameters must be available to the instructor:

i. Airspeed and airspeed limits, including the stall speed and maximum operating limit airspeed (Vmo/Mmo);

ii. Load factor and operational load factor limits; and

iii. Angle of attack and the stall identification angle of attack. See section A, paragraph 4.b. of this attachment for additional information concerning the definition of the stall identification angle of attack. This parameter may be displayed in conjunction with the FSTD validation envelope.

END QPS REQUIREMENTS

BEGIN INFORMATION

An example FSTD ''alpha/beta'' envelope display and IOS feedback mechanism are shown below in Figure 1 and Figure 2. The following examples are provided as guidance material on one possible method to display the required UPRT feedback parameters on an IOS display. FSTD sponsors may develop other methods and feedback mechanisms that provide the required parameters and support the training program objectives.

Figure 1 – Example FSTD Alpha/Beta Envelope Plot

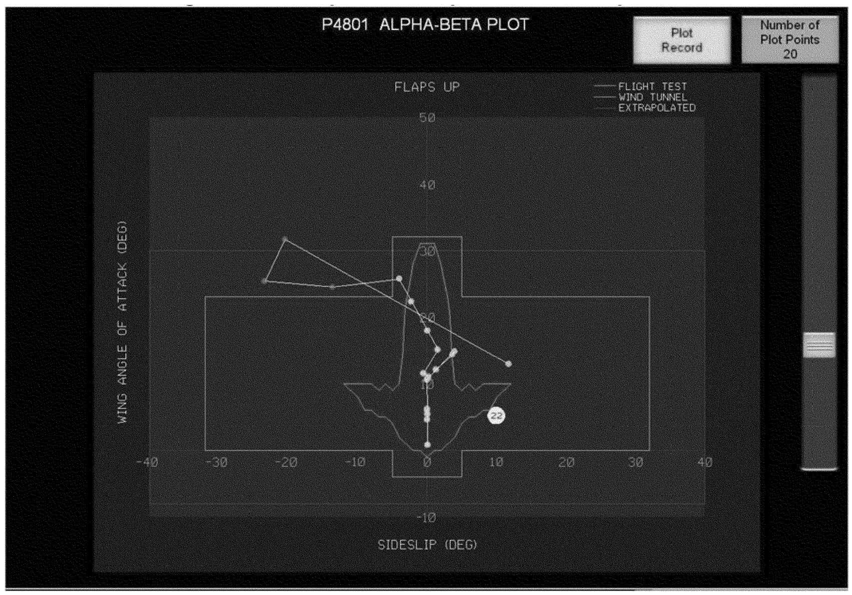
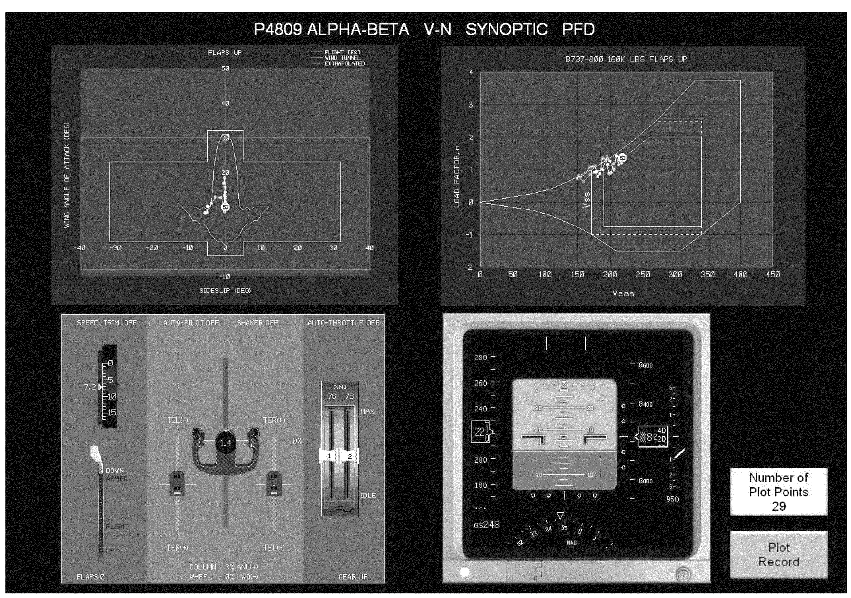


Figure 2 – Example IOS Instructor UPRT Feedback Display



END INFORMATION

BEGIN QPS REQUIREMENTS

C. Engine and Airframe Icing Evaluation (Table A1A, Section 2.j.)

1. Applicability: This section applies to all FSTDs that are used to satisfy training requirements for engine and airframe icing. New general requirements and objective requirements for simulator qualification have been developed to define aircraft specific icing models that support training objectives for the recognition and recovery from an inflight ice accretion event.

2. General Requirements: The qualification of engine and airframe icing consists of the following elements that must be considered when developing ice accretion models for use in training:

a. Ice accretion models must be developed to account for training the specific skills required for recognition of ice accumulation and execution of the required response.

b. Ice accretion models must be developed in a manner to contain aircraft specific recognition cues as determined with aircraft OEM supplied data or other suitable analytical methods.

c. At least one qualified ice accretion model must be objectively tested to demonstrate that the model has been implemented correctly and generates the correct cues as necessary for training.

3. Statement of Compliance: The SOC as described in Table A1A, Section 2.j. must contain the following information to support FSTD qualification of aircraft specific ice accretion models:

a. A description of expected aircraft specific recognition cues and degradation effects due to a typical in-flight icing encounter. Typical cues may include loss of lift, decrease in stall angle of attack, changes in pitching moment, decrease in control effectiveness, and changes in control forces in addition to any overall increase in drag. This description must be based upon relevant source data, such as aircraft OEM supplied data, accident/incident data, or other acceptable data sources. Where a particular airframe has demonstrated vulnerabilities to a specific type of ice accretion (due to accident/incident history) which requires specific training (such as supercooled large-droplet icing or tailplane icing), ice accretion models must be developed that address the training requirements.

b. A description of the data sources utilized to develop the qualified ice accretion models. Acceptable data sources may be, but are not limited to, flight test data, aircraft certification data, aircraft OEM engineering simulation data, or other analytical methods based upon established engineering principles.

4. Objective Demonstration Testing: The purpose of the objective demonstration test is to demonstrate that the ice accretion models as described in the Statement of Compliance have been implemented correctly and demonstrate the proper cues and effects as defined in the approved data sources. At least one ice accretion model must be selected for testing and included in the Master Qualification Test Guide (MQTG). Two tests are required to demonstrate engine and airframe icing effects. One test will demonstrate the FSTDs baseline performance without icing, and the second test will demonstrate the aerodynamic effects of ice accretion relative to the baseline test.

a. *Recorded Parameters:* In each of the two required MQTG cases, a time history recording must be made of the following parameters:

i. Altitude;

ii. Airspeed;

iii. Normal Acceleration;

iv. Engine Power/settings;

v. Angle of Attack/Pitch attitude;

vi. Bank Angle;

vii. Flight control inputs;

viii. Stall warning and stall buffet onset; and

ix. Other parameters as necessary to demonstrate the effects of ice accretions.

b. *Demonstration maneuver:* The FSTD sponsor must select an ice accretion model as identified in the SOC for testing. The selected maneuver must demonstrate the effects of ice accretion at high angles of attack from a trimmed condition through approach to stall and ''full'' stall as compared to a baseline (no ice buildup) test. The ice accretion models must demonstrate the cues necessary to recognize the onset of ice accretion on the airframe, lifting surfaces, and engines and provide representative degradation in performance and handling qualities to the extent that a recovery can be executed. Typical recognition cues that may be present depending upon the simulated aircraft include:

i. Decrease in stall angle of attack;

ii. Increase in stall speed;

iii. Increase in stall buffet threshold of perception speed;

iv. Changes in pitching moment;

v. Changes in stall buffet characteristics;

vi. Changes in control effectiveness or control forces; and

vii. Engine effects (power variation, vibration, etc.);

The demonstration test may be conducted by initializing and maintaining a fixed amount of ice accretion throughout the maneuver in order to consistently evaluate the aerodynamic effects.

END QPS REQUIREMENTS

[Doc. No. FAA–2002–12461, 73 FR 26490, May 9, 2008, as amended by Docket FAA–2014–0391, Amdt. 60–4, 81 FR 18218, 18219, 18240, 18283, 18300, and 18303, Mar. 30, 2016; 81 FR 32016 and 32066, May 20, 2016; Docket FAA–2018–0119, Amdt. 60–5, 83 FR 9170, Mar. 5, 2018; Amdt. 60–6, 83 FR 30275, June 27, 2018; Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75711, Dec. 9, 2022]

APPENDIX B TO PART 60—QUALIFICATION PERFORMANCE STANDARDS FOR AIRPLANE FLIGHT TRAINING DEVICES

BEGIN INFORMATION

This appendix establishes the standards for Airplane FTD evaluation and qualification at Level 4, Level 5, Level 6, or Level 7. The Flight Standards Service, is responsible for the development, application, and implementation of the standards contained within this appendix. The procedures and criteria specified in this appendix will be used by the responsible Flight Standards office when conducting airplane FTD evaluations.

TABLE OF CONTENTS

END INFORMATION

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1. INTRODUCTION

BEGIN INFORMATION

a. This appendix contains background information as well as regulatory and informative material as described later in this section. To assist the reader in determining what areas are required and what areas are permissive, the text in this appendix is divided into two sections: ''QPS Requirements'' and ''Information.'' The QPS Requirements sections contain details regarding compliance with the part 60 rule language. These details are regulatory, but are found only in this appendix. The Information sections contain material that is advisory in nature, and designed to give the user general information about the regulation.

b. [Reserved]

c. The responsible Flight Standards office encourages the use of electronic media for all communication, including any record, report, request, test, or statement required by this appendix. The electronic media used must have adequate security provisions and be acceptable to the responsible Flight Standards office.

d. Related Reading References.

(1) 14 CFR part 60.
(2) 14 CFR part 61.
(3) 14 CFR part 63.
(4) 14 CFR part 119.
(5) 14 CFR part 121.
(6) 14 CFR part 125.
(7) 14 CFR part 135.
(8) 14 CFR part 141.
(9) 14 CFR part 142.

(10) AC 120–28, as amended, Criteria for Approval of Category III Landing Weather Minima.

(11) AC 120–29, as amended, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.

(12) AC 120–35, as amended, Flightcrew Member Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.

(13) AC 120–41, as amended, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.

(14) AC 120–45, as amended, Airplane Flight Training Device Qualification.

(14) AC 120–57, as amended, Surface Movement Guidance and Control System (SMGCS).

(15) AC 150/5300–13, as amended, Airport Design.

(16) AC 150/5340–1, as amended, Standards for Airport Markings.

(17) AC 150/5340–4, as amended, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.

(18) AC 150/5340–19, as amended, Taxiway Centerline Lighting System.

(19) AC 150/5340–24, as amended, Runway and Taxiway Edge Lighting System.

(20) AC 150/5345–28, as amended, Precision Approach Path Indicator (PAPI) Systems.

(21) International Air Transport Association document, ''Flight Simulation Training Device Design and Performance Data Requirements,'' as amended.

(22) AC 25–7, as amended, Flight Test Guide for Certification of Transport Category Airplanes.

(23) AC 23–8A, as amended, Flight Test Guide for Certification of Part 23 Airplanes.

(24) International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulation Training Devices, as amended.

(25) Aeroplane Flight Simulation Training Device Evaluation Handbook, Volume I, as amended and Volume II, as amended, The Royal Aeronautical Society, London, UK.

(26) FAA Airman Certification Standards and Practical Test Standards for Airline Transport Pilot, Type Ratings, Commercial Pilot, and Instrument Ratings.

(27) The FAA Aeronautical Information Manual (AIM). An electronic version of the AIM is on the Internet at *http://www.faa.gov/atpubs*.

(28) Aeronautical Radio, Inc. (ARINC) document number 436, titled *Guidelines For Electronic Qualification Test Guide* (as amended).

(29) Aeronautical Radio, Inc. (ARINC) document 610, Guidance for *Design and Integration of Aircraft Avionics Equipment in Simulators* (as amended).

END INFORMATION

2. APPLICABILITY (§§60.1 AND 60.2)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.1, Applicability, or to §60.2, Applicability of sponsor rules to person who are not sponsors and who are engaged in certain unauthorized activities.

3. DEFINITIONS (§60.3)

See appendix F of this part for a list of definitions and abbreviations from part 1, part 60, and the QPS appendices of part 60.

4. QUALIFICATION PERFORMANCE STANDARDS (§60.4)

No additional regulatory or informational material applies to §60.4, Qualification Performance Standards.

5. QUALITY MANAGEMENT SYSTEM (§60.5)

Additional regulatory material and informational material regarding Quality Management Systems for FTDs may be found in appendix E of this part.

END INFORMATION

6. SPONSOR QUALIFICATION REQUIREMENTS. (§60.7).

BEGIN INFORMATION

a. The intent of the language in §60.7(b) is to have a specific FTD, identified by the sponsor, used at least once in an FAA-approved flight training program for the airplane simulated during the 12-month period described. The identification of the specific FTD may change from one 12-month period to the next 12-month period as long as that sponsor sponsors and uses at least one FTD at least once during the prescribed period. There is no minimum number of hours or minimum FTD periods required.

b. The following examples describe acceptable operational practices:

(1) Example One.

(a) A sponsor is sponsoring a single, specific FTD for its own use, in its own facility or elsewhere— this single FTD forms the basis for the sponsorship. The sponsor uses that FTD at least once in each 12-month period in that sponsor's FAA-approved flight training program for the airplane simulated. This 12-month period is established according to the following schedule:

(i) If the FTD was qualified prior to May 30, 2008, the 12-month period begins on the date of the first continuing qualification evaluation conducted in accordance with

§60.19 after May 30, 2008, and continues for each subsequent 12-month period;

(ii) A device qualified on or after May 30, 2008, will be required to undergo an initial or upgrade evaluation in accordance with §60.15. Once the initial or upgrade evaluation is complete, the first continuing qualification evaluation will be conducted within 6 months. The 12 month continuing qualification evaluation cycle begins on that date and continues for each subsequent 12-month period.

(b) There is no minimum number of hours of FTD use required.

(c) The identification of the specific FTD may change from one 12-month period to the next 12-month period as long as that sponsor sponsors and uses at least one FTD at least once during the prescribed period.

(2) Example Two.

(a) A sponsor sponsors an additional number of FTDs, in its facility or elsewhere. Each additionally sponsored FTD must be—

(i) Used by the sponsor in the sponsor's FAA-approved flight training program for the airplane simulated (as described in §60.7(d)(1)); or

(ii) Used by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the airplane simulated (as described in §60.7(d)(1)). This 12-month period is established in the same manner as in example one; or

(iii) Provided a statement each year from a qualified pilot, (after having flown the airplane, not the subject FTD or another FTD, during the preceding 12-month period) stating that the subject FTD's performance and handling qualities represent the airplane (as described in §60.7(d)(2)). This statement is provided at least once in each 12-month period established in the same manner as in example one.

(b) There is no minimum number of hours of FTD use required.

(3) Example Three.

(a) A sponsor in New York (in this example, a Part 142 certificate holder) establishes ''satellite'' training centers in Chicago and Moscow.

(b) The satellite function means that the Chicago and Moscow centers must operate under the New York center's certificate (in accordance with all of the New York center's practices, procedures, and policies; e.g., instructor and/or technician training/checking requirements, record keeping, QMS program).

(c) All of the FTDs in the Chicago and Moscow centers could be dry-leased (i.e., the certificate holder does not have and use FAA-approved flight training programs for the FTDs in the Chicago and Moscow centers) because—

(i) Each FTD in the Chicago center and each FTD in the Moscow center is used at least once each 12-month period by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the airplane (as described in §60.7(d)(1)); or

(ii) A statement is obtained from a qualified pilot (having flown the airplane, not the subject FTD or another FTD during the preceding 12-month period) stating that the performance and handling qualities of each FTD in the Chicago and Moscow centers represents the airplane (as described in §60.7(d)(2)).

END INFORMATION

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7. ADDITIONAL RESPONSIBILITIES OF THE SPONSOR (§60.9)

BEGIN INFORMATION

The phrase ''as soon as practicable'' in §60.9(a) means without unnecessarily disrupting or delaying beyond a reasonable time the training, evaluation, or experience being conducted in the FTD.

8. FTD USE (§60.11)

No additional regulatory or informational material applies to §60.11, FTD use.

END INFORMATION

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9. FTD Objective Data Requirements (§60.13)

BEGIN QPS REQUIREMENTS

a. Flight test data used to validate FTD performance and handling qualities must have been gathered in accordance with a flight test program containing the following:

(1) A flight test plan consisting of:

(a) The maneuvers and procedures required for aircraft certification and simulation programming and validation.

(b) For each maneuver or procedure—

(i) The procedures and control input the flight test pilot and/or engineer used.

(ii) The atmospheric and environmental conditions.

(iii) The initial flight conditions.

(iv) The airplane configuration, including weight and center of gravity.

(v) The data to be gathered.

(vi) All other information necessary to recreate the flight test conditions in the FTD.

(2) Appropriately qualified flight test personnel.

(3) An understanding of the accuracy of the data to be gathered using appropriate alternative data sources, procedures, and instrumentation that is traceable to a recognized

standard as described in Attachment 2, Table B2F of this appendix.

(4) Appropriate and sufficient data acquisition equipment or system(s), including appropriate data reduction and analysis methods and techniques, acceptable to the FAA's Aircraft Certification Service.

b. The data, regardless of source, must be presented:

(1) In a format that supports the FTD validation process;

(2) In a manner that is clearly readable and annotated correctly and completely;

(3) With resolution sufficient to determine compliance with the tolerances set forth in Attachment 2, Table B2A, Appendix B;

(4) With any necessary guidance information provided; and

(5) Without alteration, adjustments, or bias. Data may be corrected to address known data calibration errors provided that an explanation of the methods used to correct the errors appears in the QTG. The corrected data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation.

c. After completion of any additional flight test, a flight test report must be submitted in support of the validation data. The report must contain sufficient data and rationale to support qualification of the FTD at the level requested.

d. As required by §60.13(f), the sponsor must notify the responsible Flight Standards office when it becomes aware that an addition to or a revision of the flight related data or airplane systems related data is available if this data is used to program and operate a qualified FTD. The data referred to in this sub-section are those data that are used to validate the performance, handling qualities, or other characteristics of the aircraft, including data related to any relevant changes occurring after the type certification is issued. The sponsor must—

(1) Within 10 calendar days, notify the responsible Flight Standards office of the existence of this data; and

(2) Within 45 calendar days, notify the responsible Flight Standards office of—

(i) The schedule to incorporate this data into the FTD; or

(ii) The reason for not incorporating this data into the FTD.

e. In those cases where the objective test results authorize a "snapshot test" or a "series of snapshot test results" in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the "snapshot." The steady state condition must exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snap shot.

END QPS REQUIREMENTS

BEGIN INFORMATION

f. The FTD sponsor is encouraged to maintain a liaison with the manufacturer of the aircraft being simulated (or with the holder of the aircraft type certificate for the aircraft being simulated if the manufacturer is no longer in business), and if appropriate, with the person having supplied the aircraft data package for the FTD in order to facilitate the notification described in this paragraph.

g. It is the intent of the responsible Flight Standards office that for new aircraft entering service, at a point well in advance of preparation of the QTG, the sponsor should submit to the responsible Flight Standards office for approval, a descriptive document (see Appendix A, Table A2C, Sample Validation Data Roadmap for Airplanes) containing the plan for acquiring the validation data, including data sources. This document should clearly identify sources of data for all required tests, a description of the validity of these data for a specific engine type and thrust rating configuration, and the revision levels of all avionics affecting the performance or flying qualities of the aircraft. Additionally, this document should provide other information such as the rationale or explanation for cases where data or data parameters are missing, instances where engineering simulation data are used, or where flight test methods require further explanations. It should also provide a brief narrative describing the cause and effect of any deviation from data requirements. The aircraft manufacturer may provide this document.

h. There is no requirement for any flight test data supplier to submit a flight test plan or program prior to gathering flight test data. However, the responsible Flight Standards office notes that inexperienced data gatherers often provide data that is irrelevant, improperly marked, or lacking adequate justification for selection. Other problems include inadequate information regarding initial conditions or test maneuvers. The responsible Flight Standards office has been forced to refuse these data submissions as validation data for an FTD evaluation. It is for this reason that the responsible Flight Standards office recommends that any data supplier not previously experienced in this area review the data necessary for programming and for validating the performance of the FTD and discuss the flight test plan anticipated for acquiring such data with the responsible Flight Standards office well in advance of commencing the flight tests.

i. The responsible Flight Standards office will consider, on a case-by-case basis, whether to approve supplemental validation data derived from flight data recording systems such as a Quick Access Recorder or Flight Data Recorder.

END INFORMATION

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10. SPECIAL EQUIPMENT AND PERSONNEL REQUIREMENTS FOR QUALIFICATION OF THE FTD (§ 60.14).

BEGIN INFORMATION

a. In the event that the responsible Flight Standards office determines that special equipment or specifically qualified persons will be required to conduct an evaluation, the responsible Flight Standards office will make every attempt to notify the sponsor at least one (1) week, but in no case less than 72 hours, in advance of the evaluation. Examples of special equipment include flight control measurement devices, accelerometers, or oscilloscopes. Examples of specially qualified personnel include individuals specifically qualified to install or use any special equipment when its use is required.

b. Examples of a special evaluation include an evaluation conducted after: An FTD is moved; at the request of the TPAA; or as a result of comments received from users of the FTD that raise questions about the continued qualification or use of the FTD.

END INFORMATION

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11. INITIAL (AND UPGRADE) QUALIFICATION REQUIREMENTS (§ 60.15).

BEGIN QPS REQUIREMENT

a. In order to be qualified at a particular qualification level, the FTD must:

(1) Meet the general requirements listed in Attachment 1 of this appendix;

(2) Meet the objective testing requirements listed in Attachment 2 of this appendix (Level 4 FTDs do not require objective tests); and

(3) Satisfactorily accomplish the subjective tests listed in Attachment 3 of this appendix.

b. The request described in § 60.15(a) must include all of the following:

(1) A statement that the FTD meets all of the applicable provisions of this part and all applicable provisions of the QPS.

(2) Unless otherwise authorized through prior coordination with the responsible Flight Standards office, a confirmation that the sponsor will forward to the responsible Flight Standards office the statement described in § 60.15(b) in such time as to be received no later than 5 business days prior to the scheduled evaluation and may be forwarded to the responsible Flight Standards office via traditional or electronic means.

(3) Except for a Level 4 FTD, a QTG, acceptable to the responsible Flight Standards office, that includes all of the following:

(a) Objective data obtained from aircraft testing or another approved source.

(b) Correlating objective test results obtained from the performance of the FTD as prescribed in the appropriate QPS.

(c) The result of FTD subjective tests prescribed in the appropriate QPS.

(d) A description of the equipment necessary to perform the evaluation for initial qualification and the continuing qualification evaluations.

c. The QTG described in paragraph a(3) of this section, must provide the documented proof of compliance with the FTD objective tests in Attachment 2, Table B2A of this appendix.

d. The QTG is prepared and submitted by the sponsor, or the sponsor?s agent on behalf of the sponsor, to the responsible Flight Standards office for review and approval, and must include, for each objective test:

(1) Parameters, tolerances, and flight conditions;

(2) Pertinent and complete instructions for conducting automatic and manual tests;

(3) A means of comparing the FTD test results to the objective data;

(4) Any other information as necessary to assist in the evaluation of the test results;

(5) Other information appropriate to the qualification level of the FTD.

e. The QTG described in paragraphs (a)(3) and (b) of this section, must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see Attachment 4, Figure B4C, of this appendix, for a sample QTG cover page).

(2) [Reserved]

(3) An FTD information page that provides the information listed in this paragraph, if applicable (see Attachment 4, Figure B4B, of this appendix, for a sample FTD information page). For convertible FTDs, the sponsor must submit a separate page for each configuration of the FTD.

(a) The sponsor's FTD identification number or code.

(b) The airplane model and series being simulated.

(c) The aerodynamic data revision number or reference.

(d) The source of the basic aerodynamic model and the aerodynamic coefficient data used to modify the basic model.

(e) The engine model(s) and its data revision number or reference.

(f) The flight control data revision number or reference.

(g) The flight management system identification and revision level.

(h) The FTD model and manufacturer.

(i) The date of FTD manufacture.

(j) The FTD computer identification.

(k) The visual system model and manufacturer, including display type.

(l) The motion system type and manufacturer, including degrees of freedom.

(4) A Table of Contents.

(5) A log of revisions and a list of effective pages.

(6) List of all relevant data references.

(7) A glossary of terms and symbols used (including sign conventions and units).

(8) Statements of compliance and capability (SOCs) with certain requirements.

(9) Recording procedures or equipment required to accomplish the objective tests.

(10) The following information for each objective test designated in Attachment 2 of this appendix, as applicable to the qualification level sought:

(a) Name of the test.

(b) Objective of the test.

(c) Initial conditions.

(d) Manual test procedures.

(e) Automatic test procedures (if applicable).

(f) Method for evaluating FTD objective test results.

(g) List of all relevant parameters driven or constrained during the automatic test(s).

(h) List of all relevant parameters driven or constrained during the manual test(s).

(i) Tolerances for relevant parameters.

(j) Source of Validation Data (document and page number).

(k) Copy of the Validation Data (if located in a separate binder, a cross reference for the identification and page number for pertinent data location must be provided).

(l) FTD Objective Test Results as obtained by the sponsor. Each test result must reflect the date completed and must be clearly labeled as a product of the device being tested.

f. A convertible FTD is addressed as a separate FTD for each model and series airplane to which it will be converted and for the FAA qualification level sought. The responsible Flight Standards office will conduct an evaluation for each configuration. If a sponsor seeks qualification for two or more models of an airplane type using a convertible FTD, the sponsor must provide a QTG for each airplane model, or a QTG for the first airplane model and a supplement to that QTG for each additional airplane model. The responsible Flight Standards office will conduct evaluations for each airplane model.

g. The form and manner of presentation of objective test results in the QTG must include the following:

(1) The sponsor's FTD test results must be recorded in a manner acceptable to the responsible Flight Standards office, that allows easy comparison of the FTD test results to the validation data (e.g., use of a multichannel recorder, line printer, cross plotting, overlays, transparencies).

(2) FTD results must be labeled using terminology common to airplane parameters as opposed to computer software identifications.

(3) Validation data documents included in a QTG may be photographically reduced only if such reduction will not alter the graphic scaling or cause difficulties in scale interpretation or resolution.

(4) Scaling on graphical presentations must provide the resolution necessary to evaluate the parameters shown in Attachment 2, Table B2A of this appendix.

(5) Tests involving time histories, data sheets (or transparencies thereof) and FTD test results must be clearly marked with appropriate reference points to ensure an accurate comparison between FTD and airplane with respect to time. Time histories recorded via a line printer are to be clearly identified for cross-plotting on the airplane data. Overplots may not obscure the reference data.

h. The sponsor may elect to complete the QTG objective and subjective tests at the manufacturer's facility or at the sponsor's training facility (or other sponsor designated location where training will take place). If the tests are conducted at the manufacturer's facility, the sponsor must repeat at least one-third of the tests at the sponsor's training facility in order to substantiate FTD performance. The QTG must be clearly annotated to indicate when and where each test was accomplished. Tests conducted at the manufacturer's facility and at the sponsor's designated training facility must be conducted after the FTD is assembled with systems and sub-systems functional and operating in an interactive manner. The test results must be submitted to the responsible Flight Standards office.

i. The sponsor must maintain a copy of the MQTG at the FTD location.

j. All FTDs for which the initial qualification is conducted after May 30, 2014, must have an electronic MQTG (Emqtg) including all objective data obtained from airplane testing, or another approved source (reformatted or digitized), together with correlating objective test results obtained from the performance of the FTD (reformatted or digitized) as prescribed in this appendix. The Emqtg must also contain the general FTD performance or demonstration results (reformatted or digitized) prescribed in this appendix, and a description of the equipment necessary to perform the initial qualification evaluation and the continuing qualification evaluations. The Emqtg must include the original validation data used to validate FTD performance and handling qualities in either the original digitized format from the data supplier or an electronic scan of the original time-history plots that were provided by the data supplier. A copy of the Emqtg must be provided to the responsible Flight Standards office.

k. All other FTDs (not covered in subparagraph "j") must have an electronic copy of the MQTG by and after May 30, 2014. An electronic copy of the copy of the MQTG must be provided to the responsible Flight Standards office. This may be provided by an electronic scan presented in a Portable Document File (PDF), or similar format acceptable to the responsible Flight Standards office.

l. During the initial (or upgrade) qualification evaluation conducted by the responsible Flight Standards office, the sponsor must also provide a person knowledgeable about the operation of the aircraft and the operation of the FTD.

END QPS REQUIREMENTS

BEGIN INFORMATION

m. Only those FTDs that are sponsored by a certificate holder as defined in Appendix F will be evaluated by the responsible Flight Standards office. However, other FTD evaluations may be conducted on a case-by-case basis as the Administrator deems appropriate, but only in accordance with applicable agreements.

n. The responsible Flight Standards office will conduct an evaluation for each configuration, and each FTD must be evaluated as completely as possible. To ensure a thorough and uniform evaluation, each FTD is subjected to the general FTD requirements in Attachment 1 of this appendix, the objective tests listed in Attachment 2 of this appendix, and the subjective tests listed in Attachment 3 of this appendix. The evaluations described herein will include, but not necessarily be limited to the following:

(1) Airplane responses, including longitudinal and lateral-directional control responses (see Attachment 2 of this appendix);

(2) Performance in authorized portions of the simulated airplane's operating envelope, to include tasks evaluated by the responsible Flight Standards office in the areas of surface operations, takeoff, climb, cruise, descent, approach and landing, as well as abnormal and emergency operations (see Attachment 2 of this appendix);

(3) Control checks (see Attachment 1 and Attachment 2 of this appendix);

(4) Flight deck configuration (see Attachment 1 of this appendix);

(5) Pilot, flight engineer, and instructor station functions checks (see Attachment 1 and Attachment 3 of this appendix);

(6) Airplane systems and sub-systems (as appropriate) as compared to the airplane simulated (see Attachment 1 and Attachment 3 of this appendix);

(7) FTD systems and sub-systems, including force cueing (motion), visual, and aural (sound) systems, as appropriate (see Attachment 1 and Attachment 2 of this appendix); and

(8) Certain additional requirements, depending upon the qualification level sought, including equipment or circumstances that may become hazardous to the occupants. The sponsor may be subject to Occupational Safety and Health Administration requirements.

o. The responsible Flight Standards office administers the objective and subjective tests, which includes an examination of functions. The tests include a qualitative assessment of the FTD by a pilot from the responsible Flight Standards office. The evaluation team leader may assign other qualified personnel to assist in accomplishing the functions examination and/or the objective and subjective tests performed during an evaluation when required.

(1) Objective tests provide a basis for measuring and evaluating FTD performance and determining compliance with the requirements of this part.

(2) Subjective tests provide a basis for:

(a) Evaluating the capability of the FTD to perform over a typical utilization period;

(b) Determining that the FTD satisfactorily simulates each required task;

(c) Verifying correct operation of the FTD controls, instruments, and systems; and

(d) Demonstrating compliance with the requirements of this part.

p. The tolerances for the test parameters listed in Attachment 2 of this appendix reflect the range of tolerances acceptable to the responsible Flight Standards office for FTD validation and are not to be confused with design tolerances specified for FTD manufacture. In making decisions regarding tests and test results, the responsible Flight Standards office relies on the use of operational and engineering judgment in the application of data (including consideration of the way in which the flight test was flown and way the data was gathered and applied), data presentations, and the applicable tolerances for each test.

q. In addition to the scheduled continuing qualification evaluation, each FTD is subject to evaluations conducted by the responsible Flight Standards office at any time without prior notification to the sponsor. Such evaluations would be accomplished in a normal manner (i.e., requiring exclusive use of the FTD for the conduct of objective and subjective tests and an examination of functions) if the FTD is not being used for flight crewmember training, testing, or checking. However, if the FTD were being used, the evaluation would be conducted in a non-exclusive manner. This non-exclusive evaluation will be conducted by the FTD evaluator accompanying the check airman, instructor, Aircrew Program Designee (APD), or FAA inspector aboard the FTD along with the student(s) and observing the operation of the FTD during the training, testing, or checking activities.

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r. Problems with objective test results are handled as follows:

(1) If a problem with an objective test result is detected by the evaluation team during an evaluation, the test may be repeated or the QTG may be amended.

(2) If it is determined that the results of an objective test do not support the qualification level requested but do support a lower level, the responsible Flight Standards office may qualify the FTD at a lower level. For example, if a Level 6 evaluation is requested, but the FTD fails to meet the spiral stability test tolerances, it could be qualified at Level 5.

s. After an FTD is successfully evaluated, the responsible Flight Standards office issues an SOQ to the sponsor, the responsible Flight Standards office recommends the FTD to the TPAA, who will approve the FTD for use in a flight training program. The SOQ will be issued at the satisfactory conclusion of the initial or continuing qualification evaluation and will list the tasks for which the FTD is qualified, referencing the tasks described in Table B1B in Attachment 1 of this appendix. However, it is the sponsor's responsibility to obtain TPAA approval prior to using the FTD in an FAA-approved flight training program.

t. Under normal circumstances, the responsible Flight Standards office establishes a date for the initial or upgrade evaluation within ten (10) working days after determining that a complete QTG is acceptable. Unusual circumstances may warrant establishing an evaluation date before this determination is made. A sponsor may schedule an evaluation date as early as 6 months in advance. However, there may be a delay of 45 days or more in rescheduling and completing the evaluation if the sponsor is unable to meet the scheduled date. See Attachment 4, Figure B4A, Sample Request for Initial, Upgrade, or Reinstatement Evaluation, of this appendix.

u. The numbering system used for objective test results in the QTG should closely follow the numbering system set out in Attachment 2, FTD Objective Tests, Table B2A, of this appendix.

v. Contact the responsible Flight Standards office for additional information regarding the preferred qualifications of pilots used to meet the requirements of § 60.15(d).

w. Examples of the exclusions for which the FTD might not have been subjectively tested by the sponsor or the responsible Flight Standards office and for which qualification might not be sought or granted, as described in § 60.15(g)(6), include engine out maneuvers or circling approaches.

12. ADDITIONAL QUALIFICATIONS FOR CURRENTLY QUALIFIED FTDS (§ 60.16).

No additional regulatory or informational material applies to § 60.16, Additional Qualifications for a Currently Qualified FTD.

END INFORMATION

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13. PREVIOUSLY QUALIFIED FTDS (§ 60.17).

BEGIN QPS REQUIREMENTS

a. In instances where a sponsor plans to remove an FTD from active status for a period of less than two years, the following procedures apply:

(1) The responsible Flight Standards office must be notified in writing and the notification must include an estimate of the period that the FTD will be inactive;

(2) Continuing Qualification evaluations will not be scheduled during the inactive period;

(3) The responsible Flight Standards office will remove the FTD from the list of qualified FTDs on a mutually established date not later than the date on which the first missed continuing qualification evaluation would have been scheduled;

(4) Before the FTD is restored to qualified status, it must be evaluated by the responsible Flight Standards office. The evaluation content and the time required to accomplish the evaluation is based on the number of continuing qualification evaluations and sponsor-conducted quarterly inspections missed during the period of inactivity.

(5) The sponsor must notify the responsible Flight Standards office of any changes to the original scheduled time out of service;

b. FTDs qualified prior to May 31, 2016, and replacement FTD systems, are not required to meet the general FTD requirements, the objective test requirements, and the subjective test requirements of Attachments 1, 2, and 3 of this appendix as long as the FTD continues to meet the test requirements contained in the MQTG developed under the original qualification basis.

c. [Reserved]

d. FTDs qualified prior to May 31, 2016, may be updated. If an evaluation is deemed appropriate or necessary by the responsible Flight Standards office after such an update, the evaluation will not require an evaluation to standards beyond those against which the FTD was originally qualified.

e. Other certificate holders or persons desiring to use an FTD may contract with FTD sponsors to use FTDs previously qualified at a particular level for an airplane type and approved for use within an FAA-approved flight training program. Such FTDs are not required to undergo an additional qualification process, except as described in § 60.16.

f. Each FTD user must obtain approval from the appropriate TPAA to use any FTD in an FAA-approved flight training program.

g. The intent of the requirement listed in §60.17(b), for each FTD to have an SOQ within 6 years, is to have the availability of that statement (including the configuration list and the limitations to authorizations) to provide a complete picture of the FTD inventory regulated by the FAA. The issuance of the statement will not require any additional evaluation or require any adjustment to the evaluation basis for the FTD.

h. Downgrading of an FTD is a permanent change in qualification level and will necessitate the issuance of a revised SOQ to reflect the revised qualification level, as appropriate. If a temporary restriction is placed on an FTD because of a missing, malfunctioning, or inoperative component or ongoing repairs, the restriction is not a permanent change in qualification level. Instead, the restriction is temporary and is removed when the reason for the restriction has been resolved.

i. The responsible Flight Standards office will determine the evaluation criteria for an FTD that has been removed from active status for a prolonged period. The criteria will be based on the number of continuing qualification evaluations and quarterly inspections missed during the period of inactivity. For example, if the FTD were out of service for a 1 year period, it would be necessary to complete the entire QTG, since all of the quarterly evaluations would have been missed. The responsible Flight Standards office will also consider how the FTD was stored, whether parts were removed from the FTD and whether the FTD was disassembled.

j. The FTD will normally be requalified using the FAA-approved MQTG and the criteria that was in effect prior to its removal from qualification. However, inactive periods of 2 years or more will require re-qualification under the standards in effect and current at the time of requalification.

END INFORMATION

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14. INSPECTION, CONTINUING QUALIFICATION, EVALUATION, AND MAINTENANCE REQUIREMENTS (§60.19).

BEGIN QPS REQUIREMENT

a. The sponsor must conduct a minimum of four evenly spaced inspections throughout the year. The objective test sequence and content of each inspection in this sequence must be developed by the sponsor and must be acceptable to the responsible Flight Standards office.

b. The description of the functional preflight check must be contained in the sponsor's QMS.

c. Record "functional preflight" in the FTD discrepancy log book or other acceptable location, including any item found to be missing, malfunctioning, or inoperative.

d. During the continuing qualification evaluation conducted by the responsible Flight Standards office, the sponsor must also provide a person knowledgeable about the operation of the aircraft and the operation of the FTD.

END QPS REQUIREMENTS

BEGIN INFORMATION

e. The sponsor's test sequence and the content of each quarterly inspection required in §60.19(a)(1) should include a balance and a mix from the objective test requirement areas listed as follows:

(1) Performance.

(2) Handling qualities.

(3) Motion system (where appropriate).

(4) Visual system (where appropriate).

(5) Sound system (where appropriate).

(6) Other FTD systems.

f. If the evaluator plans to accomplish specific tests during a normal continuing qualification evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; but not less than 72 hours. Examples of such tests include latencies, control sweeps, or motion or visual system tests.

g. The continuing qualification evaluations described in §60.19(b) will normally require 4 hours of FTD time. However, flexibility is necessary to address abnormal situations or situations involving aircraft with additional levels of complexity (e.g., computer controlled aircraft). The sponsor should anticipate that some tests may require additional time. The continuing qualification evaluations will consist of the following:

(1) Review of the results of the quarterly inspections conducted by the sponsor since the last scheduled continuing qualification evaluation.

(2) A selection of approximately 8 to 15 objective tests from the MQTG that provide an adequate opportunity to evaluate the performance of the FTD. The tests chosen will be performed either automatically or manually and should be able to be conducted within approximately one-third (1/3) of the allotted FTD time.

(3) A subjective evaluation of the FTD to perform a representative sampling of the tasks set out in attachment 3 of this appendix. This portion of the evaluation should

take approximately two-thirds (2/3) of the allotted FTD time.

(4) An examination of the functions of the FTD may include the motion system, visual system, sound system as applicable, instructor operating station, and the normal functions and simulated malfunctions of the airplane systems. This examination is normally accomplished simultaneously with the subjective evaluation requirements.

h. The requirement established in §60.19(b)(4) regarding the frequency of responsible Flight Standards office-conducted continuing qualification evaluations for each FTD is typically 12 months. However, the establishment and satisfactory implementation of an approved QMS for a sponsor will provide a basis for adjusting the frequency of evaluations to exceed 12-month intervals.

15. LOGGING FTD DISCREPANCIES (§60.20)

No additional regulatory or informational material applies to §60.20. Logging FTD Discrepancies.

16. INTERIM QUALIFICATION OF FTDS FOR NEW AIRPLANE TYPES OR MODELS (§60.21)

No additional regulatory or informational material applies to §60.21, Interim Qualification of FTDs for New Airplane Types or Models.

END INFORMATION

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17. MODIFICATIONS TO FTDS (§60.23)

BEGIN QPS REQUIREMENTS

a. The notification described in §60.23(c)(2) must include a complete description of the planned modification, with a description of the operational and engineering effect the proposed modification will have on the operation of the FTD and the results that are expected with the modification incorporated.

b. Prior to using the modified FTD:

(1) All the applicable objective tests completed with the modification incorporated, including any necessary updates to the MQTG (e.g., accomplishment of FSTD Directives) must be acceptable to the responsible Flight Standards office; and

(2) The sponsor must provide the responsible Flight Standards office with a statement signed by the MR that the factors listed in §60.15(b) are addressed by the appropriate personnel as described in that section.

END QPS REQUIREMENTS

BEGIN INFORMATION

c. FSTD Directives are considered modification of an FTD. See Attachment 4 of this appendix for a sample index of effective FSTD Directives.

END INFORMATION

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18. OPERATION WITH MISSING, MALFUNCTIONING, OR INOPERATIVE COMPONENTS (§60.25)

BEGIN INFORMATION

a. The sponsor's responsibility with respect to §60.25(a) is satisfied when the sponsor fairly and accurately advises the user of the current status of an FTD, including any missing, malfunctioning, or inoperative (MMI) component(s).

b. It is the responsibility of the instructor, check airman, or representative of the administrator conducting training, testing, or checking to exercise reasonable and prudent judgment to determine if any MMI component is necessary for the satisfactory completion of a specific maneuver, procedure, or task.

c. If the 29th or 30th day of the 30-day period described in 60.25(b) is on a Saturday, a Sunday, or a holiday, the FAA will extend the deadline until the next business day.

d. In accordance with the authorization described in §60.25(b), the sponsor may develop a discrepancy prioritizing system to accomplish repairs based on the level of impact on the capability of the FTD. Repairs having a larger impact on the FTD's ability to provide the required training, evaluation, or flight experience will have a higher priority for repair or replacement.

END INFORMATION

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19. AUTOMATIC LOSS OF QUALIFICATION AND PROCEDURES FOR RESTORATION OF QUALIFICATION (§60.27)

BEGIN INFORMATION

If the sponsor provides a plan for how the FTD will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems; routine replacement of hydraulic fluid; control of the environmental factors in which the FTD is to be maintained) there is a greater likelihood that the responsible Flight Standards office will be able to determine the amount of testing that required for requalification.

END INFORMATION

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20. OTHER LOSSES OF QUALIFICATION AND PROCEDURES FOR RESTORATION OF QUALIFICATION (§60.29)

BEGIN INFORMATION

If the sponsor provides a plan for how the FTD will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems; routine replacement of hydraulic fluid; control of the environmental factors in which the FTD is to be maintained) there is a greater likelihood that the responsible Flight Standards office will be able to determine the amount of testing that required for requalification.

END INFORMATION

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21. RECORDKEEPING AND REPORTING (§60.31)

BEGIN QPS REQUIREMENTS

a. FTD modifications can include hardware or software changes. For FTD modifications involving software programming changes, the record required by §60.31(a)(2) must consist of the name of the aircraft system software, aerodynamic model, or engine model change, the date of the change, a summary of the change, and the reason for the change.

b. If a coded form for record keeping is used, it must provide for the preservation and retrieval of information with appropriate security or controls to prevent the inappropriate alteration of such records after the fact.

END QPS REQUIREMENTS

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22. APPLICATIONS, LOGBOOKS, REPORTS, AND RECORDS: FRAUD, FALSIFICATION, OR INCORRECT STATEMENTS (§60.33)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.33, Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements.

END INFORMATION

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23. [RESERVED]

24. LEVELS OF FTD.

BEGIN INFORMATION

a. The following is a general description of each level of FTD. Detailed standards and tests for the various levels of FTDs are fully defined in Attachments 1 through 3 of this appendix.

(1) Level 4. A device that may have an open airplane-specific flight deck area, or an enclosed airplane-specific flight deck and at least one operating system. Air/ground logic is required (no aerodynamic programming required). All displays may be flat/LCD panel representations or actual representations of displays in the aircraft. All controls, switches, and knobs may be touch sensitive activation (not capable of manual manipulation of the flight controls) or may physically replicate the aircraft in control operation.

(2) Level 5. A device that may have an open airplane-specific flight deck area, or an enclosed airplane-specific flight deck; generic aerodynamic programming; at least one operating system; and control loading that is representative of the simulated airplane only at an approach speed and configuration. All displays may be flat/LCD panel representations or actual representations of displays in the aircraft. Primary and secondary flight controls (e.g., rudder, aileron, elevator, flaps, spoilers/speed brakes, engine controls, landing gear, nosewheel steering, trim, brakes) must be physical controls. All other controls, switches, and knobs may be touch sensitive activation.

(3) Level 6. A device that has an enclosed airplane-specific flight deck; airplane-specific aerodynamic programming; all applicable airplane systems operating; control loading that is representative of the simulated airplane throughout its ground and flight envelope; and significant sound representation. All displays may be flat/LCD panel representations or actual representations of displays in the aircraft, but all controls, switches, and knobs must physically replicate the aircraft in control operation.

END INFORMATION

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(4) Level 7. A Level 7 device is one that has an enclosed airplane-specific flight deck and aerodynamic program with all applicable airplane systems operating and control loading that is representative of the simulated airplane throughout its ground and flight envelope and significant sound representation. All displays may be flat/LCD panel representations or actual representations of displays in the aircraft, but all controls, switches, and knobs must physically replicate the aircraft in control operation. It also has a visual system that provides an out-of-the-flight deck view, providing cross-flight deck viewing (for both pilots simultaneously) of a

field-of-view of at least 180° horizontally and 40° vertically.

25. FTD QUALIFICATION ON THE BASIS OF A BILATERAL AVIATION SAFETY AGREEMENT (BASA) (§ 60.37)

BEGIN INFORMATION

No additional regulatory or informational material applies to § 60.37, FTD Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA).

END INFORMATION

ATTACHMENT 1 TO APPENDIX B TO PART 60—GENERAL FTD REQUIREMENTS

BEGIN QPS REQUIREMENTS

1. REQUIREMENTS

a. Certain requirements included in this appendix must be supported with an SOC as defined in Appendix F, which may include objective and subjective tests. The requirements for SOCs are indicated in the ''General FTD Requirements'' column in Table B1A of this appendix.

b. Table B1A describes the requirements for the indicated level of FTD. Many devices include operational systems or functions that exceed the requirements outlined in this section. In any event, all systems will be tested and evaluated in accordance with this appendix to ensure proper operation.

END QPS REQUIREMENTS

BEGIN INFORMATION

2. DISCUSSION

a. This attachment describes the general requirements for qualifying Level 4 through Level 6 FTDs. The sponsor should also consult the objectives tests in Attachment 2 of this appendix and the examination of functions and subjective tests listed in Attachment 3 of this appendix to determine the complete requirements for a specific level FTD.

b. The material contained in this attachment is divided into the following categories:

(1) General Flight deck Configuration.
(2) Programming.
(3) Equipment Operation.
(4) Equipment and facilities for instructor/evaluator functions.
(5) Motion System.
(6) Visual System.
(7) Sound System.

c. Table B1A provides the standards for the General FTD Requirements.

d. Table B1B provides the tasks that the sponsor will examine to determine whether the FTD satisfactorily meets the requirements for flight crew training, testing, and experience, and provides the tasks for which the simulator may be qualified.

e. Table B1C provides the functions that an instructor/check airman must be able to control in the simulator.

f. It is not required that all of the tasks that appear on the List of Qualified Tasks (part of the SOQ) be accomplished during the initial or continuing qualification evaluation.

END INFORMATION

Table B1A – Minimum FTD Requirements

QPS REQUIREMENTS						INFORMATION
Entry Number	**General FTD Requirements**	**FTD Level**				**Notes**
		4	**5**	**6**	**7**	
1. General Flight deck Configuration.						
1.a.	The FTD must have a flight deck that is a replica of the airplane simulated with controls, equipment, observable flight deck indicators, circuit breakers, and bulkheads properly located, functionally accurate and replicating the airplane. The direction of movement of controls and switches must be identical to that in the airplane. Pilot seat(s) must afford the capability for the occupant to be able to achieve the design “eye position.” Equipment for the operation of the flight deck windows must be included, but the actual windows need not be operable. Fire axes, extinguishers, and spare light bulbs must be available in the flight FTD, but may be relocated to a suitable location as near as practical to the original position. Fire axes, landing gear pins, and any similar purpose instruments need only be represented in silhouette.			X	X	For FTD purposes, the flight deck consists of all that space forward of a cross section of the fuselage at the most extreme aft setting of the pilots' seats including additional, required flight crewmember duty stations and those required bulkheads aft of the pilot seats. For clarification, bulkheads containing only items such as landing gear pin storage compartments, fire axes and

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	The use of electronically displayed images with physical overlay or masking for FTD instruments and/or instrument panels is acceptable provided: (1) All instruments and instrument panel layouts are dimensionally correct with differences, if any, being imperceptible to the pilot; (2) Instruments replicate those of the airplane including full instrument functionality and embedded logic; (3) Instruments displayed are free of quantization (stepping); (4) Instrument display characteristics replicate those of the airplane including: resolution, colors, luminance, brightness, fonts, fill patterns, line styles and symbology; (5) Overlay or masking, including bezels and bugs, as applicable, replicates the airplane panel(s); (6) Instrument controls and switches replicate and operate with the same technique, effort, travel and in the same direction as those in the airplane; (7) Instrument lighting replicates that of the airplane and is operated from the FSTD control for that lighting and, if applicable, is at a level commensurate with other lighting operated by that same control; and (8) As applicable, instruments must have faceplates that replicate those in the airplane; and Level 7 FTD only; The display image of any three dimensional instrument, such as an electro-mechanical instrument, should appear to have the same three dimensional depth as the replicated instrument. The appearance of the simulated instrument, when viewed from the principle operator's angle, should replicate that of the actual airplane instrument. Any instrument reading inaccuracy due to viewing angle and parallax present in the actual airplane instrument should be duplicated in the simulated instrument display image. Viewing angle error and parallax must be minimized on shared instruments such and engine displays and standby indicators.					extinguishers, spare light bulbs, aircraft documents pouches are not considered essential and may be omitted. For Level 6 FTDs, flight deck window panes may be omitted where non-distracting and subjectively acceptable to conduct qualified training tasks.
1.b.	The FTD must have equipment (e.g., instruments, panels, systems, circuit breakers, and controls) simulated sufficiently for the authorized training/checking events to be accomplished. The installed equipment must be located in a spatially correct location and may be in a flight deck or an open flight deck area. Additional equipment required for the authorized training/checking events must be available in the FTD, but may be located in a suitable location as near as practical to the spatially correct position.	X	X			

	Actuation of equipment must replicate the appropriate function in the airplane. Fire axes, landing gear pins, and any similar purpose instruments need only be represented in silhouette.					
1.c.	Those circuit breakers that affect procedures or result in observable flight deck indications must be properly located and functionally accurate.				X	
2. Programming.						
2.a.1	The FTD must provide the proper effect of aerodynamic changes for the combinations of drag and thrust normally encountered in flight. This must include the effect of change in airplane attitude, thrust, drag, altitude, temperature, and configuration. Level 6 additionally requires the effects of changes in gross weight and center of gravity. Level 5 requires only generic aerodynamic programming. An SOC is required.		X	X		
2.a.2	A flight dynamics model that accounts for various combinations of drag and thrust normally encountered in flight must correspond to actual flight conditions, including the effect of change in airplane attitude, thrust, drag, altitude, temperature, gross weight, moments of inertia, center of gravity location, and configuration. The effects of pitch attitude and of fuel slosh on the aircraft center of gravity must be simulated. An SOC is required.				X	
2.b.	The FTD must have the computer capacity, accuracy, resolution, and dynamic response needed to meet the qualification level sought. An SOC is required.	X	X	X	X	
2.c.1	Relative responses of the flight deck instruments must be measured by latency tests, or transport delay tests, and may not exceed 300 milliseconds. The instruments must respond to abrupt input at the pilot's position within the allotted time, but not before the time when the airplane responds under the same conditions. (1) Latency: The FTD instrument and, if applicable, the motion system and the visual system response must not be prior to that time when the		X	X		The intent is to verify that the FTD provides instrument cues that are, within the stated time delays, like the airplane responses. For airplane response, acceleration in the appropriate, corresponding rotational axis is preferred.

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	airplane responds and may respond up to 300 milliseconds after that time under the same conditions. (2) Transport Delay: As an alternative to the Latency requirement, a transport delay objective test may be used to demonstrate that the FTD system does not exceed the specified limit. The sponsor must measure all the delay encountered by a step signal migrating from the pilot's control through all the simulation software modules in the correct order, using a handshaking protocol, finally through the normal output interfaces to the instrument display and, if applicable, the motion system, and the visual system.					Additional information regarding Latency and Transport Delay testing may be found in Appendix A, Attachment 2, paragraph 15.
2.c.2.	Relative responses of the motion system, visual system, and flight deck instruments, measured by latency tests or transport delay tests. Motion onset should occur before the start of the visual scene change (the start of the scan of the first video field containing different information) but must occur before the end of the scan of that video field. Instrument response may not occur prior to motion onset. Test results must be within the following limits: 100 ms for the motion (if installed) and instrument systems; and 120 ms for the visual system.				**X**	The intent is to verify that the FTD provides instrument, motion, and visual cues that are, within the stated time delays, like the airplane responses. For airplane response, acceleration in the appropriate, corresponding rotational axis is preferred.
2.d.	Ground handling and aerodynamic programming must include the following:					
2.d.1.	Ground effect.				**X**	Ground effect includes modeling that accounts for roundout, flare, touchdown, lift, drag, pitching moment, trim, and power while in ground effect.
2.d.2.	Ground reaction.				**X**	Ground reaction includes modeling that accounts for strut deflections, tire friction, and side forces. This is the reaction of the airplane upon contact with the runway during landing, and may differ with changes in factors such as gross weight, airspeed, or rate of descent on touchdown.

2.d.3.	Ground handling characteristics, including aerodynamic and ground reaction modeling including steering inputs, operations with crosswind, gusting crosswind, braking, thrust reversing, deceleration, and turning radius.				X	
2.e.	If the aircraft being simulated is one of the aircraft listed in § 121.358, Low-altitude windshear system equipment requirements, the FTD must employ windshear models that provide training for recognition of windshear phenomena and the execution of recovery procedures. Models must be available to the instructor/evaluator for the following critical phases of flight: (1) Prior to takeoff rotation; (2) At liftoff; (3) During initial climb; and (4) On final approach, below 500 ft AGL. The QTG must reference the FAA Windshear Training Aid or present alternate airplane related data, including the implementation method(s) used. If the alternate method is selected, wind models from the Royal Aerospace Establishment (RAE), the Joint Airport Weather Studies (JAWS) Project and other recognized sources may be implemented, but must be supported and properly referenced in the QTG. The addition of realistic levels of turbulence associated with each required windshear profile must be available and selectable to the instructor. In addition to the four basic windshear models required for qualification, at least two additional “complex” windshear models must be available to the instructor which represent the complexity of actual windshear encounters. These models must be available in the takeoff and landing configurations and must consist of independent variable winds in multiple simultaneous components. The Windshear Training Aid provides two such example “complex” windshear models that may be used to satisfy this requirement.				X	Windshear models may consist of independent variable winds in multiple simultaneous components. The FAA Windshear Training Aid presents one acceptable means of compliance with FTD wind model requirements. The FTD should employ a method to ensure the required survivable and non-survivable windshear scenarios are repeatable in the training environment. For Level 7 FTDs, windshear training tasks may only be qualified for aircraft equipped with a synthetic stall warning system. The qualified windshear profile(s) are evaluated to ensure the synthetic stall warning (and not the stall buffet) is first indication of the stall.
2.f.	The FTD must provide for manual and automatic testing of FTD hardware and software programming to determine compliance with FTD objective tests as prescribed in Attachment 2 of this appendix. An SOC is required.				X	Automatic “flagging” of out-of-tolerance situations is encouraged.
2.g.	The FTD must accurately reproduce the following runway conditions: (1) Dry; (2) Wet;				X	

	(3) Icy; (4) Patchy Wet; (5) Patchy Icy; and (6) Wet on Rubber Residue in Touchdown Zone. An SOC is required.					
2.h.	The FTD must simulate: (1) brake and tire failure dynamics, including antiskid failure; and (2) decreased brake efficiency due to high brake temperatures, if applicable. An SOC is required				**X**	FTD pitch, side loading, and directional control characteristics should be representative of the airplane.
2.i.	Engine and Airframe Icing Modeling that includes the effects of icing, where appropriate, on the airframe, aerodynamics, and the engine(s). Icing models must simulate the aerodynamic degradation effects of ice accretion on the airplane lifting surfaces including loss of lift, decrease in stall angle of attack, change in pitching moment, decrease in control effectiveness, and changes in control forces in addition to any overall increase in drag. Aircraft systems (such as the stall protection system and autoflight system) must respond properly to ice accretion consistent with the simulated aircraft. Aircraft OEM data or other acceptable analytical methods must be utilized to develop ice accretion models that are representative of the simulated aircraft's performance degradation in a typical in-flight icing encounter. Acceptable analytical methods may include wind tunnel analysis and/or engineering analysis of the aerodynamic effects of icing on the lifting surfaces coupled with tuning and supplemental subjective assessment by a subject matter expert pilot. SOC required.				**X**	SOC should be provided describing the effects which provide training in the specific skills required for recognition of icing phenomena and execution of recovery. The SOC should describe the source data and any analytical methods used to develop ice accretion models including verification that these effects have been tested. Icing effects simulation models are only required for those airplanes authorized for operations in icing conditions. Icing simulation models should be developed to provide training in the specific skills required for recognition of ice accumulation and execution of the required response. See Attachment 7 of this Appendix for further guidance material.

2.j.	The aerodynamic modeling in the FTD must include: (1) Low-altitude level-flight ground effect; (2) Mach effect at high altitude; (3) Normal and reverse dynamic thrust effect on control surfaces; (4) Aeroelastic representations; and (5) Nonlinearities due to sideslip. An SOC is required and must include references to computations of aeroelastic representations and of nonlinearities due to sideslip.				**X**	See Attachment 2 of this appendix, paragraph 5, for further information on ground effect.
2.k.	The FTD must have aerodynamic and ground reaction modeling for the effects of reverse thrust on directional control, if applicable. An SOC is required.				**X**	
3. Equipment Operation.						
3.a.	All relevant instrument indications involved in the simulation of the airplane must automatically respond to control movement or external disturbances to the simulated airplane; e.g., turbulence or windshear. Numerical values must be presented in the appropriate units. For Level 7 FTDs, instrument indications must also respond to effects resulting from icing.		**X**	**X**	**X**	
3.b.1.	Navigation equipment must be installed and operate within the tolerances applicable for the airplane. Levels 6 must also include communication equipment (inter-phone and air/ground) like that in the airplane and, if appropriate to the operation being conducted, an oxygen mask microphone system. Level 5 need have only that navigation equipment necessary to fly an instrument approach.		**X**	**X**		
3.b.2.	Communications, navigation, caution, and warning equipment must be installed and operate within the tolerances applicable for the airplane. Instructor control of internal and external navigational aids. Navigation aids must be usable within range or line-of-sight without restriction, as applicable to the geographic area.				**X**	See Attachment 3 of this appendix for further information regarding long-range navigation equipment.
3.b.3.	Complete navigation database for at least 3 airports with corresponding precision and non-precision approach procedures, including navigational database updates.				**X**	

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3.c.1.	Installed systems must simulate the applicable airplane system operation, both on the ground and in flight. Installed systems must be operative to the extent that applicable normal, abnormal, and emergency operating procedures included in the sponsor's training programs can be accomplished. Level 6 must simulate all applicable airplane flight, navigation, and systems operation. Level 5 must have at least functional flight and navigational controls, displays, and instrumentation. Level 4 must have at least one airplane system installed and functional.	**X**	**X**	**X**		
3.c.2.	Simulated airplane systems must operate as the airplane systems operate under normal, abnormal, and emergency operating conditions on the ground and in flight. Once activated, proper systems operation must result from system management by the crew member and not require any further input from the instructor's controls.				**X**	Airplane system operation should be predicated on, and traceable to, the system data supplied by the airplane manufacturer, original equipment manufacturer or alternative approved data for the airplane system or component. At a minimum, alternate approved data should validate the operation of all normal, abnormal, and emergency operating procedures and training tasks the FSTD is qualified to conduct.
3.d.	The lighting environment for panels and instruments must be sufficient for the operation being conducted.	**X**	**X**	**X**	**X**	Back-lighted panels and instruments may be installed but are not required.
3.e.	The FTD must provide control forces and control travel that corresponds to the airplane being simulated. Control forces must react in the same manner as in the airplane under the same flight conditions. For Level 7 FTDs, control systems must replicate airplane operation for the normal and any non-normal modes including back-up systems and should reflect failures of associated systems. Appropriate cockpit indications and messages must be replicated.			**X**	**X**	

3.f.	The FTD must provide control forces and control travel of sufficient precision to manually fly an instrument approach.		**X**			
3.e.	FTD control feel dynamics must replicate the airplane. This must be determined by comparing a recording of the control feel dynamics of the FTD to airplane measurements. For initial and upgrade qualification evaluations, the control dynamic characteristics must be measured and recorded directly from the flight deck controls, and must be accomplished in takeoff, cruise, and landing flight conditions and configurations.				**X**	
4. Instructor or Evaluator Facilities.						
4.a.1.	In addition to the flight crewmember stations, suitable seating arrangements for an instructor/check airman and FAA Inspector must be available. These seats must provide adequate view of crewmember's panel(s).	**X**	**X**	**X**		These seats need not be a replica of an aircraft seat and may be as simple as an office chair placed in an appropriate position.
4.a.2.	In addition to the flight crewmember stations, the FTD must have at least two suitable seats for the instructor/check airman and FAA inspector. These seats must provide adequate vision to the pilot's panel and forward windows. All seats other than flight crew seats need not represent those found in the airplane, but must be adequately secured to the floor and equipped with similar positive restraint devices.				**X**	The responsible Flight Standards office will consider alternatives to this standard for additional seats based on unique flight deck configurations.
4.b.1.	The FTD must have instructor controls that permit activation of normal, abnormal, and emergency conditions as appropriate. Once activated, proper system operation must result from system management by the crew and not require input from the instructor controls.	**X**	**X**	**X**		
4.b.2.	The FTD must have controls that enable the instructor/evaluator to control all required system variables and insert all abnormal or emergency conditions into the simulated airplane systems as described in the sponsor's FAA-approved training program; or as described in the relevant operating manual as appropriate.				**X**	
4.c.	The FTD must have instructor controls for all environmental effects expected to be available at the IOS; e.g., clouds, visibility, icing, precipitation, temperature, storm cells and microbursts, turbulence, and intermediate and high altitude wind speed and direction.				**X**	
4.d.	The FTD must provide the instructor or evaluator the ability to present ground and air hazards.				**X**	For example, another airplane crossing the active runway or converging airborne traffic.
5. Motion System.						

5.a.	The FTD may have a motion system, if desired, although it is not required. If a motion system is installed and additional training, testing, or checking credits are being sought on the basis of having a motion system, the motion system operation may not be distracting and must be coupled closely to provide integrated sensory cues. The motion system must also respond to abrupt input at the pilot's position within the allotted time, but not before the time when the airplane responds under the same conditions.		X	X	X	The motion system standards set out in part 60, Appendix A for at least Level A simulators is acceptable.
5.b.	If a motion system is installed, it must be measured by latency tests or transport delay tests and may not exceed 300 milliseconds. Instrument response may not occur prior to motion onset.			X	X	The motion system standards set out in part 60, Appendix A for at least Level A simulators is acceptable.
6. Visual System.						
6.a.	The FTD may have a visual system, if desired, although it is not required. If a visual system is installed, it must meet the following criteria:	X	X	X		
6.a.1.	The visual system must respond to abrupt input at the pilot's position. An SOC is required.		X	X		
6.a.2.	The visual system must be at least a single channel, non-collimated display. An SOC is required.	X	X	X		
6.a.3.	The visual system must provide at least a field-of-view of 18° vertical / 24° horizontal for the pilot flying. An SOC is required.	X	X	X		
6.a.4.	The visual system must provide for a maximum parallax of 10° per pilot. An SOC is required.	X	X	X		
6.a.5.	The visual scene content may not be distracting. An SOC is required.	X	X	X		
6.a.6.	The minimum distance from the pilot's eye position to the surface of a direct view display may not be less than the distance to any front panel instrument. An SOC is required.					
6.a.7.	The visual system must provide for a minimum resolution of 5 arc-minutes for both computed and displayed pixel size. An SOC is required.	X	X	X		
6.b.	If a visual system is installed and additional training, testing, or checking credits are being sought on the basis of having a visual system, a visual system meeting the standards set out for at least a Level A FFS (see Appendix A of this part) will be required. A "direct-view," non-collimated visual system (with the other requirements for a Level A visual system met) may be considered satisfactory for those			X		Directly projected, non-collimated visual displays may prove to be unacceptable for dual pilot applications.

	installations where the visual system design "eye point" is appropriately adjusted for each pilot's position such that the parallax error is at or less than 10º simultaneously for each pilot. An SOC is required.					
6.c.	The FTD must have a visual system providing an out-of-the-flight deck view.				X	
6.d.	The FTD must provide a continuous visual field-of-view of at least176° horizontally and 36° vertically or the number of degrees necessary to meet the visual ground segment requirement, whichever is greater. The minimum horizontal field-of-view coverage must be plus and minus one-half (½) of the minimum continuous field-of-view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. An SOC is required and must explain the system geometry measurements including system linearity and field-of-view. Collimation is not required but parallax effects must be minimized (not greater than 10° for each pilot when aligned for the point midway between the left and right seat eyepoints).				X	The horizontal field-of-view is traditionally described as a 180º field-of-view. However, the field-of-view is technically no less than 176º. Additional field-of-view capability may be added at the sponsor's discretion provided the minimum fields of view are retained.
6.e.	The visual system must be free from optical discontinuities and artifacts that create non-realistic cues.				X	Non-realistic cues might include image "swimming" and image "roll-off," that may lead a pilot to make incorrect assessments of speed, acceleration, or situational awareness.
6.f.	The FTD must have operational landing lights for night scenes. Where used, dusk (or twilight) scenes require operational landing lights.				X	
6.g.	The FTD must have instructor controls for the following: (1) Visibility in statute miles (km) and runway visual range (RVR) in ft.(m); (2) Airport selection; and (3) Airport lighting.				X	
6.h.	The FTD must provide visual system compatibility with dynamic response programming.				X	
6.i.	The FTD must show that the segment of the ground visible from the FTD flight deck is the same as from the airplane flight deck (within established				X	This will show the modeling accuracy of RVR, glideslope, and localizer for a given weight, configuration, and speed within

	tolerances) when at the correct airspeed, in the landing configuration, at the appropriate height above the touchdown zone, and with appropriate visibility.					the airplane's operational envelope for a normal approach and landing.
6.j.	The FTD must provide visual cues necessary to assess sink rates (provide depth perception) during takeoffs and landings, to include: (1) Surface on runways, taxiways, and ramps; and (2) Terrain features.				**X**	
6.k.	The FTD must provide for accurate portrayal of the visual environment relating to the FTD attitude.				**X**	Visual attitude vs. FTD attitude is a comparison of pitch and roll of the horizon as displayed in the visual scene compared to the display on the attitude indicator.
6.l.	The FTD must provide for quick confirmation of visual system color, RVR, focus, and intensity. An SOC is required.				**X**	
6.m.	The FTD must be capable of producing at least 10 levels of occulting.				**X**	
6.n.	Night Visual Scenes. When used in training, testing, or checking activities, the FTD must provide night visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Scenes must include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by airplane landing lights.				**X**	
6.o.	Dusk (or Twilight) Visual Scenes. When used in training, testing, or checking activities, the FTD must provide dusk (or twilight) visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Dusk (or twilight) scenes, as a minimum, must provide full color presentations of reduced ambient intensity, sufficient surfaces with appropriate textural cues that include self-illuminated objects such as road networks, ramp lighting and airport signage, to conduct a visual approach, landing and airport movement (taxi). Scenes must include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by airplane landing lights. If provided, directional horizon lighting must have correct orientation and be consistent with surface shading effects. Total night or dusk (twilight) scene				**X**	

	content must be comparable in detail to that produced by 10,000 visible textured surfaces and 15,000 visible lights with sufficient system capacity to display 16 simultaneously moving objects. An SOC is required.					
6.p.	Daylight Visual Scenes. The FTD must provide daylight visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Any ambient lighting must not "washout" the displayed visual scene. Total daylight scene content must be comparable in detail to that produced by 10,000 visible textured surfaces and 6,000 visible lights with sufficient system capacity to display 16 simultaneously moving objects. The visual display must be free of apparent and distracting quantization and other distracting visual effects while the FTD is in motion. An SOC is required.				**X**	
6.q.	The FTD must provide operational visual scenes that portray physical relationships known to cause landing illusions to pilots.				**X**	For example: short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path, unique topographic features.
6.r.	The FTD must provide special weather representations of light, medium, and heavy precipitation near a thunderstorm on takeoff and during approach and landing. Representations need only be presented at and below an altitude of 2,000 ft. (610 m) above the airport surface and within 10 miles (16 km) of the airport.				**X**	
6.s.	The FTD must present visual scenes of wet and snow-covered runways, including runway lighting reflections for wet conditions, partially obscured lights for snow conditions, or suitable alternative effects.				**X**	
6.t.	The FTD must present realistic color and directionality of all airport lighting.				**X**	
6.u.	The following weather effects as observed on the visual system must be simulated and respective instructor controls provided. (1) Multiple cloud layers with adjustable bases, tops, sky coverage and scud effect; (2) Storm cells activation and/or deactivation;				**X**	Scud effects are low, detached, and irregular clouds below a defined cloud layer.

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	(3) Visibility and runway visual range (RVR), including fog and patchy fog effect; (4) Effects on ownship external lighting; (5) Effects on airport lighting (including variable intensity and fog effects); (6) Surface contaminants (including wind blowing effect); (7) Variable precipitation effects (rain, hail, snow); (8) In-cloud airspeed effect; and (9) Gradual visibility changes entering and breaking out of cloud.					
6.v.	The simulator must provide visual effects for: (1) Light poles; (2) Raised edge lights as appropriate; and (3) Glow associated with approach lights in low visibility before physical lights are seen,				**X**	Visual effects for light poles and raised edge lights are for the purpose of providing additional depth perception during takeoff, landing, and taxi training tasks. Three dimensional modeling of the actual poles and stanchions is not required.
7. Sound System.						
7.a.	The FTD must provide flight deck sounds that result from pilot actions that correspond to those that occur in the airplane.			**X**	**X**	
7.b.	The volume control must have an indication of sound level setting which meets all qualification requirements.				**X**	This indication is of the sound level setting as evaluated during the FTD's initial evaluation.
7.c.	The FTD must accurately simulate the sound of precipitation, windshield wipers, and other significant airplane noises perceptible to the pilot during normal and abnormal operations, and include the sound of a crash (when the FTD is landed in an unusual attitude or in excess of the structural gear limitations); normal engine and thrust reversal sounds; and the sounds of flap, gear, and spoiler extension and retraction. Sounds must be directionally representative. An SOC is required.				**X**	

7.d.	The FTD must provide realistic amplitude and frequency of flight deck noises and sounds. FTD performance must be recorded, subjectively assessed for the initial evaluation, and be made a part of the QTG.				**X**	

Table B1B - Table of Tasks vs. FTD Level

QPS REQUIREMENTS						INFORMATION
Entry Number	**Subjective Requirements** In order to be qualified at the FTD qualification level indicated, the FTD must be able to perform at least the tasks associated with that level of qualification. See Notes 1, 2 and 3 at the end of the Table	**FTD Level**				**Notes**
		4	**5**	**6**	**7**	
1. Preflight Procedures.						
1.a.	Preflight Inspection (flight deck only)	**A**	**A**	**X**	**X**	
1.b.	Engine Start	**A**	**A**	**X**	**X**	
1.c.	Taxiing				**T**	
1.d.	Pre-takeoff Checks	**A**	**A**	**X**	**X**	
2. Takeoff and Departure Phase.						
2.a.	Normal and Crosswind Takeoff				**T**	
2.b.	Instrument Takeoff				**T**	
2.c.	Engine Failure During Takeoff				**T**	
2.d.	Rejected Takeoff (requires visual system)			**A**	**X**	
2.e.	Departure Procedure		**X**	**X**	**X**	
3. Inflight Maneuvers.						
3.a.	Steep Turns		**X**	**X**	**X**	
3.b	Approaches to Stalls		**A**	**X**	**X**	Approach to stall maneuvers qualified only where the aircraft does not exhibit stall buffet as the first indication of the stall.
3.c.	Engine Failure—Multiengine Airplane		**A**	**X**	**X**	
3.d.	Engine Failure—Single-Engine Airplane		**A**	**X**	**X**	
3.e.	Specific Flight Characteristics incorporated into the user's FAA approved flight training program.	**A**	**A**	**A**	**A**	Level 4 FTDs have no minimum requirement for aerodynamic programming and are generally not qualified to conduct in-flight maneuvers.
3.f.	Windshear Recovery				**T**	For Level 7 FTD, windshear recovery may be qualified at the Sponsor's option. See Table B1A for specific requirements and limitations.
4. Instrument Procedures.						
4.a.	Standard Terminal Arrival / Flight Management System Arrivals Procedures		**A**	**X**	**X**	

Table B1B - Table of Tasks vs. FTD Level

QPS REQUIREMENTS						INFORMATION
Entry Number	**Subjective Requirements** In order to be qualified at the FTD qualification level indicated, the FTD must be able to perform at least the tasks associated with that level of qualification. See Notes 1, 2 and 3 at the end of the Table	**FTD Level**				**Notes**
		4	**5**	**6**	**7**	
4.b.	Holding		**A**	**X**	**X**	
4.c.	Precision Instrument					
4.c.1.	All engines operating.		**A**	**X**	**X**	e.g., Autopilot, Manual (Flt. Dir. Assisted), Manual (Raw Data)
4.c.2.	One engine inoperative.				**T**	e.g., Manual (Flt. Dir. Assisted), Manual (Raw Data)
4.d.	Non-precision Instrument Approach		**A**	**X**	**X**	e.g., NDB, VOR, VOR/DME, VOR/TAC, RNAV, LOC, LOC/BC, ADF, and SDF.
4.e.	Circling Approach (requires visual system)			**A**	**X**	Specific authorization required.
4.f.	Missed Approach					
4.f.1.	Normal.		**A**	**X**	**X**	
4.f.2.	One engine Inoperative.				**T**	
5. Landings and Approaches to Landings.						
5.a.	Normal and Crosswind Approaches and Landings				**T**	
5.b.	Landing From a Precision / Non-Precision Approach				**T**	
5.c.	Approach and Landing with (Simulated) Engine Failure – Multiengine Airplane				**T**	
5.d.	Landing From Circling Approach				**T**	
5.e.	Rejected Landing				**T**	
5.f.	Landing From a No Flap or a Nonstandard Flap Configuration Approach				**T**	
6. Normal and Abnormal Procedures.						
6.a.	Engine (including shutdown and restart)	**A**	**A**	**X**	**X**	
6.b.	Fuel System	**A**	**A**	**X**	**X**	
6.c.	Electrical System	**A**	**A**	**X**	**X**	
6.d.	Hydraulic System	**A**	**A**	**X**	**X**	
6.e.	Environmental and Pressurization Systems	**A**	**A**	**X**	**X**	
6.f.	Fire Detection and Extinguisher Systems	**A**	**A**	**X**	**X**	
6.g.	Navigation and Avionics Systems	**A**	**A**	**X**	**X**	
6.h.	Automatic Flight Control System, Electronic Flight Instrument System, and Related Subsystems	**A**	**A**	**X**	**X**	

Table B1B - Table of Tasks vs. FTD Level						
QPS REQUIREMENTS						INFORMATION
Entry Number	**Subjective Requirements** In order to be qualified at the FTD qualification level indicated, the FTD must be able to perform at least the tasks associated with that level of qualification. See Notes 1, 2 and 3 at the end of the Table	FTD Level				Notes
		4	5	6	7	
6.i.	Flight Control Systems	A	A	X	X	
6.j.	Anti-ice and Deice Systems	A	A	X	X	
6.k.	Aircraft and Personal Emergency Equipment	A	A	X	X	
7. Emergency Procedures.						
7.a.	Emergency Descent (Max. Rate)		A	X	X	
7.b.	Inflight Fire and Smoke Removal		A	X	X	
7.c.	Rapid Decompression		A	X	X	
7.d.	Emergency Evacuation	A	A	X	X	
8. Postflight Procedures.						
8.a.	After-Landing Procedures	A	A	X	X	
8.b.	Parking and Securing	A	A	X	X	

Note 1: An “A” in the table indicates that the system, task, or procedure, although not required to be present, may be examined if the appropriate airplane system is simulated in the FTD and is working properly.

Note 2: Items not installed or not functional on the FTD and not appearing on the SOQ Configuration List, are not required to be listed as exceptions on the SOQ.

Note 3: A “T” in the table indicates that the task may only be qualified for introductory initial or recurrent qualification training. These tasks may not be qualified for proficiency testing or checking credits in an FAA approved flight training program.</PHOTO>

TABLE B1C—TABLE OF FTD SYSTEM TASKS QPS REQUIREMENTS

QPS Requirements					Information
Entry No.	Subjective Requirements In order to be qualified at the FTD qualification level indicated, the FTD must be able to perform at least the tasks associated with that level of qualification.	FTD level			Notes
		4	5	6	
1. Instructor Operating Station (IOS).					
1.a.	Power switch(es)	X	X	X	
1.b.	Airplane conditions	A	X	X	e.g., GW, CG, Fuel loading, Systems, Ground Crew.
1.c.	Airports/Runways	X	X	X	e.g., Selection and Presets; Surface and Lighting controls if equipped with a visual system.
1.d.	Environmental controls	X	X	X	e.g., Temp, Wind.
1.e.	Airplane system malfunctions (Insertion/deletion)	A	X	X	
1.f.	Locks, Freezes, and Repositioning	X	X	X	
1.g.	Sound Controls. (On/off/adjustment)	X	X	X	
1.h.	Motion/Control Loading System, as appropriate. On/off/emergency stop.	A	A	A	
2. Observer Seats/Stations.					
2.a.	Position/Adjustment/Positive restraint system	X	X	X	

Note 1: An "A" in the table indicates that the system, task, or procedure, although not required to be present, may be examined if the appropriate system is in the FTD and is working properly.

ATTACHMENT 2 TO APPENDIX B TO PART 60—FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS

BEGIN INFORMATION

1. DISCUSSION

a. For the purposes of this attachment, the flight conditions specified in the Flight Conditions Column of Table B2A, are defined as follows:

(1) Ground—on ground, independent of airplane configuration;

(2) Take-off—gear down with flaps/slats in any certified takeoff position;

(3) First segment climb—gear down with flaps/slats in any certified takeoff position (normally not above 50 ft AGL);

(4) Second segment climb—gear up with flaps/slats in any certified takeoff position (normally between 50 ft and 400 ft AGL);

(5) Clean—flaps/slats retracted and gear up;

(6) Cruise—clean configuration at cruise altitude and airspeed;

(7) Approach—gear up or down with flaps/slats at any normal approach position as recommended by the airplane manufacturer; and

(8) Landing—gear down with flaps/slats in any certified landing position.

b. The format for numbering the objective tests in Appendix A, Attachment 2, Table A2A, and the objective tests in Appendix B, Attachment 2, Table B2A, is identical. However, each test required for FFSs is not necessarily required for FTDs. Also, each test required for FTDs is not necessarily required for FFSs. Therefore, when a test number (or series of numbers) is not required, the term ''Reserved'' is used in the table at that location. Following this numbering format provides a degree of commonality between the two tables and substantially reduces the potential for confusion when referring to objective test numbers for either FFSs or FTDs.

c. The reader is encouraged to review the Airplane Flight Simulator Evaluation Handbook, Volumes I and II, published by the Royal Aeronautical Society, London, UK, and FAA AC 25–7, as amended, Flight Test Guide for Certification of Transport Category Airplanes, and AC 23–8, as amended, Flight Test Guide for Certification of Part 23 Airplanes, for references and examples regarding flight testing requirements and techniques.

d. If relevant winds are present in the objective data, the wind vector should be clearly noted as part of the data presentation, expressed in conventional terminology, and related to the runway being used for the test.

e. A Level 4 FTD does not require objective tests and therefore, Level 4 is not addressed in the following table.

END INFORMATION

BEGIN QPS REQUIREMENTS

2. TEST REQUIREMENTS

a. The ground and flight tests required for qualification are listed in Table B2A Objective Tests. Computer generated FTD test results must be provided for each test except where an alternate test is specifically authorized by the responsible Flight Standards office. If a flight condition or operating condition is required for the test but does not apply to the airplane being simulated or to the qualification level sought, it may be disregarded (e.g., an engine out missed approach for a single-engine airplane; a maneuver using reverse thrust for an airplane without reverse thrust capability). Each test result is compared against the validation data described in §60.13, and in Appendix B. The results must be produced on an appropriate recording device acceptable to the responsible Flight Standards office and must include FTD number, date, time, conditions, tolerances, and appropriate dependent variables portrayed in comparison to the validation data. Time histories are required unless otherwise indicated in Table B2A. All results must be labeled using the tolerances and units given.

b. Table B2A in this attachment sets out the test results required, including the parameters, tolerances, and flight conditions for FTD validation. Tolerances are provided for the listed tests because mathematical modeling and acquisition and development of reference data are often inexact. All tolerances listed in the following tables are applied to FTD performance. When two tolerance values are given for a parameter, the less restrictive may be used unless otherwise indicated. In those cases where a tolerance is expressed only as a percentage, the tolerance percentage applies to the maximum value of that parameter within its normal operating range as measured from the neutral or zero position unless otherwise indicated.

c. Certain tests included in this attachment must be supported with a SOC. In Table B2A, requirements for SOCs are indicated in the "Test Details" column.

d. When operational or engineering judgment is used in making assessments for flight test data applications for FTD validity, such judgment may not be limited to a single parameter. For example, data that exhibit rapid variations of the measured parameters may require interpolations or a "best fit" data section. All relevant parameters related to a given maneuver or flight condition must be provided to allow overall interpretation. When it is difficult or impossible to match FTD to airplane data throughout a time history, differences must be justified by providing a comparison of other related variables for the condition being assessed.

e. It is not acceptable to program the FTD so that the mathematical modeling is correct only at the validation test points. Unless otherwise noted, FTD tests must represent airplane performance and handling qualities at operating weights and centers of gravity (CG) typical of normal operation. FTD tests at extreme weight or CG conditions may be acceptable where required for concurrent aircraft certification testing. Tests of handling qualities must include validation of augmentation devices.

f. When comparing the parameters listed to those of the airplane, sufficient data must also be provided to verify the correct flight condition and airplane configuration changes. For example, to show that control force is within the parameters for a static stability test, data to show the correct airspeed, power, thrust or torque, airplane configuration, altitude, and other appropriate datum identification parameters must also be given. If comparing short period dynamics, normal acceleration may be used to establish a match to the airplane, but airspeed, altitude, control input, airplane configuration, and other appropriate data must also be given. If comparing landing gear change dynamics, pitch, airspeed, and altitude may be used to establish a match to the airplane, but landing gear position must also be provided. All airspeed values must be properly annotated (e.g., indicated versus calibrated). In addition, the same variables must be used for comparison (e.g., compare inches to inches rather than inches to centimeters).

g. The QTG provided by the sponsor must clearly describe how the FTD will be set up and operated for each test. Each FTD subsystem may be tested independently, but overall integrated testing of the FTD must be accomplished to assure that the total FTD system meets the prescribed standards. A manual test procedure with explicit and detailed steps for completing each test must also be provided.

h. For previously qualified FTDs, the tests and tolerances of this attachment may be used in subsequent continuing qualification evaluations for any given test if the sponsor has submitted a proposed MQTG revision to the responsible Flight Standards office and has received responsible Flight Standards office approval.

i. FTDs are evaluated and qualified with an engine model simulating the airplane data supplier's flight test engine. For qualification of alternative engine models (either variations of the flight test engines or other manufacturer's engines) additional tests with the alternative engine models may be required. This attachment contains guidelines for alternative engines.

j. Testing Computer Controlled Aircraft (CCA) simulators, or other highly augmented airplane simulators, flight test data is required for the Normal (N) and/or Non-normal (NN) control states, as indicated in this attachment. Where test results are independent of control state, Normal or Non-normal control data may be used. All tests in Table B2A require test results in the Normal control state unless specifically noted otherwise in the Test Details section following the CCA designation. The responsible Flight Standards office will determine what tests are appropriate for airplane simulation data. When making this determination, the responsible Flight Standards office may require other levels of control state degradation for specific airplane tests. Where Non-normal control states are required, test data must be provided for one or more Non-normal control states, and must include the least augmented state. Where applicable, flight test data must record Normal and Non-normal states for:

(1) Pilot controller deflections or electronically generated inputs, including location of input; and

(2) Flight control surface positions unless test results are not affected by, or are independent of, surface positions.

k. Tests of handling qualities must include validation of augmentation devices. FTDs for highly augmented airplanes will be validated both in the unaugmented configuration (or failure state with the maximum permitted degradation in handling qualities) and the augmented configuration. Where various levels of handling qualities result from failure states, validation of the effect of the failure is necessary. Requirements for testing will be mutually agreed to between the sponsor and the responsible Flight Standards office on a case-by-case basis.

l. Some tests will not be required for airplanes using airplane hardware in the FTD flight deck (e.g., ''side stick controller''). These exceptions are noted in Section 2 ''Handling Qualities'' in Table B2A of this attachment. However, in these cases, the sponsor must provide a statement that the airplane hardware meets the appropriate manufacturer's specifications and the sponsor must have supporting information to that fact available for responsible Flight Standards office review.

m. For objective test purposes, see Appendix F of this part for the definitions of ''Near maximum,'' ''Light,'' and ''Medium'' gross weight.

END QPS REQUIREMENTS

BEGIN INFORMATION

n. In those cases where the objective test results authorize a ''snapshot test'' or a ''series of snapshot test results'' in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the ''snapshot.'' The steady state condition must exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snap shot.

o. Refer to AC 120–27, ''Aircraft Weight and Balance'' and FAA–H–8083–1, ''Aircraft Weight and Balance Handbook'' for more information.

END INFORMATION

Table B2A - Flight Training Device (FTD) Objective Tests

QPS REQUIREMENTS								INFORMATION
Test		Tolerance	Flight Conditions	Test Details	FTD Level			Notes
Entry Number	Title				5	6	7	
1. Performance.								
1.a.	**Taxi.**							
1.a.1	Minimum radius turn.	±0.9 m (3 ft) or ±20% of airplane turn radius.	Ground.	Plot both main and nose gear loci and key engine parameter(s). Data for no brakes and the minimum thrust required to maintain a steady turn except for airplanes requiring asymmetric thrust or braking to achieve the minimum radius turn.			X	
1.a.2	Rate of turn versus nosewheel steering angle (NWA).	±10% or ±2°/s of turn rate.	Ground.	Record for a minimum of two speeds, greater than minimum turning radius speed with one at a typical taxi speed, and with a spread of at least 5 kt.			X	
1.b.	**Takeoff.**			*Note.— For Level 7 FTD, all airplane manufacturer commonly-used certificated take-off flap settings must be demonstrated at least once either in minimum unstick speed (1.b.3), normal take-off (1.b.4), critical engine failure on take-off (1.b.5) or crosswind take-off (1.b.6).*				
1.b.1	Ground acceleration time and distance.	±1.5 s or ±5% of time; and ±61 m (200 ft) or ±5% of distance. For Level 6 FTD: ±1.5 s or ±5% of time.	Takeoff.	Acceleration time and distance must be recorded for a minimum of 80% of the total time from brake release to V_r. Preliminary aircraft certification data may be used.		X	X	May be combined with normal takeoff (1.b.4.) or rejected takeoff (1.b.7.). Plotted data should be shown using appropriate scales for each portion of the maneuver. For Level 6 FTD, this test is required only if RTO training credit is sought.
1.b.2	Minimum control speed, ground (V_{mcg}) using aerodynamic controls only per applicable airworthiness requirement or alternative engine inoperative test to demonstrate ground control characteristics.	±25% of maximum airplane lateral deviation reached or ±1.5 m (5 ft). For airplanes with reversible flight control systems: ±10% or ±2.2 daN (5 lbf) rudder pedal force.	Takeoff.	Engine failure speed must be within ±1 kt of airplane engine failure speed. Engine thrust decay must be that resulting from the mathematical model for the engine applicable to the FTD under test. If the modeled engine is not the same as the airplane manufacturer's flight test engine, a further test may be run with the same initial conditions using the thrust from the flight test data as the driving parameter.			X	If a V_{mcg} test is not available, an acceptable alternative is a flight test snap engine deceleration to idle at a speed between V_1 and V_1-10 kt, followed by control of heading using aerodynamic control only and recovery should be achieved with the main gear on the ground. To ensure only aerodynamic control, nosewheel steering must be disabled (i.e. castored) or the nosewheel held slightly off the ground.

1.b.3	Minimum unstick speed (V_{mu}) or equivalent test to demonstrate early rotation take-off characteristics.	±3 kt airspeed. ±1.5° pitch angle.	Takeoff.	Record time history data from 10 knots before start of rotation until at least 5 seconds after the occurrence of main gear lift-off.			**X**	V_{mu} is defined as the minimum speed at which the last main landing gear leaves the ground. Main landing gear strut compression or equivalent air/ground signal should be recorded. If a V_{mu} test is not available, alternative acceptable flight tests are a constant high-attitude takeoff run through main gear lift-off or an early rotation takeoff. If either of these alternative solutions is selected, aft body contact/tail strike protection functionality, if present on the airplane, should be active.
1.b.4	Normal take-off.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±6 m (20 ft) height. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force.	Takeoff.	Data required for near maximum certificated takeoff weight at mid center of gravity location and light takeoff weight at an aft center of gravity location. If the airplane has more than one certificated take-off configuration, a different configuration must be used for each weight. Record takeoff profile from brake release to at least 61 m (200 ft) AGL.			**X**	The test may be used for ground acceleration time and distance (1.b.1). Plotted data should be shown using appropriate scales for each portion of the maneuver.
1.b.5	Critical engine failure on take-off.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±6 m (20 ft) height. ±2° roll angle. ±2° side-slip angle. ±3° heading angle. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force; ±1.3 daN (3 lbf) or ±10% of wheel force; and	Takeoff.	Record takeoff profile to at least 61 m (200 ft) AGL. Engine failure speed must be within ±3 kt of airplane data. Test at near maximum takeoff weight			**X**	

		±2.2 daN (5 lbf) or ±10% of rudder pedal force.						
1.b.6	Crosswind take-off.	± 3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±6 m (20 ft) height. ±2° roll angle. ±2° side-slip angle. ±3° heading angle. Correct trends at ground speeds below 40 kt for rudder/pedal and heading angle. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force; ±1.3 daN (3 lbf) or ±10% of wheel force; and ±2.2 daN (5 lbf) or ±10% of rudder pedal force.	Takeoff.	Record takeoff profile from brake release to at least 61 m (200 ft) AGL. This test requires test data, including wind profile, for a crosswind component of at least 60% of the airplane performance data value measured at 10 m (33 ft) above the runway. Wind components must be provided as headwind and crosswind values with respect to the runway.			**X**	In those situations where a maximum crosswind or a maximum demonstrated crosswind is not known, contact the responsible Flight Standards office.
1.b.7.a.	Rejected Takeoff.	±5% of time or ±1.5 s. ±7.5% of distance or ±76 m (250 ft). For Level 6 FTD: ±5% of time or ±1.5 s.	Takeoff.	Record at mass near maximum takeoff weight. Speed for reject must be at least 80% of V_1. Maximum braking effort, auto or manual. Where a maximum braking demonstration is not available, an acceptable alternative is a test using approximately 80% braking and full reverse, if applicable. Time and distance must be recorded from brake release to a full stop.			**X**	Autobrakes will be used where applicable.
1.b.7.b.	Rejected Takeoff.	±5% of time or ±1.5 s.	Takeoff	Record time for at least 80% of the segment from initiation of the rejected takeoff to full stop.		**X**		For Level 6 FTD, this test is required only if RTO training credit is sought.

1.b.8.	Dynamic Engine Failure After Takeoff.	±2°/s or ±20% of body angular rates.	Takeoff.	Engine failure speed must be within ±3 kt of airplane data. Engine failure may be a snap deceleration to idle. Record hands-off from 5 s before engine failure to +5 s or 30° roll angle, whichever occurs first. **CCA**: Test in Normal and Non-normal control state.			**X**	For safety considerations, airplane flight test may be performed out of ground effect at a safe altitude, but with correct airplane configuration and airspeed.
1.c.	**Climb.**							
1.c.1.	Normal Climb, all engines operating.	±3 kt airspeed. ±0.5 m/s (100 ft/ min) or ±5% of rate of climb.	Clean.	Flight test data are preferred; however, airplane performance manual data are an acceptable alternative. Record at nominal climb speed and mid initial climb altitude. FTD performance is to be recorded over an interval of at least 300 m (1, 000 ft).	**X**	**X**	**X**	For Level 5 and Level 6 FTDs, this may be a snapshot test result.
1.c.2.	One-engine-inoperative 2nd segment climb.	±3 kt airspeed. ±0.5 m/s (100 ft/ min) or ±5% of rate of climb, but not less than airplane performance data requirements.	2nd segment climb.	Flight test data is preferred; however, airplane performance manual data is an acceptable alternative. Record at nominal climb speed. FTD performance is to be recorded over an interval of at least 300 m (1,000 ft). Test at WAT (weight, altitude or temperature) limiting condition.			**X**	
1.c.3.	One Engine Inoperative En route Climb.	±10% time, ±10% distance, ±10% fuel used	Clean	Flight test data or airplane performance manual data may be used. Test for at least a 1,550 m (5,000 ft) segment.			**X**	
1.c.4.	One Engine Inoperative Approach Climb for airplanes with icing accountability if provided in the airplane performance data for this phase of flight.	±3 kt airspeed. ±0.5 m/s (100 ft/ min) or ±5% rate of climb, but not less than airplane performance data.	Approach	Flight test data or airplane performance manual data may be used. FTD performance to be recorded over an interval of at least 300 m (1,000 ft). Test near maximum certificated landing weight as may be applicable to an approach in icing conditions.			**X**	Airplane should be configured with all anti-ice and de-ice systems operating normally, gear up and go-around flap. All icing accountability considerations, in accordance with the airplane performance data for an approach in icing conditions, should be applied.
1.d.	**Cruise / Descent.**							
1.d.1.	Level flight acceleration	±5% Time	Cruise	Time required to increase airspeed a minimum of 50 kt, using maximum continuous thrust rating or equivalent.			**X**	

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				For airplanes with a small operating speed range, speed change may be reduced to 80% of operational speed change.				
1.d.2.	Level flight deceleration.	±5% Time	Cruise	Time required to decrease airspeed a minimum of 50 kt, using idle power. For airplanes with a small operating speed range, speed change may be reduced to 80% of operational speed change.			**X**	
1.d.3.	Cruise performance.	±.05 EPR or ±3% N1 or ±5% of torque. ±5% of fuel flow.	Cruise.	The test may be a single snapshot showing instantaneous fuel flow, or a minimum of two consecutive snapshots with a spread of at least 3 minutes in steady flight.			**X**	
1.d.4.	Idle descent.	±3 kt airspeed. ±1.0 m/s (200 ft/min) or ±5% of rate of descent.	Clean.	Idle power stabilized descent at normal descent speed at mid altitude. FTD performance to be recorded over an interval of at least 300 m (1,000 ft).			**X**	
1.d.5.	Emergency descent.	±5 kt airspeed. ±1.5 m/s (300 ft/min) or ±5% of rate of descent.	As per airplane performance data.	FTD performance to be recorded over an interval of at least 900 m (3,000 ft).			**X**	Stabilized descent to be conducted with speed brakes extended if applicable, at mid altitude and near V_{mo} or according to emergency descent procedure.
1.e.	**Stopping.**							
1.e.1.	Deceleration time and distance, manual wheel brakes, dry runway, no reverse thrust.	±1.5 s or ±5% of time. For distances up to 1,220 m (4,000 ft), the smaller of ±61 m (200 ft) or ±10% of distance. For distances greater than 1,220 m (4,000 ft), ±5% of distance.	Landing.	Time and distance must be recorded for at least 80% of the total time from touchdown to a full stop. Position of ground spoilers and brake system pressure must be plotted (if applicable). Data required for medium and near maximum certificated landing weight. Engineering data may be used for the medium weight condition.			**X**	
1.e.2.	Deceleration time and distance, reverse thrust, no wheel brakes, dry runway.	±1.5 s or ±5% of time; and the smaller of ±61 m (200 ft) or ±10% of distance.	Landing	Time and distance must be recorded for at least 80% of the total time from initiation of reverse thrust to full thrust reverser minimum operating speed. Position of ground spoilers must be plotted (if applicable). Data required for medium and near maximum certificated landing weight. Engineering data may be used for the medium weight condition.			**X**	
1.e.3.	Stopping distance, wheel brakes, wet runway.	±61 m (200 ft) or ±10% of distance.	Landing.	Either flight test or manufacturer's performance manual data must be used, where available.			**X**	

				Engineering data, based on dry runway flight test stopping distance and the effects of contaminated runway braking coefficients, are an acceptable alternative.				
1.e.4.	Stopping distance, wheel brakes, icy runway.	±61 m (200 ft) or ±10% of distance.	Landing.	Either flight test or manufacturer's performance manual data must be used, where available. Engineering data, based on dry runway flight test stopping distance and the effects of contaminated runway braking coefficients, are an acceptable alternative.			X	
1.f.	**Engines.**							
1.f.1.	Acceleration.	For Level 7 FTD: ±10% Ti or ±0.25 s; and ±10% Tt or ±0.25 s. For Level 6 FTD: ±10% Tt or ±0.25 s. For Level 5 FTD: ±1 s	Approach or landing	Total response is the incremental change in the critical engine parameter from idle power to go-around power.	X	X	X	See Appendix F of this part for definitions of T_i and T_t.
1.f.2.	Deceleration.	For Level 7 FTD: ±10% Ti or ±0.25 s; and ±10% Tt or ±0.25 s. For Level 6 FTD: ±10% Tt or ±0.25 s. For Level 5 FTD: ±1 s	Ground	Total response is the incremental change in the critical engine parameter from maximum take-off power to idle power.	X	X	X	See Appendix F of this part for definitions of T_i and T_t.
2. Handling Qualities.								
2.a.	**Static Control Tests.**							
	Note.1 — Testing of position versus force is not applicable if forces are generated solely by use of airplane hardware in the FTD. *Note 2 — Pitch, roll and yaw controller position versus force or time should be measured at the control. An alternative method in lieu of external test fixtures at the flight controls would be to have recording and measuring instrumentation built into the FTD. The force and position data from this instrumentation could be directly recorded and matched to the airplane data. Provided the instrumentation was verified by using external measuring equipment while conducting the static control checks, or equivalent means, and that evidence of the satisfactory comparison is included in the MQTG, the instrumentation could be used for both initial and recurrent evaluations for the measurement of all required control checks. Verification of the instrumentation by using external measuring equipment should be repeated if major modifications and/or repairs are made to the control loading system. Such a permanent installation could be used without any time being lost for the installation of external devices. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures as the validation data where applicable.* *Note 3 — (Level 7 FTD only) FTD static control testing from the second set of pilot controls is only required if both sets of controls are not mechanically interconnected on the FTD. A rationale is required from the data provider if a single set of data is applicable to both sides. If controls are mechanically interconnected in the FTD, a single set of tests is sufficient.*							
2.a.1.a.	Pitch controller position versus force and surface position calibration.	±0.9 daN (2 lbf) breakout. ±2.2 daN (5 lbf) or ±10% of force. ±2° elevator angle.	Ground.	Record results for an uninterrupted control sweep to the stops.		X	X	Test results should be validated with in-flight data from tests such as longitudinal static stability, stalls, etc.
2.a.1.b.	Pitch controller position versus force	±0.9 daN (2 lbf) breakout.	As determined by sponsor	Record results during initial qualification evaluation for an uninterrupted control sweep to the stops. The recorded tolerances apply to subsequent comparisons on continuing qualification evaluations.	X			Applicable only on continuing qualification evaluations. The intent is to design the control feel for Level 5 to be able to manually fly an instrument

		±2.2 daN (5 lbf) or ±10% of force.						approach; and not to compare results to flight test or other such data.
2.a.2.a.	Roll controller position versus force and surface position calibration.	±0.9 daN (2 lbf) breakout. ±1.3 daN (3 lbf) or ±10% of force. ±2° aileron angle. ±3° spoiler angle.	Ground.	Record results for an uninterrupted control sweep to the stops.		X	X	Test results should be validated with in-flight data from tests such as engine-out trims, steady state side-slips, etc.
2.a.2.b.	Roll controller position versus force	±0.9 daN (2 lbf) breakout. ±1.3 daN (3 lbf) or ±10% of force.	As determined by sponsor	Record results during initial qualification evaluation for an uninterrupted control sweep to the stops. The recorded tolerances apply to subsequent comparisons on continuing qualification evaluations.	X			Applicable only on continuing qualification evaluations. The intent is to design the control feel for Level 5 to be able to manually fly an instrument approach; and not to compare results to flight test or other such data.
2.a.3.a.	Rudder pedal position versus force and surface position calibration.	±2.2 daN (5 lbf) breakout. ±2.2 daN (5 lbf) or ±10% of force. ±2° rudder angle.	Ground.	Record results for an uninterrupted control sweep to the stops.		X	X	Test results should be validated with in-flight data from tests such as engine-out trims, steady state side-slips, etc.
2.a.3.b.	Rudder pedal position versus force	±2.2 daN (5 lbf) breakout. ±2.2 daN (5 lbf) or ±10% of force.	As determined by sponsor	Record results during initial qualification evaluation for an uninterrupted control sweep to the stops. The recorded tolerances apply to subsequent comparisons on continuing qualification evaluations.	X			Applicable only on continuing qualification evaluations. The intent is to design the control feel for Level 5 to be able to manually fly an instrument approach; and not to compare results to flight test or other such data.
2.a.4.a.	Nosewheel Steering Controller Force and Position Calibration.	±0.9 daN (2 lbf) breakout. ±1.3 daN (3 lbf) or ±10% of force. ±2° NWA.	Ground.	Record results of an uninterrupted control sweep to the stops.			X	
2.a.4.b.	Nosewheel Steering Controller Force	±0.9 daN (2 lbf) breakout. ±1.3 daN (3 lbf) or ±10% of force.	Ground.	Record results of an uninterrupted control sweep to the stops.		X		
2.a.5.	Rudder Pedal Steering Calibration.	±2° NWA.	Ground.	Record results of an uninterrupted control sweep to the stops.		X	X	
2.a.6.	Pitch Trim Indicator vs. Surface Position Calibration.	±0.5° trim angle.	Ground.			X	X	The purpose of the test is to compare FSTD surface position indicator against the FSTD flight controls model computed value.

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2.a.7.	Pitch Trim Rate.	±10% of trim rate (°/s) or ±0.1°/s trim rate.	Ground and approach.	Trim rate to be checked at pilot primary induced trim rate (ground) and autopilot or pilot primary trim rate in-flight at go-around flight conditions. For CCA, representative flight test conditions must be used.			**X**	
2.a.8.	Alignment of cockpit throttle lever versus selected engine parameter.	When matching engine parameters: ±5° of TLA. When matching detents: ±3% N1 or ±.03 EPR or ±3% torque, or ±3% maximum rated manifold pressure, or equivalent. Where the levers do not have angular travel, a tolerance of ±2 cm (±0.8 in) applies.	Ground.	Simultaneous recording for all engines. The tolerances apply against airplane data. For airplanes with throttle detents, all detents to be presented and at least one position between detents/ endpoints (where practical). For airplanes without detents, end points and at least three other positions are to be presented.		**X**	**X**	Data from a test airplane or engineering test bench are acceptable, provided the correct engine controller (both hardware and software) is used. In the case of propeller-driven airplanes, if an additional lever, usually referred to as the propeller lever, is present, it should also be checked. This test may be a series of snapshot tests.
2.a.9.a.	Brake pedal position versus force and brake system pressure calibration.	±2.2 daN (5 lbf) or ±10% of force. ±1.0 MPa (150 psi) or ±10% of brake system pressure.	Ground.	Relate the hydraulic system pressure to pedal position in a ground static test. Both left and right pedals must be checked.			**X**	FTD computer output results may be used to show compliance.
2.a.9.b.	Brake pedal position versus force	±2.2 daN (5 lbf) or ±10% of force.	Ground.	Two data points are required: zero and maximum deflection. Computer output results may be used to show compliance.		**X**		FTD computer output results may be used to show compliance. Test not required unless RTO credit is sought.
2.b.	**Dynamic Control Tests.**							
	Note.— Tests 2.b.1, 2.b.2 and 2.b.3 are not applicable for FTDs where the control forces are completely generated within the airplane controller unit installed in the FTD. Power setting may be that required for level flight unless otherwise specified. See paragraph 4 of Appendix A, Attachment 2.							
2.b.1.	Pitch Control.	**For underdamped systems**: $T(P_0)$ ±10% of P_0 or ±0.05 s. $T(P_1)$ ±20% of P_1 or ±0.05 s. $T(P_2)$ ±30% of P_2 or ±0.05 s. $T(P_n)$ ±10*(n+1)% of P_n	Takeoff, Cruise, and Landing.	Data must be for normal control displacements in both directions (approximately 25% to 50% of full throw or approximately 25% to 50% of maximum allowable pitch controller deflection for flight conditions limited by the maneuvering load envelope). Tolerances apply against the absolute values of each period (considered independently).			**X**	n = the sequential period of a full oscillation. Refer to paragraph 4 of Appendix A, Attachment 2 for additional information. For overdamped and critically damped systems, see Figure A2B of Appendix A for an illustration of the reference measurement.

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		or ±0.05 s. $T(A_n)$ ±10% of A_{max}, where A_{max} is the largest amplitude or ±0.5% of the total control travel (stop to stop). $T(A_d)$ ±5% of A_d = residual band or ±0.5% of the maximum control travel = residual band. ±1 significant overshoots (minimum of 1 significant overshoot). Steady state position within residual band. *Note 1.— Tolerances should not be applied on period or amplitude after the last significant overshoot.* *Note 2.— Oscillations within the residual band are not considered significant and are not subject to tolerances.* **For overdamped and critically damped systems only**, the following tolerance applies: $T(P_0)$ ±10% of P_0 or ±0.05 s.						
2.b.2.	Roll Control.	Same as 2.b.1.	Takeoff, Cruise, and Landing.	Data must be for normal control displacement (approximately 25% to 50% of full throw or approximately 25% to 50% of maximum allowable roll controller deflection for flight conditions limited by the maneuvering load envelope).			**X**	Refer to paragraph 4 of Appendix A, Attachment 2 for additional information. For overdamped and critically damped systems, see Figure A2B of Appendix A for an illustration of the reference measurement.
2.b.3.	Yaw Control.	Same as 2.b.1.	Takeoff, Cruise, and Landing.	Data must be for normal control displacement (approximately 25% to 50% of full throw).			**X**	Refer to paragraph 4 of Appendix A, Attachment 2 for additional information.

								For overdamped and critically damped systems, see Figure A2B of Appendix A for an illustration of the reference measurement.
2.b.4.	Small Control Inputs – Pitch.	±0.15°/s body pitch rate or ±20% of peak body pitch rate applied throughout the time history.	Approach or Landing.	Control inputs must be typical of minor corrections made while established on an ILS approach (approximately 0.5 to 2°/s pitch rate). Test in both directions. Show time history data from 5 s before until at least 5 s after initiation of control input. If a single test is used to demonstrate both directions, there must be a minimum of 5 s before control reversal to the opposite direction. **CCA**: Test in normal and non-normal control state.			X	
2.b.5.	Small Control Inputs – Roll.	±0.15°/s body roll rate or ±20% of peak body roll rate applied throughout the time history.	Approach or landing.	Control inputs must be typical of minor corrections made while established on an ILS approach (approximately 0.5 to 2°/s roll rate). Test in one direction. For airplanes that exhibit non-symmetrical behavior, test in both directions. Show time history data from 5 s before until at least 5 s after initiation of control input. If a single test is used to demonstrate both directions, there must be a minimum of 5 s before control reversal to the opposite direction. **CCA**: Test in normal and non-normal control state.			X	
2.b.6.	Small Control Inputs – Yaw.	±0.15°/s body yaw rate or ±20% of peak body yaw rate applied throughout the time history.	Approach or landing.	Control inputs must be typical of minor corrections made while established on an ILS approach (approximately 0.5 to 2°/s yaw rate). Test in both directions. Show time history data from 5 s before until at least 5 s after initiation of control input. If a single test is used to demonstrate both directions, there must be a minimum of 5 s before control reversal to the opposite direction. **CCA:** Test in normal and non-normal control state.			X	

2.c.	**Longitudinal Control Tests.**							
	Power setting is that required for level flight unless otherwise specified.							
2.c.1.a.	Power Change Dynamics.	±3 kt airspeed. ±30 m (100 ft) altitude. ±1.5° or ±20% of pitch angle.	Approach.	Power change from thrust for approach or level flight to maximum continuous or go-around power. Time history of uncontrolled free response for a time increment equal to at least 5 s before initiation of the power change to the completion of the power change + 15 s. **CCA:** Test in normal and non-normal control mode			X	
2.c.1.b.	Power Change Force.	±5 lb (2.2 daN) or, ±20% pitch control force.	Approach.	May be a series of snapshot test results. Power change dynamics test as described in test 2.c.1.a. will be accepted. **CCA:** Test in Normal and Non-normal control mode.	X	X		
2.c.2.a.	Flap/Slat Change Dynamics.	±3 kt airspeed. ±30 m (100 ft) altitude. ±1.5° or ±20% of pitch angle.	Takeoff through initial flap retraction, and approach to landing.	Time history of uncontrolled free response for a time increment equal to at least 5 s before initiation of the reconfiguration change to the completion of the reconfiguration change + 15 s. **CCA:** Test in normal and non-normal control mode			X	
2.c.2.b.	Flap/Slat Change Force.	±5 lb (2.2 daN) or, ±20% pitch control force.	Takeoff through initial flap retraction, and approach to landing.	May be a series of snapshot test results. Flap/Slat change dynamics test as described in test 2.c.2.a. will be accepted. **CCA:** Test in Normal and Non-normal control mode.	X	X		
2.c.3.	Spoiler/Speedbrake Change Dynamics.	±3 kt airspeed. ±30 m (100 ft) altitude. ±1.5° or ±20% of pitch angle.	Cruise.	Time history of uncontrolled free response for a time increment equal to at least 5 s before initiation of the configuration change to the completion of the configuration change +15 s. Results required for both extension and retraction. **CCA:** Test in normal and non-normal control mode			X	
2.c.4.a.	Gear Change Dynamics.	±3 kt airspeed. ±30 m (100 ft) altitude. ±1.5° or ±20% of pitch angle.	Takeoff (retraction), and Approach (extension).	Time history of uncontrolled free response for a time increment equal to at least 5 s before initiation of the configuration change to the completion of the configuration change + 15 s. **CCA:** Test in normal and non-normal control mode			X	
2.c.4.b.	Gear Change Force.	±5 lb (2.2 daN) or, ±20% pitch control force.	Takeoff (retraction) and Approach (extension).	May be a series of snapshot test results. Gear change dynamics test as described in test 2.c.4.a. will be accepted.	X	X		

				CCA: Test in Normal and Non-normal control mode.				
2.c.5.	Longitudinal Trim.	±1° elevator angle. ±0.5° stabilizer or trim surface angle. ±1° pitch angle. ±5% of net thrust or equivalent.	Cruise, Approach, and Landing.	Steady-state wings level trim with thrust for level flight. This test may be a series of snapshot tests. Level 5 FTD may use equivalent stick and trim controllers in lieu of elevator and trim surface. **CCA**: Test in normal or non-normal control mode, as applicable.	**X**	**X**	**X**	
2.c.6.	Longitudinal Maneuvering Stability (Stick Force/g).	±2.2 daN (5 lbf) or ±10% of pitch controller force. Alternative method: ±1° or ±10% of the change of elevator angle.	Cruise, Approach, and Landing.	Continuous time history data or a series of snapshot tests may be used. Test up to approximately 30° of roll angle for approach and landing configurations. Test up to approximately 45° of roll angle for the cruise configuration. Force tolerance not applicable if forces are generated solely by the use of airplane hardware in the FTD. Alternative method applies to airplanes which do not exhibit stick-force-per-g characteristics. **CCA:** Test in normal or non-normal control mode		**X**	**X**	
2.c.7.	Longitudinal Static Stability.	±2.2 daN (5 lbf) or ±10% of pitch controller force. Alternative method: ±1° or ±10% of the change of elevator angle.	Approach.	Data for at least two speeds above and two speeds below trim speed. The speed range must be sufficient to demonstrate stick force versus speed characteristics. This test may be a series of snapshot tests. Force tolerance is not applicable if forces are generated solely by the use of airplane hardware in the FTD. Alternative method applies to airplanes which do not exhibit speed stability characteristics. Level 5 must exhibit positive static stability, but need not comply with the numerical tolerance. **CCA:** Test in normal or non-normal control mode, as applicable.	**X**	**X**	**X**	
2.c.8.a.	Approach to Stall Characteristics	±3 kt airspeed for initial buffet, stall warning, and stall speeds. Control inputs must be plotted and demonstrate	Second Segment Climb, High Altitude Cruise (Near Performance Limited Condition), and Approach or Landing	Each of the following stall entry methods must be demonstrated in at least one of the three required flight conditions: ▪ Stall entry at wings level (1g) ▪ Stall entry in turning flight of at least 25° bank angle (accelerated stall)			**X**	Tests may be conducted at centers of gravity typically required for airplane certification stall testing.

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		correct trend and magnitude. ±2.0° pitch angle ±2.0° angle of attack ±2.0° bank angle ±2.0° sideslip angle Additionally, for those simulators with reversible flight control systems: ±10% or ±5 lb (2.2 daN)) Stick/Column force (prior to "g break" only).		▪ Stall entry in a power-on condition (required only for turboprop aircraft) The required cruise condition must be conducted in a flaps-up (clean) configuration. The second segment climb and approach/landing conditions must be conducted at different flap settings. For airplanes that exhibit stall buffet as the first indication of a stall, for qualification of this task, the FTD must be equipped with a vibration system that meets the applicable subjective and objective requirements in Appendix A of this Part.				
2.c.8.b.	Stall Warning (actuation of stall warning device.)	±3 kts. airspeed, ±2° bank for speeds greater than actuation of stall warning device or initial buffet.	Second Segment Climb, and Approach or Landing.	The stall maneuver must be entered with thrust at or near idle power and wings level (1g). Record the stall warning signal and initial buffet if applicable. **CCA:** Test in Normal and Non-normal control states.	**X**	**X**		
2.c.9.a.	Phugoid Dynamics.	±10% of period. ±10% of time to one half or double amplitude or ±0.02 of damping ratio.	Cruise.	Test must include three full cycles or that necessary to determine time to one half or double amplitude, whichever is less. **CCA:** Test in non-normal control mode.		**X**	**X**	
2.c.9.b.	Phugoid Dynamics.	±10% period, Representative damping.	Cruise.	The test must include whichever is less of the following: Three full cycles (six overshoots after the input is completed), or the number of cycles sufficient to determine representative damping. **CCA:** Test in non-normal control mode.	**X**			
2.c.10	Short Period Dynamics.	±1.5° pitch angle or ±2°/s pitch rate. ±0.1 g normal acceleration	Cruise.	**CCA:** (Level 7 FTD) Test in normal and non-normal control mode. (Level 6 FTD) Test in non-normal control mode.		**X**	**X**	
2.c.11.	**(Reserved)**							
2.d.	**Lateral Directional Tests.**							
	Power setting is that required for level flight unless otherwise specified.							
2.d.1.	Minimum control speed, air (V_{mca}) or landing (V_{mcl}), per applicable airworthiness requirement or low speed engine-inoperative handling characteristics in the air.	±3 kt airspeed.	Takeoff or Landing (whichever is most critical in the airplane).	Takeoff thrust must be set on the operating engine(s). Time history or snapshot data may be used. **CCA**: Test in normal or non-normal control state, as applicable.			**X**	Minimum speed may be defined by a performance or control limit which prevents demonstration of V_{mca} or V_{mcl} in the conventional manner.

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2.d.2.	Roll Response (Rate).	±2°/s or ±10% of roll rate. For airplanes with reversible flight control systems (Level 7 FTD only): ±1.3 daN (3 lbf) or ±10% of wheel force.	Cruise, and Approach or Landing.	Test with normal roll control displacement (approximately one-third of maximum roll controller travel). This test may be combined with step input of flight deck roll controller test 2.d.3.	**X**	**X**	**X**	
2.d.3.	Step input of flight deck roll controller.	±2° or ±10% of roll angle.	Approach or Landing.	This test may be combined with roll response (rate) test 2.d.2. **CCA:** (Level 7 FTD) Test in normal and non-normal control mode. (Level 6 FTD) Test in non-normal control mode.		**X**	**X**	With wings level, apply a step roll control input using approximately one-third of the roll controller travel. When reaching approximately 20° to 30° of bank, abruptly return the roll controller to neutral and allow approximately 10 seconds of airplane free response.
2.d.4.a.	Spiral Stability.	Correct trend and ±2° or ±10% of roll angle in 20 s. If alternate test is used: correct trend and ±2° aileron angle.	Cruise, and Approach or Landing.	Airplane data averaged from multiple tests may be used. Test for both directions. As an alternative test, show lateral control required to maintain a steady turn with a roll angle of approximately 30°. **CCA:** Test in non-normal control mode.			**X**	
2.d.4.b.	Spiral Stability.	Correct trend and ±3° or ±10% of roll angle in 20 s.	Cruise	Airplane data averaged from multiple tests may be used. Test for both directions. As an alternative test, show lateral control required to maintain a steady turn with a roll angle of approximately 30°. **CCA:** Test in non-normal control mode.		**X**		
2.d.4.c.	Spiral Stability.	Correct trend	Cruise	Airplane data averaged from multiple tests may be used. **CCA:** Test in non-normal control mode.	**X**			
2.d.5.	Engine Inoperative Trim.	±1° rudder angle or ±1° tab angle or equivalent rudder pedal. ±2° side-slip angle.	Second Segment Climb, and Approach or Landing.	This test may consist of snapshot tests.			**X**	Test should be performed in a manner similar to that for which a pilot is trained to trim an engine failure condition. 2nd segment climb test should be at takeoff thrust. Approach or landing test should be at thrust for level flight.
2.d.6.a.	Rudder Response.	±2°/s or ±10% of yaw rate.	Approach or Landing.	For Level 7 FTD: Test with stability augmentation on and off.		**X**	**X**	

				Test with a step input at approximately 25% of full rudder pedal throw. Not required if rudder input and response is shown in Dutch Roll test (test 2.d.7). **CCA:** Test in normal and non-normal control mode				
2.d.6.b.	Rudder Response.	Roll rate ±2°/sec, bank angle ±3°.	Approach or Landing.	May be roll response to a given rudder deflection. **CCA:** Test in Normal and Non-normal control states.	X			May be accomplished as a yaw response test, in which case the procedures and requirements of test 2.d.6.a. will apply.
2.d.7.	Dutch Roll	±0.5 s or ±10% of period. ±10% of time to one half or double amplitude or ±.02 of damping ratio. (Level 7 FTD only): ±1 s or ±20% of time difference between peaks of roll angle and side-slip angle.	Cruise, and Approach or Landing.	Test for at least six cycles with stability augmentation off. **CCA:** Test in non-normal control mode.		X	X	
2.d.8.	Steady State Sideslip.	For a given rudder position: ±2° roll angle; ±1° side-slip angle; ±2° or ±10% of aileron angle; and ±5° or ±10% of spoiler or equivalent roll controller position or force. For airplanes with reversible flight control systems (Level 7 FTD only): ±1.3 daN (3 lbf) or ±10% of wheel force.	Approach or Landing.	This test may be a series of snapshot tests using at least two rudder positions (in each direction for propeller-driven airplanes), one of which must be near maximum allowable rudder. (Level 5 and Level 6 FTD only): Sideslip angle is matched only for repeatability and only on continuing qualification evaluations.	X	X	X	

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		±2.2 daN (5 lbf) or ±10% of rudder pedal force.						
2.e.	**Landings.**							
2.e.1.	Normal Landing.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±3 m (10 ft) or ±10% of height. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force.	Landing.	Test from a minimum of 61 m (200 ft) AGL to nosewheel touchdown. **CCA:** Test in normal and non-normal control mode, if applicable.			**X**	Two tests should be shown, including two normal landing flaps (if applicable) one of which should be near maximum certificated landing mass, the other at light or medium mass.
2.e.2.	Minimum Flap Landing.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±3 m (10 ft) or ±10% of height. For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force.	Minimum Certified Landing Flap Configuration.	Test from a minimum of 61 m (200 ft) AGL to nosewheel touchdown. Test at near maximum certificated landing weight.			**X**	
2.e.3.	Crosswind Landing.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±3 m (10 ft) or ±10% of height. ±2° roll angle. ±2° side-slip angle. ±3° heading angle.	Landing.	Test from a minimum of 61 m (200 ft) AGL to a 50% decrease in main landing gear touchdown speed. It requires test data, including wind profile, for a crosswind component of at least 60% of airplane performance data value measured at 10 m (33 ft) above the runway. Wind components must be provided as headwind and crosswind values with respect to the runway.			**X**	In those situations where a maximum crosswind or a maximum demonstrated crosswind is not known, contact the responsible Flight Standards office.

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		For airplanes with reversible flight control systems: ±2.2 daN (5 lbf) or ±10% of column force. ±1.3 daN (3 lbf) or ±10% of wheel force. ±2.2 daN (5 lbf) or ±10% of rudder pedal force.						
2.e.4.	One Engine Inoperative Landing.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±3 m (10 ft) or ±10% of height. ±2° roll angle. ±2° side-slip angle. ±3° heading angle.	Landing.	Test from a minimum of 61 m (200 ft) AGL to a 50% decrease in main landing gear touchdown speed.			**X**	
2.e.5.	Autopilot landing (if applicable).	±1.5 m (5 ft) flare height. ±0.5 s or ± 10% of Tf. ±0.7 m/s (140 ft/min) rate of descent at touchdown. ±3 m (10 ft) lateral deviation during roll-out.	Landing.	If autopilot provides roll-out guidance, record lateral deviation from touchdown to a 50% decrease in main landing gear touchdown speed. Time of autopilot flare mode engage and main gear touchdown must be noted.			**X**	See Appendix F of this part for definition of T_f.
2.e.6.	All-engine autopilot go-around.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA.	As per airplane performance data.	Normal all-engine autopilot go-around must be demonstrated (if applicable) at medium weight.			**X**	
2.e.7.	One engine inoperative go around.	±3 kt airspeed. ±1.5° pitch angle. ±1.5° AOA. ±2° roll angle.	As per airplane performance data.	Engine inoperative go-around required near maximum certificated landing weight with critical engine inoperative. Provide one test with autopilot (if applicable) and one without autopilot.			**X**	

		±2° side-slip angle.		**CCA**: Non-autopilot test to be conducted in non-normal mode.				
2.e.8.	Directional control (rudder effectiveness) with symmetric reverse thrust.	±5 kt airspeed. ±2°/s yaw rate.	Landing.	Apply rudder pedal input in both directions using full reverse thrust until reaching full thrust reverser minimum operating speed.			X	
2.e.9.	Directional control (rudder effectiveness) with asymmetric reverse thrust.	±5 kt airspeed. ±3° heading angle.	Landing.	With full reverse thrust on the operating engine(s), maintain heading with rudder pedal input until maximum rudder pedal input or thrust reverser minimum operation speed is reached.			X	
2.f.	**Ground Effect.**							
	Test to demonstrate Ground Effect.	±1° elevator angle. ±0.5° stabilizer angle. ±5% of net thrust or equivalent. ±1° AOA. ±1.5 m (5 ft) or ±10% of height. ±3 kt airspeed. ±1° pitch angle.	Landing.	A rationale must be provided with justification of results. **CCA:** Test in normal or non-normal control mode, as applicable.			X	See paragraph on Ground Effect in this attachment for additional information.
2.g.	**Reserved**							
2.h.	**Flight Maneuver and Envelope Protection Functions.**							
	Note. — The requirements of 2.h are only applicable to computer-controlled airplanes. Time history results of response to control inputs during entry into each envelope protection function (i.e. with normal and degraded control states if their function is different) are required. Set thrust as required to reach the envelope protection function.							
2.h.1.	Overspeed.	±5 kt airspeed.	Cruise.				X	
2.h.2.	Minimum Speed.	±3 kt airspeed.	Takeoff, Cruise, and Approach or Landing.				X	
2.h.3.	Load Factor.	±0.1g normal load factor	Takeoff, Cruise.				X	
2.h.4.	Pitch Angle.	±1.5° pitch angle	Cruise, Approach.				X	
2.h.5.	Bank Angle.	±2° or ±10% bank angle	Approach.				X	
2.h.6.	Angle of Attack.	±1.5° angle of attack	Second Segment Climb, and Approach or Landing.				X	
3. Reserved								
4. Visual System.								
4.a.	**Visual scene quality**							
4.a.1.	Continuous cross-cockpit visual field of view.	Visual display providing each pilot with a minimum of 176° horizontal and 36° vertical continuous field of view.	Not applicable.	Required as part of MQTG but not required as part of continuing evaluations.			X	Field of view should be measured using a visual test pattern filling the entire visual scene (all channels) consisting of a matrix of black and white 5° squares.

								Installed alignment should be confirmed in an SOC (this would generally consist of results from acceptance testing).
4.a.2.	System Geometry	Geometry of image should have no distracting discontinuities.					X	
4.a.3	Surface resolution (object detection).	Not greater than 4 arc minutes.	Not applicable.				X	Resolution will be demonstrated by a test of objects shown to occupy the required visual angle in each visual display used on a scene from the pilot's eyepoint. The object will subtend 4 arc minutes to the eye. This may be demonstrated using threshold bars for a horizontal test. A vertical test should also be demonstrated. The subtended angles should be confirmed by calculations in an SOC.
4.a.4	Light point size.	Not greater than 8 arc minutes.	Not applicable.				X	Light point size should be measured using a test pattern consisting of a centrally located single row of white light points displayed as both a horizontal and vertical row. It should be possible to move the light points relative to the eyepoint in all axes. At a point where modulation is just discernible in each visual channel, a calculation should be made to determine the light spacing. An SOC is required to state test method and calculation.
4.a.5	Raster surface contrast ratio.	Not less than 5:1.	Not applicable.				X	Surface contrast ratio should be measured using a raster drawn test pattern filling the entire visual scene (all channels). The test pattern should consist of black and white squares, 5° per square, with a white square in the center of each channel.

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								Measurement should be made on the center bright square for each channel using a 1° spot photometer. This value should have a minimum brightness of 7 cd/m² (2 ft-lamberts). Measure any adjacent dark squares. The contrast ratio is the bright square value divided by the dark square value. *Note 1. — During contrast ratio testing, FTD aft-cab and flight deck ambient light levels should be as low as possible.* *Note 2. — Measurements should be taken at the center of squares to avoid light spill into the measurement device.*
4.a.6	Light point contrast ratio.	Not less than 10:1.	Not applicable.				X	Light point contrast ratio should be measured using a test pattern demonstrating an area of greater than 1° area filled with white light points and should be compared to the adjacent background. *Note. — Light point modulation should be just discernible on calligraphic systems but will not be discernable on raster systems.* Measurements of the background should be taken such that the bright square is just out of the light meter FOV. *Note. — During contrast ratio testing, FTD aft-cab and flight deck ambient light levels should be as low as practical.*
4.a.7	Light point brightness.	Not less than 20 cd/m² (5.8 ft-lamberts).	Not applicable.				X	Light points should be displayed as a matrix creating a square. On calligraphic systems the light points should just merge.

								On raster systems the light points should overlap such that the square is continuous (individual light points will not be visible).
4.a.8	Surface brightness.	Not less than 14 cd/m² (4.1 ft-lamberts) on the display.	Not applicable.				**X**	Surface brightness should be measured on a white raster, measuring the brightness using the 1° spot photometer. Light points are not acceptable. Use of calligraphic capabilities to enhance raster brightness is acceptable.
4.b	**Head-Up Display (HUD)**							
4.b.1	Static Alignment.	Static alignment with displayed image. HUD bore sight must align with the center of the displayed image spherical pattern. Tolerance +/- 6 arc min.					**X**	Alignment requirement only applies to the pilot flying.
4.b.2	System display.	All functionality in all flight modes must be demonstrated.					**X**	A statement of the system capabilities should be provided and the capabilities demonstrated
4.b.3	HUD attitude versus FTD attitude indicator (pitch and roll of horizon).	Pitch and roll align with aircraft instruments.	Flight				**X**	Alignment requirement only applies to the pilot flying.
4.c	**Enhanced Flight Vision System (EFVS)**							
4.c.1	Registration test.	Alignment between EFVS display and out of the window image must represent the alignment typical of the aircraft and system type.	Takeoff point and on approach at 200 ft.				**X**	Alignment requirement only applies to the pilot flying. *Note.— The effects of the alignment tolerance in 4.b.1 should be taken into account.*
4.c.2	EFVS RVR and visibility calibration.	The scene represents the EFVS view at 350 m (1,200 ft) and 1,609 m (1 sm) RVR including correct light intensity.	Flight				**X**	Infra-red scene representative of both 350 m (1,200 ft), and 1,609 m (1 sm) RVR. Visual scene may be removed.
4.c.3	Thermal crossover.	Demonstrate thermal crossover effects during day to night transition.	Day and night				**X**	The scene will correctly represent the thermal

								characteristics of the scene during a day to night transition.
4.d	**Visual ground segment**							
4.d.1	Visual ground segment (VGS).	Near end: the correct number of approach lights within the computed VGS must be visible. Far end: ±20% of the computed VGS. The threshold lights computed to be visible must be visible in the FTD.	Trimmed in the landing configuration at 30 m (100 ft) wheel height above touchdown zone on glide slope at an RVR setting of 300 m (1,000 ft) or 350 m (1,200 ft).	This test is designed to assess items impacting the accuracy of the visual scene presented to a pilot at DH on an ILS approach. These items include: 1) RVR/Visibility; 2) glide slope (G/S) and localizer modeling accuracy (location and slope) for an ILS; 3) for a given weight, configuration and speed representative of a point within the airplane's operational envelope for a normal approach and landing; and 4) Radio altimeter. *Note. — If non-homogeneous fog is used, the vertical variation in horizontal visibility should be described and included in the slant range visibility calculation used in the VGS computation.*			X	Pre-position for this test is encouraged but may be achieved via manual or autopilot control to the desired position.
4.e	**Visual System Capacity**							
4.e.1	System capacity – Day mode.	Not less than: 10,000 visible textured surfaces, 6,000 light points, 16 moving models.	Not applicable				X	Demonstrated through use of a visual scene rendered with the same image generator modes used to produce scenes for training. The required surfaces, light points, and moving models should be displayed simultaneously.
4.e.2	System capacity – Twilight/night mode.	Not less than: 10,000 visible textured surfaces, 15,000 light points, 16 moving models.	Not applicable				X	Demonstrated through use of a visual scene rendered with the same image generator modes used to produce scenes for training. The required surfaces, light points, and moving models should be displayed simultaneously.
5. Sound System. The sponsor will not be required to repeat the operational sound tests (i.e., tests 5.a.1. through 5.a.8. (or 5.b.1. through 5.b.9.) and 5.c., as appropriate) during continuing qualification evaluations if frequency response and background noise test results are within tolerance when compared to the initial qualification evaluation results, and the sponsor shows that no software changes have occurred that will affect the FTD's sound system. If the frequency response test method is chosen and fails, the sponsor may elect to fix the frequency response problem and repeat the test or the sponsor may elect to repeat the operational sound tests. If the operational sound tests are repeated during continuing qualification								

evaluations, the results may be compared against initial qualification evaluation results. All tests in this section must be presented using an unweighted 1/3-octave band format from band 17 to 42 (50 Hz to 16 kHz). A minimum 20 second average must be taken at a common location from where the initial evaluation sound results were gathered.								
5.a.	**Turbo-jet airplanes.**							All tests in this section should be presented using an unweighted 1/3-octave band format from at least band 17 to 42 (50 Hz to 16 kHz). A measurement of minimum 20 s should be taken at the location corresponding to the approved data set. Refer to paragraph 7 of Appendix A, Attachment 2.
5.a.1.	Ready for engine start.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to engine start. The APU must be on if appropriate.			X	
5.a.2.	All engines at idle.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to takeoff.			X	
5.a.3.	All engines at maximum allowable thrust with brakes set.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when	Ground.	Normal condition prior to takeoff.			X	

		compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.						
5.a.4.	Climb	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	En-route climb.	Medium altitude.			X	
5.a.5.	Cruise	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Cruise.	Normal cruise configuration.			X	
5.a.6.	Speed brake/spoilers extended (as appropriate).	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Cruise.	Normal and constant speed brake deflection for descent at a constant airspeed and power setting.			X	
5.a.7	Initial approach.	Initial evaluation: Subjective assessment of 1/3 octave bands.	Approach.	Constant airspeed, gear up, flaps/slats as appropriate.			X	

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		Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.						
5.a.8	Final approach.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Landing.	Constant airspeed, gear down, landing configuration flaps.			**X**	
5.b	**Propeller-driven airplanes**							All tests in this section should be presented using an unweighted 1/3-octave band format from at least band 17 to 42 (50 Hz to 16 kHz). A measurement of minimum 20 s should be taken at the location corresponding to the approved data set. Refer to paragraph 7 of Appendix A, Attachment 2.
5.b.1.	Ready for engine start.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to engine start. The APU must be on if appropriate.			**X**	

5.b.2	All propellers feathered, if applicable.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to take-off.			**X**	
5.b.3.	Ground idle or equivalent.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to takeoff.			**X**	
5.b.4	Flight idle or equivalent.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Ground.	Normal condition prior to takeoff.			**X**	
5.b.5	All engines at maximum allowable power with brakes set.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the	Ground.	Normal condition prior to takeoff.			**X**	

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		average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.						
5.b.6	Climb.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	En-route climb.	Medium altitude.			**X**	
5.b.7	Cruise	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Cruise.	Normal cruise configuration.			**X**	
5.b.8	Initial approach.	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	Approach.	Constant airspeed, gear up, flaps extended as appropriate, RPM as per operating manual.			**X**	
5.b.9	Final approach.	Initial evaluation: Subjective assessment of 1/3 octave bands.	Landing.	Constant airspeed, gear down, landing configuration flaps, RPM as per operating manual.			**X**	

		Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.						
5.c.	**Special cases.**	Initial evaluation: Subjective assessment of 1/3 octave bands. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.	As appropriate.				X	This applies to special steady-state cases identified as particularly significant to the pilot, important in training, or unique to a specific airplane type or model.
5.d	**FTD background noise**	Initial evaluation: background noise levels must fall below the sound levels described in Appendix A, Attachment 2, Paragraph 7.c (5). Recurrent evaluation: ±3 dB per 1/3 octave band compared to initial evaluation.		Results of the background noise at initial qualification must be included in the QTG document and approved by the responsible Flight Standards office. The measurements are to be made with the simulation running, the sound muted and a dead cockpit.			X	The simulated sound will be evaluated to ensure that the background noise does not interfere with training. Refer to paragraph 7 of this Appendix A, Attachment 2. This test should be presented using an unweighted 1/3 octave band format from band 17 to 42 (50 Hz to 16 kHz).
5.e	**Frequency response**	Initial evaluation: not applicable. Recurrent evaluation: cannot exceed ±5 dB difference on three consecutive bands when compared to initial evaluation and the average of the absolute differences between initial and recurrent evaluation results cannot exceed 2 dB.					X	Only required if the results are to be used during continuing qualification evaluations in lieu of airplane tests. The results must be approved by the responsible Flight Standards office during the initial qualification. This test should be presented using an unweighted 1/3 octave band format from band 17 to 42 (50 Hz to 16 kHz).

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6	**SYSTEMS INTEGRATION**							
6.a.	**System response time**							
6.a.1	Transport delay.	Instrument response: 100 ms (or less) after airplane response. Visual system response: 120 ms (or less) after airplane response.	Pitch, roll and yaw.				X	One separate test is required in each axis. Where EFVS systems are installed, the EFVS response should be within + or - 30 ms from visual system response, and not before motion system response. *Note.— The delay from the airplane EFVS electronic elements should be added to the 30 ms tolerance before comparison with visual system reference.*
6.a.2	Transport delay.	300 milliseconds or less after controller movement.	Pitch, roll and yaw.		X	X		If transport delay is the chosen method to demonstrate relative responses, the sponsor and the responsible Flight Standards office will use the latency values to ensure proper FTD response when reviewing those existing tests where latency can be identified (e.g., short period, roll response, rudder response).

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BEGIN INFORMATION

3. FOR ADDITIONAL INFORMATION ON THE FOLLOWING TOPICS, PLEASE REFER TO APPENDIX A, ATTACHMENT 2, AND THE INDICATED PARAGRAPH WITHIN THAT ATTACHMENT

- Control Dynamics, paragraph 4.
- Motion System, paragraph 6.
- Sound System, paragraph 7.
- Engineering Simulator Validation Data, paragraph 9.
- Validation Test Tolerances, paragraph 11.
- Validation Data Road Map, paragraph 12.
- Acceptance Guidelines for Alternative Engines Data, paragraph 13.
- Acceptance Guidelines for Alternative Avionics, paragraph 14.
- Transport Delay Testing, paragraph 15.
- Continuing Qualification Evaluation Validation Data Presentation, paragraph 16.

END INFORMATION

4. ALTERNATIVE OBJECTIVE DATA FOR FTD LEVEL 5

BEGIN QPS REQUIREMENTS

a. This paragraph (including the following tables) is relevant only to FTD Level 5. It is provided because this level is required to simulate the performance and handling characteristics of a set of airplanes with similar characteristics, such as normal airspeed/altitude operating envelope and the same number and type of propulsion systems (engines).

b. Tables B2B through B2E reflect FTD performance standards that are acceptable to the FAA. A sponsor must demonstrate that a device performs within these parameters, as applicable. If a device does not meet the established performance parameters for some or for all of the applicable tests listed in Tables B2B through B2E, the sponsor may use FAA accepted flight test data for comparison purposes for those tests.

c. Sponsors using the data from Tables B2B through B2E must comply with the following:

(1) Submit a complete QTG, including results from all of the objective tests appropriate for the level of qualification sought as set out in Table B2A. The QTG must highlight those results that demonstrate the performance of the FTD is within the allowable performance ranges indicated in Tables B2B through B2E, as appropriate.

(2) The QTG test results must include all relevant information concerning the conditions under which the test was conducted; *e.g.*, gross weight, center of gravity, airspeed, power setting, altitude (climbing, descending, or level), temperature, configuration, and any other parameter that impacts the conduct of the test.

(3) The test results become the validation data against which the initial and all subsequent continuing qualification evaluations are compared. These subsequent evaluations will use the tolerances listed in Table B2A.

(4) Subjective testing of the device must be performed to determine that the device performs and handles like an airplane within the appropriate set of airplanes.

END QPS REQUIREMENTS

BEGIN INFORMATION

d. The reader is encouraged to consult the Airplane Flight Simulator Evaluation Handbook, Volumes I and II, published by the Royal Aeronautical Society, London, UK, and AC 25–7, Flight Test Guide for Certification of Transport Category Airplanes, and AC 23–8A, Flight Test Guide for Certification of Part 23 Airplanes, as amended, for references and examples regarding flight testing requirements and techniques.

END INFORMATION

Table B2B - Alternative Data Source for FTD Level 5

Small, Single Engine (Reciprocating) Airplane

QPS REQUIREMENT

The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.

Applicable Test		
Entry Number	**Title and Procedure**	**Authorized Performance Range**
1.	**Performance.**	
1.c	**Climb.**	
1.c.1.	Normal climb with nominal gross weight, at best rate-of-climb airspeed.	Climb rate = 500 - 1200 fpm (2.5 - 6 m/sec).
1.f.	**Engines.**	
1.f.1.	Acceleration; idle to takeoff power.	2 - 4 Seconds.
1.f.2.	Deceleration; takeoff power to idle.	2 - 4 Seconds.
2.	**Handling Qualities.**	
2.c.	**Longitudinal Tests.**	
2.c.1.	Power change force.	
	(a) Trim for straight and level flight at 80% of normal cruise airspeed with necessary power. Reduce power to flight idle. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
	OR	

Table B2B - Alternative Data Source for FTD Level 5

Small, Single Engine (Reciprocating) Airplane

QPS REQUIREMENT

The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.

Applicable Test		
Entry Number	**Title and Procedure**	**Authorized Performance Range**
	(b) Trim for straight and level flight at 80 percent of normal cruise airspeed with necessary power. Add power to maximum setting. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Pull).
2.c.2.	Flap/slat change force.	
	(a) Trim for straight and level flight with flaps fully retracted at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Extend the flaps to 50 percent of full flap travel. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
	OR	
	b) Trim for straight and level flight with flaps extended to 50% of full flap travel, at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Retract the flaps to zero. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Pull).
2.c.4.	Gear change force.	
	(a) Trim for straight and level flight with landing gear retracted at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Extend the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Push).
	OR	
	(b) Trim for straight and level flight with landing gear extended, at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Retract the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Pull).
2.c.5.	Longitudinal trim.	Must be able to trim longitudinal stick force to “zero” in each of the following configurations: cruise; approach; and landing.
2.c.7.	Longitudinal static stability.	Must exhibit positive static stability.

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Table B2B - Alternative Data Source for FTD Level 5		
Small, Single Engine (Reciprocating) Airplane		
QPS REQUIREMENT The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.		
Applicable Test		**Authorized Performance Range**
Entry Number	**Title and Procedure**	
2.c.8.	Stall warning (actuation of stall warning device) with nominal gross weight; wings level; and a deceleration rate of not more than three (3) knots per second.	
	a) Landing configuration.	40 - 60 knots; ± 5° of bank.
	b) Clean configuration.	Landing configuration speed + 10 - 20%.
2.c.9.b.	Phugoid dynamics.	Must have a phugoid with a period of 30 - 60 seconds. May not reach ½ or double amplitude in less than 2 cycles.
2.d.	**Lateral Directional Tests.**	
2.d.2.	Roll response (rate). Roll rate must be measured through at least 30 degree of roll. Aileron control must be deflected 1/3 (33.3 percent) of maximum travel.	Must have a roll rate of 4° - 25°/second.
2.d.4.c.	Spiral stability. Cruise configuration and normal cruise airspeed. Establish a 20 degree - 30 degree bank. When stabilized, neutralize the aileron control and release. Must be completed in both directions of turn.	Initial bank angle (± 5°) after 20 seconds.
2.d.6.b.	Rudder response. Use 25 percent of maximum rudder deflection. (Applicable to approach or landing configuration.)	2° - 6° /second yaw rate.
2.d.8.	Steady state sideslip. Use 50 percent rudder deflection. (Applicable to approach and landing configurations.)	2 percent – 10 percent of bank; 4 percent - 10 percent of sideslip; and 2 percent -10 percent of aileron.
6.	FTD System Response Time.	
6.a.	Flight deck instrument systems response to an abrupt pilot controller input. One test is required in each axis (pitch, roll, yaw).	300 milliseconds or less.

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Table B2C - Alternative Data Source for FTD Level 5		
Small, Multi-Engine (Reciprocating) Airplane		
QPS REQUIREMENT The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.		
Applicable Test		**Authorized Performance Range**
Entry Number	**Title and Procedure**	
1.	**Performance.**	
1.c	**Climb.**	
1.c.1.	Normal climb with nominal gross weight, at best rate-of-climb airspeed.	Climb airspeed = 95 – 115 knots. Climb rate = 500 – 1500 fpm (2.5 – 7.5 m/sec)
1.f.	**Engines.**	
1.f.1.	Acceleration; idle to takeoff power.	2 - 5 Seconds.
1.f.2.	Deceleration; takeoff power to idle.	2 - 5 Seconds.
2.	**Handling Qualities.**	
2.c.	**Longitudinal Tests.**	
2.c.1.	Power change force.	
	(a) Trim for straight and level flight at 80 percent of normal cruise airspeed with necessary power. Reduce power to flight idle. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	10 - 25 lbs (2.2 - 6.6 daN) of force (Push).
	OR	
	(b) Trim for straight and level flight at 80 percent of normal cruise airspeed with necessary power. Add power to maximum setting. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Pull).
2.c.2.	Flap/slat change force.	
	(a) Trim for straight and level flight with flaps fully retracted at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Extend the flaps to 50 percent of full flap travel. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Push).

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Table B2C - Alternative Data Source for FTD Level 5 Small, Multi-Engine (Reciprocating) Airplane QPS REQUIREMENT The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.		
Applicable Test		**Authorized Performance Range**
Entry Number	**Title and Procedure**	
	OR	
	(b) Trim for straight and level flight with flaps extended to 50 percent of full flap travel, at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Retract the flaps to zero. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Pull).
2.c.4.	Gear change force.	
	(a) Trim for straight and level flight with landing gear retracted at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Extend the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Push).
	OR	
	(b) Trim for straight and level flight with landing gear extended, at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Retract the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Pull).
2.c.5.	Longitudinal trim.	Must be able to trim longitudinal stick force to “zero” in each of the following configurations: cruise; approach; and landing.
2.c.7.	Longitudinal static stability.	Must exhibit positive static stability.
2.c.8.	Stall warning (actuation of stall warning device) with nominal gross weight; wings level; and a deceleration rate of not more than three (3) knots per second.	

Table B2C - Alternative Data Source for FTD Level 5

Small, Multi-Engine (Reciprocating) Airplane

QPS REQUIREMENT

The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.

Applicable Test		Authorized Performance Range
Entry Number	**Title and Procedure**	
	(a) Landing configuration.	60 - 90 knots; ± 5 degree of bank.
	(b) Clean configuration.	Landing configuration speed + 10 - 20%.
2.c.9.b.	Phugoid dynamics.	Must have a phugoid with a period of 30 - 60 seconds. May not reach ½ or double amplitude in less than 2 cycles.
2.d.	**Lateral Directional Tests.**	
2.d.2.	Roll response. Roll rate must be measured through at least 30 degree of roll. Aileron control must be deflected 1/3 (33.3 percent) of maximum travel.	Must have a roll rate of 4- 25 degree /second.
2.d.4.c.	Spiral stability. Cruise configuration and normal cruise airspeed. Establish a 20 degree – 30 degree bank. When stabilized, neutralize the aileron control and release. Must be completed in both directions of turn.	Initial bank angle (± 5 degree) after 20 seconds.
2.d.6.b.	Rudder response. Use 25 percent of maximum rudder deflection. (Applicable to approach or landing configuration.)	3 - 6 degree /second yaw rate.
2.d.8.	Steady state sideslip. Use 50 percent rudder deflection. (Applicable to approach and landing configurations.)	2 - 10 degree of bank; 4 - 10 degrees of sideslip; and 2 - 10 degree of aileron.
6.	**FTD System Response Time.**	
6.a.	Flight deck instrument systems response to an abrupt pilot controller input. One test is required in each axis (pitch, roll, yaw).	300 milliseconds or less.

Table B2D - Alternative Data Source for FTD Level 5		
Small, Single Engine (Turbo-Propeller) Airplane		
QPS REQUIREMENT The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.		
Applicable Test		**Authorized Performance Range**
Entry Number	**Title and Procedure**	
1.	**Performance.**	
1.c	**Climb.**	
1.c.1.	Normal climb with nominal gross weight, at best rate-of-climb airspeed.	Climb airspeed = 95 – 115 knots. Climb rate = 800 – 1800 fpm (4 - 9 m/sec)
1.f.	**Engines.**	
1.f.1.	Acceleration; idle to takeoff power.	4 - 8 Seconds.
1.f.2.	Deceleration; takeoff power to idle.	3 - 7 Seconds.
2.	**Handling Qualities.**	
2.c.	**Longitudinal Tests.**	
2.c.1.	Power change force.	
	a) Trim for straight and level flight at 80 percent of normal cruise airspeed with necessary power. Reduce power to flight idle. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	8 lbs (3.5 daN) of Push force – 8 lbs (3.5 daN) of Pull force.
	OR	
	b) Trim for straight and level flight at 80 percent of normal cruise airspeed with necessary power. Add power to maximum setting. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	12 - 22 lbs (5.3 – 9.7 daN) of force (Pull).
2.c.2.	Flap/slat change force.	
	a) Trim for straight and level flight with flaps fully retracted at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Extend the flaps to 50 percent of full flap travel. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
	OR	

Table B2D - Alternative Data Source for FTD Level 5		
Small, Single Engine (Turbo-Propeller) Airplane		
QPS REQUIREMENT The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.		
Applicable Test		**Authorized Performance Range**
Entry Number	**Title and Procedure**	
	b) Trim for straight and level flight with flaps extended to 50 percent of full flap travel, at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Retract the flaps to zero. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Pull).
2.c.4.	Gear change force.	
	a) Trim for straight and level flight with landing gear retracted at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Extend the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Push).
	OR	
	b) Trim for straight and level flight with landing gear extended, at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Retract the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Pull).
2.c.5.	Longitudinal trim.	Must be able to trim longitudinal stick force to "zero" in each of the following configurations: cruise; approach; and landing.
2.c.7.	Longitudinal static stability.	Must exhibit positive static stability.
2.c.8.	Stall warning (actuation of stall warning device) with nominal gross weight; wings level; and a deceleration rate of not more than three (3) knots per second.	
	a) Landing configuration.	60 - 90 knots; ± 5 degree of bank.
	b) Clean configuration.	Landing configuration speed + 10 - 20 percent.
2.c.9.b.	Phugoid dynamics.	Must have a phugoid with a period of 30 - 60 seconds. May not reach ½ or double amplitude in less than 2 cycles.

Table B2D - Alternative Data Source for FTD Level 5		
Small, Single Engine (Turbo-Propeller) Airplane		
QPS REQUIREMENT The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.		
Applicable Test		**Authorized Performance Range**
Entry Number	**Title and Procedure**	
2.d.	**Lateral Directional Tests.**	
2.d.2.	Roll response. Roll rate must be measured through at least 30° of roll. Aileron control must be deflected 1/3 (33.3 percent) of maximum travel.	Must have a roll rate of 4 - 25 degree /second.
2.d.4.c.	Spiral stability. Cruise configuration and normal cruise airspeed. Establish a 20° - 30° bank. When stabilized, neutralize the aileron control and release. Must be completed in both directions of turn.	Initial bank angle (± 5 degree) after 20 seconds.
2.d.6.b.	Rudder response. Use 25 percent of maximum rudder deflection. (Applicable to approach or landing configuration.)	3 - 6 degree /second yaw rate.
2.d.8.	Steady state sideslip. Use 50 percent rudder deflection. (Applicable to approach and landing configurations.)	2 - 10 degree of bank; 4 - 10 degree of sideslip; and 2 - 10 degree of aileron.
6.	**FTD System Response Time.**	
6.a.	Flight deck instrument systems response to an abrupt pilot controller input. One test is required in each axis (pitch, roll, yaw).	300 milliseconds or less.

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Table B2E - Alternative Data Source for FTD Level 5

Multi-Engine (Turbo-Propeller) Airplane

QPS REQUIREMENT

The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.

Applicable Test: Entry Number	Applicable Test: Title and Procedure	Authorized Performance Range
1.	**Performance.**	
1.c	**Climb.**	
1.c.1.	Normal climb with nominal gross weight, at best rate-of-climb airspeed.	Climb airspeed = 120 – 140 knots. Climb rate = 1000 – 3000 fpm (5 - 15 m/sec)
1.f.	**Engines.**	
1.f.1.	Acceleration; idle to takeoff power.	2 - 6 Seconds.
1.f.2.	Deceleration; takeoff power to idle.	1 - 5 Seconds.
2.	**Handling Qualities.**	
2.c.	**Longitudinal Tests.**	
2.c.1.	Power change force.	
	a) Trim for straight and level flight at 80 percent of normal cruise airspeed with necessary power. Reduce power to flight idle. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	8 lbs (3.5 daN) of Push force to 8 lbs (3.5 daN) of Pull force.
	OR	
	b) Trim for straight and level flight at 80 percent of normal cruise airspeed with necessary power. Add power to maximum setting. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	12 - 22 lbs (5.3 – 9.7 daN) of force (Pull).
2.c.2.	Flap/slat change force.	
	a) Trim for straight and level flight with flaps fully retracted at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Extend the flaps to 50 percent of full flap travel. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
	OR	

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Table B2E - Alternative Data Source for FTD Level 5

Multi-Engine (Turbo-Propeller) Airplane

QPS REQUIREMENT

The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.

Applicable Test: Entry Number	Applicable Test: Title and Procedure	Authorized Performance Range
	b) Trim for straight and level flight with flaps extended to 50 percent of full flap travel, at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Retract the flaps to zero. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Pull).
2.c.4.	Gear change force.	
	a) Trim for straight and level flight with landing gear retracted at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Extend the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Push).
	OR	
	b) Trim for straight and level flight with landing gear extended, at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Retract the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Pull).
2.c.5.	Longitudinal trim.	Must be able to trim longitudinal stick force to "zero" in each of the following configurations: cruise; approach; and landing.
2.c.7.	Longitudinal static stability.	Must exhibit positive static stability.
2.c.8.	Stall warning (actuation of stall warning device) with nominal gross weight; wings level; and a deceleration rate of not more than three (3) knots per second.	
	a) Landing configuration.	80 - 100 knots; ± 5° of bank.
	b) Clean configuration.	Landing configuration speed + 10 - 20 percent.
2.c.9.b.	Phugoid dynamics.	Must have a phugoid with a period of 30 - 60 seconds. May not reach ½ or double amplitude in less than 2 cycles.
2.d.	**Lateral Directional Tests.**	

Table B2E - Alternative Data Source for FTD Level 5		
Multi-Engine (Turbo-Propeller) Airplane		
QPS REQUIREMENT The performance parameters in this table must be used to program the FTD if flight test data is not used to program the FTD.		
Applicable Test		**Authorized Performance Range**
Entry Number	**Title and Procedure**	
2.d.2.	Roll response. Roll rate must be measured through at least 30 degree of roll. Aileron control must be deflected 1/3 (33.3 percent) of maximum travel.	Must have a roll rate of 4 - 25 degree /second.
2.d.4.c.	Spiral stability. Cruise configuration and normal cruise airspeed. Establish a 20 - 30 dgree bank. When stabilized, neutralize the aileron control and release. Must be completed in both directions of turn.	Initial bank angle (± 5°) after 20 seconds.
2.d.6.b.	Rudder response. Use 25 percent of maximum rudder deflection. (Applicable to approach or landing configuration.)	3 - 6 degree /second yaw rate.
2.d.8.	Steady state sideslip. Use 50 percent rudder deflection. (Applicable to approach and landing configurations.)	2 - 10 degree of bank; 4 - 10 degree of sideslip; and 2 -10 degree of aileron.
6.	**FTD System Response Time.**	
6.a.	Flight deck instrument systems response to an abrupt pilot controller input. One test is required in each axis (pitch, roll, yaw).	300 milliseconds or less.

END QPS REQUIREMENTS

BEGIN QPS REQUIREMENTS

5. ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION: LEVEL 6 FTD ONLY

a. Sponsors are not required to use the alternative data sources, procedures, and instrumentation. However, a sponsor may choose to use one or more of the alternative sources, procedures, and instrumentation described in Table B2F.

END QPS REQUIREMENTS

BEGIN INFORMATION

b. It has become standard practice for experienced FTD manufacturers to use such techniques as a means of establishing data bases for new FTD configurations while awaiting the availability of actual flight test data; and then comparing this new data with the newly available flight test data. The results of such comparisons have, as reported by some recognized and experienced simulation experts, become increasingly consistent and indicate that these techniques, applied with appropriate experience, are becoming dependably accurate for the development of aerodynamic models for use in Level 6 FTDs.

c. In reviewing this history, the responsible Flight Standards office has concluded that, with proper care, those who are experienced in the development of aerodynamic models for FTD application can successfully use these modeling techniques to acceptably alter the method by which flight test data may be acquired and, when applied to Level 6 FTDs, does not compromise the quality of that simulation.

d. The information in the table that follows (Table of Alternative Data Sources, Procedures, and Information: Level 6 FTD Only) is presented to describe an acceptable alternative to data sources for Level 6 FTD modeling and validation, and an acceptable alternative to the procedures and instrumentation found in the flight test methods traditionally accepted for gathering modeling and validation data.

(1) Alternative data sources that may be used for part or all of a data requirement are the Airplane Maintenance Manual, the Airplane Flight Manual (AFM), Airplane Design Data, the Type Inspection Report (TIR), Certification Data or acceptable supplemental flight test data.

(2) The responsible Flight Standards office recommends that use of the alternative instrumentation noted in Table B2F be coordinated with the responsible Flight Standards office prior to employment in a flight test or data gathering effort.

e. The responsible Flight Standards office position regarding the use of these alternative data sources, procedures, and instrumentation is based on three primary preconditions and presumptions regarding the objective data and FTD aerodynamic program modeling.

(1) Data gathered through the alternative means does not require angle of attack (AOA) measurements or control surface position measurements for any flight test. AOA can be sufficiently derived if the flight test program insures the collection of acceptable level, unaccelerated, trimmed flight data. Angle of attack may be validated by conducting the three basic ‘‘fly-by’’ trim tests. The FTD time history tests should begin in level, unaccelerated, and trimmed flight, and the results should be compared with the flight test pitch angle.

(2) A simulation controls system model should be rigorously defined and fully mature. It should also include accurate gearing and cable stretch characteristics (where applicable) that are determined from actual aircraft measurements. Such a model does not require control surface position measurements in the flight test objective data for Level 6 FTD applications.

f. Table B2F is not applicable to Computer Controlled Aircraft FTDs.

g. Utilization of these alternate data sources, procedures, and instrumentation does not relieve the sponsor from compliance with the balance of the information contained in this document relative to Level 6 FTDs.

h. The term ‘‘inertial measurement system’’ allows the use of a functional global positioning system (GPS).

END INFORMATION

TABLE B2F—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION LEVEL 6 FTD

QPS Requirements The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix B are not used.		Information
Objective test reference number and title	Alternative data sources, procedures, and instrumentation	Notes
1.b.1. .... Performance. Takeoff. Ground acceleration time.	Data may be acquired through a synchronized video recording of a stop watch and the calibrated airplane airspeed indicator. Hand-record the flight conditions and airplane configuration.	This test is required only if RTO is sought.
1.b.7. .... Performance. Takeoff. Rejected takeoff.	Data may be acquired through a synchronized video recording of a stop watch and the calibrated airplane airspeed indicator. Hand-record the flight conditions and airplane configuration.	This test is required only if RTO is sought.
1.c.1. .... Performance. Climb. Normal climb all engines operating.	Data may be acquired with a synchronized video of calibrated airplane instruments and engine power throughout the climb range.	
1.f.1. .... Performance. Engines. Acceleration	Data may be acquired with a synchronized video recording of engine instruments and throttle position.	
1.f.2. .... Performance. Engines. Deceleration	Data may be acquired with a synchronized video recording of engine instruments and throttle position.	
2.a.1.a. Handling qualities. Static control tests. Pitch controller position vs. force and surface position calibration.	Surface position data may be acquired from flight data recorder (FDR) sensor or, if no FDR sensor, at selected, significant column positions (encompassing significant column position data points), acceptable to the responsible Flight Standards office, using a control surface protractor on the ground. Force data may be acquired by using a hand held force gauge at the same column position data points..	For airplanes with reversible control systems, surface position data acquisition should be accomplished with winds less than 5 kts.
2.a.2.a. Handling qualities. Static control tests. Wheel position vs. force and surface position calibration..	Surface position data may be acquired from flight data recorder (FDR) sensor or, if no FDR sensor, at selected, significant wheel positions (encompassing significant wheel position data points), acceptable to the responsible Flight Standards office, using a control surface protractor on the ground. Force data may be acquired by using a hand held force gauge at the same wheel position data points..	For airplanes with reversible control systems, surface position data acquisition should be accomplished with winds less than 5 kts.
2.a.3.a. Handling qualities. Static control tests. Rudder pedal position vs. force and surface position calibration..	Surface position data may be acquired from flight data recorder (FDR) sensor or, if no FDR sensor, at selected, significant rudder pedal positions (encompassing significant rudder pedal position data points), acceptable to the responsible Flight Standards office, using a control surface protractor on the ground. Force data may be acquired by using a hand held force gauge at the same rudder pedal position data points..	For airplanes with reversible control systems, surface position data acquisition should be accomplished with winds less than 5 kts.
2.a.4. .... Handling qualities. Static control tests. Nosewheel steering force.	Breakout data may be acquired with a hand held force gauge. The remainder of the force to the stops may be calculated if the force gauge and a protractor are used to measure force after breakout for at least 25% of the total displacement capability.	
2.a.5. .... Handling qualities. Static control tests. Rudder pedal steering calibration.	Data may be acquired through the use of force pads on the rudder pedals and a pedal position measurement device, together with design data for nosewheel position.	

TABLE B2F—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION LEVEL 6 FTD—Continued

QPS Requirements The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix B are not used.		Information
Objective test reference number and title	Alternative data sources, procedures, and instrumentation	Notes
2.a.6. .... Handling qualities. Static control tests. Pitch trim indicator vs. surface position calibration.	Data may be acquired through calculations.	
2.a.8. .... Handling qualities. Static control tests. Alignment of power lever angle vs. selected engine parameter (e.g., EPR, N_1, Torque, Manifold pressure).	Data may be acquired through the use of a temporary throttle quadrant scale to document throttle position. Use a synchronized video to record steady state instrument readings or hand-record steady state engine performance readings.	
2.a.9. .... Handling qualities. Static control tests. Brake pedal position vs. force.	Use of design or predicted data is acceptable. Data may be acquired by measuring deflection at "zero" and at "maximum."	
2.c.1. .... Handling qualities. Longitudinal control tests. Power change force.	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments, throttle position, and the force/position measurements of flight deck controls.	Power change dynamics test is acceptable using the same data acquisition methodology.
2.c.2. .... Handling qualities. Longitudinal control tests. Flap/slat change force.	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated airplane instruments, flap/slat position, and the force/position measurements of flight deck controls.	Flap/slat change dynamics test is acceptable using the same data acquisition methodology.
2.c.4. .... Handling qualities. Longitudinal control tests. Gear change force.	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments, gear position, and the force/position measurements of flight deck controls.	Gear change dynamics test is acceptable using the same data acquisition methodology.
2.c.5. .... Handling qualities. Longitudinal control tests. Longitudinal trim.	Data may be acquired through use of an inertial measurement system and a synchronized video of flight deck controls position (previously calibrated to show related surface position) and engine instrument readings.	
2.c.6. .... Handling qualities. Longitudinal control tests. Longitudinal maneuvering stability (stick force/g).	Data may be acquired through the use of an inertial measurement system and a synchronized video of the calibrated airplane instruments; a temporary, high resolution bank angle scale affixed to the attitude indicator; and a wheel and column force measurement indication.	
2.c.7. .... Handling qualities. Longitudinal control tests. Longitudinal static stability	Data may be acquired through the use of a synchronized video of the airplane flight instruments and a hand held force gauge.	
2.c.8. .... Handling qualities. Longitudinal control tests. Stall Warning (activation of stall warning device).	Data may be acquired through a synchronized video recording of a stop watch and the calibrated airplane airspeed indicator. Hand-record the flight conditions and airplane configuration.	Airspeeds may be cross checked with those in the TIR and AFM.

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TABLE B2F—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION LEVEL 6 FTD—Continued

QPS Requirements The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix B are not used.		Information
Objective test reference number and title	Alternative data sources, procedures, and instrumentation	Notes
2.c.9.a. Handling qualities. Longitudinal control tests. Phugoid dynamics.	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments and the force/position measurements of flight deck controls.	
2.c.10. Handling qualities. Longitudinal control tests. Short period dynamics.	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments and the force/position measurements of flight deck controls.	
2.c.11. Handling qualities. Longitudinal control tests. Gear and flap/slat operating times.	May use design data, production flight test schedule, or maintenance specification, together with an SOC.	
2.d.2. Handling qualities. Lateral directional tests. Roll response (rate).	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments and the force/position measurements of flight deck lateral controls.	
2.d.3. Handling qualities. Lateral directional tests. (a) Roll overshoot. OR (b) Roll response to flight deck roll controller step input.	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments and the force/position measurements of flight deck lateral controls.	
2.d.4. Handling qualities. Lateral directional tests. Spiral stability.	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments; the force/position measurements of flight deck controls; and a stop watch.	
2.d.6.a. Handling qualities. Lateral directional tests. Rudder response.	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments; the force/position measurements of rudder pedals.	
2.d.7. Handling qualities. Lateral directional tests. Dutch roll, (yaw damper OFF).	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments and the force/position measurements of flight deck controls.	
2.d.8. Handling qualities. Lateral directional tests. Steady state sideslip.	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated airplane instruments and the force/position measurements of flight deck controls.	

ATTACHMENT 3 TO APPENDIX B TO PART 60—FLIGHT TRAINING DEVICE (FTD) SUBJECTIVE EVALUATION

BEGIN INFORMATION

1. DISCUSSION

a. The subjective tests provide a basis for evaluating the capability of the FTD to perform over a typical utilization period. The items listed in the Table of Functions and Subjective Tests are used to determine whether the FTD competently simulates each required maneuver, procedure, or task; and verifying correct operation of the FTD controls, instruments, and systems. The tasks do not limit or exceed the authorizations for use of a given level of FTD as described on the SOQ or as approved by the TPAA. All items in the following paragraphs are subject to examination.

b. All simulated airplane systems functions will be assessed for normal and, where appropriate, alternate operations. Simulated airplane systems are listed separately under ‘‘Any Flight Phase’’ to ensure appropriate attention to systems checks. Operational navigation systems (including inertial navigation systems, global positioning systems, or other long-range systems) and the associated electronic display systems will be evaluated if installed. The pilot will include in his report to the TPAA, the effect of the system operation and any system limitation.

c. At the request of the TPAA, the Pilot may assess the FTD for a special aspect of a sponsor's training program during the functions and subjective portion of an evaluation. Such an assessment may include a portion of a specific operation (e.g., a Line Oriented Flight Training (LOFT) scenario) or special emphasis items in the sponsor's training program. Unless directly related to a requirement for the qualification level, the results of such an evaluation would not affect the qualification of the FTD.

END INFORMATION

TABLE B3A—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 6 FTD

QPS requirements	
Entry No.	Operations tasks
Tasks in this table are subject to evaluation if appropriate for the airplane system or systems simulated as indicated in the SOQ Configuration List as defined in Appendix B, Attachment 2 of this part.	
1. Preflight	
	Accomplish a functions check of all installed switches, indicators, systems, and equipment at all crewmembers' and instructors' stations, and determine that the flight deck (or flight deck area) design and functions replicate the appropriate airplane.
2. Surface Operations (pre-takeoff)	
2.a.	Engine start:
2.a.1.	Normal start.
2.a.2.	Alternative procedures start.
2.a.3.	Abnormal procedures start/shut down.
2.b.	Pushback/Powerback (powerback requires visual system).
3. Takeoff (requires appropriate visual system as set out in Table B1A, item 6; Appendix B, Attachment 1.)	
3.a.	Instrument takeoff:
3.a.1.	Engine checks (e.g., engine parameter relationships, propeller/mixture controls).
3.a.2.	Acceleration characteristics.
3.a.3.	Nosewheel/rudder steering.
3.a.4.	Landing gear, wing flap, leading edge device operation.
3.b.	Rejected takeoff:
3.b.1.	Deceleration characteristics.
3.b.2.	Brakes/engine reverser/ground spoiler operation.
3.b.3.	Nosewheel/rudder steering.
4. In-Flight Operations	
4.a.	Normal climb.
4.b.	Cruise:
4.b.1.	Demonstration of performance characteristics (speed vs. power).
4.b.2.	Normal turns.
4.b.3.	Demonstration of high altitude handling.
4.b.4.	Demonstration of high airspeed handling/overspeed warning.
4.b.5.	Demonstration of Mach effects on control and trim.

TABLE B3A—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 6 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
4.b.6.	Steep turns.
4.b.7.	In-Flight engine shutdown (procedures only).
4.b.8.	In-Flight engine restart (procedures only).
4.b.9.	Specific flight characteristics.
4.b.10.	Response to loss of flight control power.
4.b.11.	Response to other flight control system failure modes.
4.b.12.	Operations during icing conditions.
4.b.13.	Effects of airframe/engine icing.
4.c.	Other flight phase:
4.c.1.	Approach to stalls in the following configurations:
4.c.1.a.	Cruise.
4.c.1.b.	Takeoff or approach.
4.c.1.c.	Landing.
4.c.2.	High angle of attack maneuvers in the following configurations:
4.c.2.a.	Cruise.
4.c.2.b.	Takeoff or approach.
4.c.2.c.	Landing.
4.c.3.	Slow flight.
4.c.4.	Holding.
5. Approaches	
5.a.	Non-precision Instrument Approaches:
5.a.1.	With use of autopilot and autothrottle, as applicable.
5.a.2.	Without use of autopilot and autothrottle, as applicable.
5.a.3.	With 10 knot tail wind.
5.a.4.	With 10 knot crosswind.
5.b.	Precision Instrument Approaches:
5.b.1.	With use of autopilot, autothrottle, and autoland, as applicable.
5.b.2.	Without use of autopilot, autothrottle, and autoland, as applicable.
5.b.3.	With 10 knot tail wind.
5.b.4.	With 10 knot crosswind.
6. Missed Approach	
6.a.	Manually controlled.
6.b.	Automatically controlled (if applicable).
7. Any Flight Phase, as appropriate	
7.a.	Normal system operation (installed systems).
7.b.	Abnormal/Emergency system operation (installed systems).

TABLE B3A—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 6 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
7.c.	Flap operation.
7.d.	Landing gear operation.
7.e.	Engine Shutdown and Parking.
7.e.1.	Systems operation.
7.e.2.	Parking brake operation.
8. Instructor Operating Station (IOS), as appropriate. Functions in this section are subject to evaluation only if appropriate for the airplane and/or installed on the specific FTD involved	
8.a.	Power Switch(es).
8.b.	Airplane conditions.
8.b.1.	Gross weight, center of gravity, and fuel loading and allocation.
8.b.2.	Airplane systems status.
8.b.3.	Ground crew functions (e.g., external power, push back).
8.c.	Airports.
8.c.1.	Selection.
8.c.2.	Runway selection.
8.c.3.	Preset positions (e.g., ramp, over FAF).
8.d.	Environmental controls.
8.d.1.	Temperature.
8.d.2.	Climate conditions (e.g., ice, rain).
8.d.3.	Wind speed and direction.
8.e.	Airplane system malfunctions.
8.e.1.	Insertion/deletion.
8.e.2.	Problem clear.
8.f.	Locks, Freezes, and Repositioning.
8.f.1.	Problem (all) freeze/release.
8.f.2.	Position (geographic) freeze/release.
8.f.3.	Repositioning (locations, freezes, and releases).
8.f.4.	Ground speed control.
8.f.5.	Remote IOS, if installed.
9. Sound Controls. On/off/adjustment	
10. Control Loading System (as applicable) On/off/emergency stop.	
11. Observer Stations.	
11.a.	Position.
11.b.	Adjustments.
End QPS Requirements	

TABLE B3B—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 5 FTD

QPS requirements	
Entry No.	Operations tasks Tasks in this table are subject to evaluation if appropriate for the airplane system or systems simulated as indicated in the SOQ Configuration List as defined in Appendix B, Attachment 2 of this part.
1. Preflight	
	Accomplish a functions check of all installed switches, indicators, systems, and equipment at all crewmembers' and instructors' stations, and determine that the flight deck (or flight deck area) design and functions replicate the appropriate airplane.
2. Surface Operations (pre-takeoff)	
2.a.	Engine start (if installed):
2.a.1.	Normal start.
2.a.2.	Alternative procedures start.
2.a.3.	Abnormal/Emergency procedures start/shut down.
3. In-Flight Operations	
3.a.	Normal climb.
3.b.	Cruise:
3.b.1.	Performance characteristics (speed vs. power).
3.b.2.	Normal turns.
3.c.	Normal descent.
4. Approaches	
4.a.	Coupled instrument approach maneuvers (as applicable for the systems installed).
5. Any Flight Phase	
5.a.	Normal system operation (Installed systems).
5.b.	Abnormal/Emergency system operation (Installed systems).
5.c.	Flap operation.
5.d.	Landing gear operation
5.e.	Engine Shutdown and Parking (if installed).
5.e.1.	Systems operation.
5.e.2.	Parking brake operation.
6. Instructor Operating Station (IOS)	
6.a.	Power Switch(es).
6.b.	Preset positions—ground, air.
6.c.	Airplane system malfunctions (Installed systems).
6.c.1.	Insertion/deletion.
6.c.2.	Problem clear.

Table B3C

Table of Functions and Subjective Tests Level 4 FTD	
QPS requirements	
Entry No.	**Operations tasks** **Tasks in this table are subject to evaluation if appropriate for the airplane system or systems simulated as indicated in the SOQ Configuration List as defined in Appendix B, Attachment 2 of this part.**
1.	Level 4 FTDs are required to have at least one operational system. The responsible Flight Standards office will accomplish a functions check of all installed systems, switches, indicators, and equipment at all crewmembers' and instructors' stations, and determine that the flight deck (or flight deck area) design and functions replicate the appropriate airplane.

Table B3D - Table of Functions and Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	**Operations Tasks**
	Tasks in this table are subject to evaluation if appropriate for the airplane simulated as indicated in the SOQ Configuration List or the level of FTD qualification involved. Items not installed or not functional on the FTD and, therefore, not appearing on the SOQ Configuration List, are not required to be listed as exceptions on the SOQ.
1.	**Preparation For Flight**
1.a.	**Pre-flight.** Accomplish a functions check of all switches, indicators, systems, and equipment at all crew members' and instructors' stations and determine that:
1.a.1	The flight deck design and functions are identical to that of the airplane simulated.
2.	**Surface Operations (pre-flight).**
2.a.	**Engine Start.**
2.a.1.	Normal start.
2.a.2.	Alternate start procedures.
2.a.3.	Abnormal starts and shutdowns (e.g., hot/hung start, tail pipe fire).
2.b.	**Taxi.**
2.b.1	Pushback/powerback
2.b.2.	Thrust response.
2.b.3.	Power lever friction.
2.b.4.	Ground handling.
2.b.5.	Reserved
2.b.6.	Taxi aids (e.g. taxi camera, moving map)
2.b.7.	Low visibility (taxi route, signage, lighting, markings, etc.)
2.c.	**Brake Operation**
2.c.1.	Brake operation (normal and alternate/emergency).
2.c.2.	Brake fade (if applicable).
3.	**Take-off.**
3.a.	**Normal.**
3.a.1.	Airplane/engine parameter relationships, including run-up.
3.a.2.	Nosewheel and rudder steering.
3.a.3.	Crosswind (maximum demonstrated and gusting crosswind).
3.a.4.	Special performance
3.a.4.a	Reduced V_1
3.a.4.b	Maximum engine de-rate.
3.a.4.c	Soft surface.
3.a.4.d	Short field/short take-off and landing (STOL) operations.
3.a.4.e	Obstacle (performance over visual obstacle).
3.a.5.	Low visibility take-off.
3.a.6.	Landing gear, wing flap leading edge device operation.
3.a.7.	Contaminated runway operation.
3.b.	Abnormal/emergency.

Table B3D - Table of Functions and Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	**Operations Tasks**
3.b.1.	Rejected Take-off.
3.b.2.	Rejected special performance (e.g., reduced V_1, max de-rate, short field operations).
3.b.3.	Rejected take-off with contaminated runway.
3.b.4.	Takeoff with a propulsion system malfunction (allowing an analysis of causes, symptoms, recognition, and the effects on aircraft performance and handling) at the following points: . (iii) Prior to V1 decision speed. (iv) Between V1 and Vr (rotation speed). (iii)Between Vr and 500 feet above ground level.
3.b.5.	Flight control system failures, reconfiguration modes, manual reversion and associated handling.
4.	**Climb.**
4.a.	Normal.
4.b.	One or more engines inoperative.
4.c.	Approach climb in icing (for airplanes with icing accountability).
5.	**Cruise.**
5.a.	**Performance characteristics (speed vs. power, configuration, and attitude)**
5.a.1.	Straight and level flight.
5.a.2.	Change of airspeed.
5.a.3.	High altitude handling.
5.a.4.	High Mach number handling (Mach tuck, Mach buffet) and recovery (trim change).
5.a.5.	Overspeed warning (in excess of V_{mo} or M_{mo}).
5.a.6.	High IAS handling.
5.b.	**Maneuvers.**
5.b.1.	High Angle of Attack
5.b.1.a	High angle of attack, approach to stalls, stall warning, and stall buffet (take-off, cruise, approach, and landing configuration) including reaction of the autoflight system and stall protection system.
5.b.1.b	Reserved
5.b.2.	Slow flight
5.b.3.	Reserved
5.b.4.	Flight envelope protection (high angle of attack, bank limit, overspeed, etc.).
5.b.5.	Turns with/without speedbrake/spoilers deployed.
5.b.6.	Normal and standard rate turns.
5.b.7.	Steep turns
5.b.8.	Performance turn
5.b.9.	In flight engine shutdown and restart (assisted and windmill).
5.b.10.	Maneuvering with one or more engines inoperative, as appropriate.
5.b.11.	Specific flight characteristics (e.g., direct lift control).
5.b.12.	Flight control system failures, reconfiguration modes, manual reversion and associated handling.
5.b.13	Gliding to a forced landing.

Table B3D - Table of Functions and Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	**Operations Tasks**
5.b.14	Visual resolution and FSTD handling and performance for the following (where applicable by aircraft type and training program):
5.b.14.a	Terrain accuracy for forced landing area selection.
5.b.14.b	Terrain accuracy for VFR Navigation.
5.b.14.c	Eights on pylons (visual resolution).
5.b.14.d	Turns about a point.
5.b.14.e	S-turns about a road or section line.
6.	**Descent.**
6.a.	Normal.
6.b.	Maximum rate/emergency (clean and with speedbrake, etc.).
6.c.	With autopilot.
6.d.	Flight control system failures, reconfiguration modes, manual reversion and associated handling.
7.	**Instrument Approaches And Landing.** Those instrument approach and landing tests relevant to the simulated airplane type are selected from the following list. Some tests are made with limiting wind velocities, under windshear conditions, and with relevant system failures, including the failure of the Flight Director. If Standard Operating Procedures allow use autopilot for non-precision approaches, evaluation of the autopilot will be included.
7.a.	**Precision approach**
7.a.1	CAT I published approaches.
7.a.1.a	Manual approach with/without flight director including landing.
7.a.1.b	Autopilot/autothrottle coupled approach and manual landing.
7.a.1.c	Autopilot/autothrottle coupled approach, engine(s) inoperative.
7.a.1.d	Manual approach, engine(s) inoperative.
7.a.1.e	HUD/EFVS
7.a.2	CAT II published approaches.
7.a.2.a	Autopilot/autothrottle coupled approach to DH and landing (manual and autoland).
7.a.2.b	Autopilot/autothrottle coupled approach with one-engine-inoperative approach to DH and go-around (manual and autopilot).
7.a.2.c	HUD/EFVS
7.a.3	CAT III published approaches.
7.a.3.a	Autopilot/autothrottle coupled approach to landing and roll-out (if applicable) guidance (manual and autoland).
7.a.3.b	Autopilot/autothrottle coupled approach to DH and go-around (manual and autopilot).
7.a.3.c	Autopilot/autothrottle coupled approach to land and roll-out (if applicable) guidance with one engine inoperative (manual and autoland).
7.a.3.d	Autopilot/autothrottle coupled approach to DH and go-around with one engine inoperative (manual and autopilot).
7.a.3.e	HUD/EFVS
7.a.4	Autopilot/autothrottle coupled approach (to a landing or to a go-around):

Table B3D - Table of Functions and Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	**Operations Tasks**
7.a.4.a	With generator failure.
7.a.4.b.1	With maximum tail wind component certified or authorized.
7.a.4.b.2	Reserved
7.a.4.c.1	With maximum crosswind component demonstrated or authorized.
7.a.4.c.2	Reserved
7.a.5	PAR approach, all engine(s) operating and with one or more engine(s) inoperative.
7.a.6	MLS, GBAS, all engine(s) operating and with one or more engine(s) inoperative.
7.b.	**Non-precision approach.**
7.b.1	Surveillance radar approach, all engine(s) operating and with one or more engine(s) inoperative.
7.b.2	NDB approach, all engine(s) operating and with one or more engine(s) inoperative.
7.b.3	VOR, VOR/DME, TACAN approach, all engines(s) operating and with one or more engine(s) inoperative.
7.b.4	RNAV / RNP / GNSS (RNP at nominal and minimum authorized temperatures) approach, all engine(s) operating and with one or more engine(s) inoperative.
7.b.5	ILS LLZ (LOC), LLZ back course (or LOC-BC) approach, all engine(s) operating and with one or more engine(s) inoperative.
7.b.6	ILS offset localizer approach, all engine(s) operating and with one or more engine(s) inoperative.
7.c	**Approach procedures with vertical guidance (APV), e.g. SBAS, flight path vector.**
7.c.1	APV/baro-VNAV approach, all engine(s) operating and with one or more engine(s) inoperative.
7.c.2	Area navigation (RNAV) approach procedures based on SBAS, all engine(s) operating and with one or more engine(s) inoperative.
8.	**Visual Approaches (Visual Segment) And Landings.** Flight simulators with visual systems, which permit completing a special approach procedure in accordance with applicable regulations, may be approved for that particular approach procedure.
8.a.	Maneuvering, normal approach and landing, all engines operating with and without visual approach aid guidance.
8.b.	Approach and landing with one or more engines inoperative.
8.c.	Operation of landing gear, flap/slats and speedbrakes (normal and abnormal).
8.d.	Approach and landing with crosswind (max. demonstrated and gusting crosswind).
8.e.	Approach and landing with flight control system failures, reconfiguration modes, manual reversion and associated handling (most significant degradation which is probable).
8.e.1.	Approach and landing with trim malfunctions.
8.e.1.a	Longitudinal trim malfunction.
8.e.1.b	Lateral-directional trim malfunction.

Table B3D - Table of Functions and Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	**Operations Tasks**
8.f.	Approach and landing with standby (minimum) electrical/hydraulic power.
8.g.	Approach and landing from circling conditions (circling approach).
8.h.	Approach and landing from visual traffic pattern.
8.i.	Approach and landing from non-precision approach.
8.j.	Approach and landing from precision approach.
9.	**Missed Approach.**
9.a.	All engines, manual and autopilot.
9.b.	Engine(s) inoperative, manual and autopilot.
9.c.	Rejected landing
9.d.	With flight control system failures, reconfiguration modes, manual reversion and associated handling.
9.e.	Reserved
10.	**Surface Operations (landing, after-landing and post-flight).**
10.a	**Landing roll and taxi.**
10.a.1	HUD/EFVS.
10.a.2.	Spoiler operation.
10.a.3.	Reverse thrust operation.
10.a.4.	Directional control and ground handling, both with and without reverse thrust.
10.a.5.	Reduction of rudder effectiveness with increased reverse thrust (rear pod-mounted engines).
10.a.6.	Brake and anti-skid operation
10.a.6.a	Brake and anti-skid operation with dry, patchy wet, wet on rubber residue, and patchy icy conditions.
10.a.6.b	Reserved
10.a.6.c	Reserved
10.a.6.d	Auto-braking system operation.
10.b	**Engine shutdown and parking.**
10.b.1	Engine and systems operation.
10.b.2	Parking brake operation.
11.	**Any Flight Phase.**
11.a.	**Airplane and engine systems operation (where fitted).**
11.a.1.	Air conditioning and pressurization (ECS).
11.a.2.	De-icing/anti-icing.
11.a.3.	Auxiliary power unit (APU).
11.a.4.	Communications.
11.a.5.	Electrical.
11.a.6.	Fire and smoke detection and suppression.
11.a.7.	Flight controls (primary and secondary).
11.a.8.	Fuel and oil
11.a.9.	Hydraulic
11.a.10.	Pneumatic
11.a.11.	Landing gear.
11.a.12.	Oxygen.
11.a.13.	Engine.

Table B3D - Table of Functions and Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	**Operations Tasks**
11.a.14.	Airborne radar.
11.a.15.	Autopilot and Flight Director.
11.a.16.	Terrain awareness warning systems and collision avoidance systems (e.g. EGPWS, GPWS, TCAS).
11.a.17.	Flight control computers including stability and control augmentation.
11.a.18.	Flight display systems.
11.a.19.	Flight management computers.
11.a.20.	Head-up displays (including EFVS, if appropriate).
11.a.21.	Navigation systems
11.a.22.	Stall warning/avoidance
11.a.23.	Wind shear avoidance/recovery guidance equipment
11.a.24.	Flight envelope protections
11.a.25.	Electronic flight bag
11.a.26.	Automatic checklists (normal, abnormal and emergency procedures).
11.a.27.	Runway alerting and advisory system.
11.b.	**Airborne procedures.**
11.b.1.	Holding.
11.b.2.	Air hazard avoidance (traffic, weather, including visual correlation).
11.b.3.	Windshear.
11.b.3.a	Prior to take-off rotation.
11.b.3.b	At lift-off
11.b.3.c	During initial climb.
11.b.3.d	On final approach, below 150 m (500 ft) AGL.
11.b.4.	Reserved

Entry Number	Table B3E - Functions And Subjective Tests Level 7 FTD QPS REQUIREMENTS Airport Modeling Requirements
This table specifies the minimum airport model content and functionality to qualify a simulator at the indicated level. This table applies only to the airport models required for FTD qualification.	
	Begin QPS Requirements
1.	**Reserved**
2.a.	**Functional test content requirements**
2.a.1	**Airport scenes**
2.a.1.a	A minimum of three (3) real-world airport models to be consistent with published data used for airplane operations and capable of demonstrating all the visual system features below. Each model should be in a different visual scene to permit assessment of FSTD automatic visual scene changes. The model identifications must be acceptable to the sponsor's TPAA, selectable from the IOS, and listed on the SOQ.
2.a.1.b	Reserved
2.a.1.c	Reserved
2.a.1.d	**Airport model content.** For circling approaches, all tests apply to the runway used for the initial approach and to the runway of intended landing. If all runways in an airport model used to meet the requirements of this attachment are not designated as "in use," then the "in use" runways must be listed on the SOQ (e.g., KORD, Rwys 9R, 14L, 22R). Models of airports with more than one runway must have all significant runways not "in-use" visually depicted for airport and runway recognition purposes. The use of white or off white light strings that identify the runway threshold, edges, and ends for twilight and night scenes are acceptable for this requirement. Rectangular surface depictions are acceptable for daylight scenes. A visual system's capabilities must be balanced between providing airport models with an accurate representation of the airport and a realistic representation of the surrounding environment. Airport model detail must be developed using airport pictures, construction drawings and maps, or other similar data, or developed in accordance with published regulatory material; however, this does not require that such models contain details that are beyond the design capability of the currently qualified visual system. Only one "primary" taxi route from parking to the runway end will be required for each "in-use" runway.
2.a.2	**Visual scene fidelity.**
2.a.2.a	The visual scene must correctly represent the parts of the airport and its surroundings used in the training program.
2.a.2.b	Reserved
2.a.2.c	Reserved
2.a.3	**Runways and taxiways.**
2.a.3.a	Reserved
2.a.3.b	Representative runways and taxiways.
2.a.3.c	Reserved
2.a.4	Reserved
2.a.5	Runway threshold elevations and locations must be modeled to provide correlation with airplane systems (e.g. HUD, GPS, compass, altimeter).

Table B3E - Functions And Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	Airport Modeling Requirements
2.a.6	Reserved
2.a.7	**Runway surface and markings for each "in-use" runway must include the following, if appropriate:**
2.a.7.a	Threshold markings.
2.a.7.b	Runway numbers.
2.a.7.c	Touchdown zone markings.
2.a.7.d	Fixed distance markings.
2.a.7.e	Edge markings.
2.a.7.f	Center line markings.
2.a.7.g	Reserved
2.a.7.h	Reserved
2.a.7.i	Windsock that gives appropriate wind cues.
2.a.8	**Runway lighting of appropriate colors, directionality, behavior and spacing for the "in-use" runway including the following:**
2.a.8.a	Threshold lights.
2.a.8.b	Edge lights.
2.a.8.c	End lights.
2.a.8.d	Center line lights.
2.a.8.e	Touchdown zone lights.
2.a.8.f	Lead-off lights.
2.a.8.g	Appropriate visual landing aid(s) for that runway.
2.a.8.h	Appropriate approach lighting system for that runway.
2.a.9	**Taxiway surface and markings (associated with each "in-use" runway):**
2.a.9.a	Edge markings
2.a.9.b	Center line markings.
2.a.9.c	Runway holding position markings.
2.a.9.d	ILS critical area markings.
2.a.9.e	Reserved
2.a.10	**Taxiway lighting of appropriate colors, directionality, behavior and spacing (associated with each "in-use" runway):**
2.a.10.a	Edge lights.
2.a.10.b	Center line lights.
2.a.10.c	Runway holding position and ILS critical area lights.
2.a.11	**Required visual model correlation with other aspects of the airport environment simulation.**
2.a.11.a	The airport model must be properly aligned with the navigational aids that are associated with operations at the runway "in-use".
2.a.11.b	Reserved
2.a.12	**Airport buildings, structures and lighting.**
2.a.12.a	Buildings, structures and lighting:
2.a.12.a.1	Reserved

Table B3E - Functions And Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	Airport Modeling Requirements
2.a.12.a.2	Representative airport buildings, structures and lighting.
2.a.12.a.3	Reserved
2.a.12.b	Reserved
2.a.12.c	Representative moving and static airport clutter (e.g. other airplanes, power carts, tugs, fuel trucks, additional gates).
2.a.12.d	Reserved
2.a.13	**Terrain and obstacles.**
2.a.13.a	Reserved
2.a.13.b	Representative depiction of terrain and obstacles within 46 km (25 NM) of the reference airport.
2.a.14	**Significant, identifiable natural and cultural features.**
2.a.14.a	Reserved
2.a.14.b	Representative depiction of significant and identifiable natural and cultural features within 46 km (25 NM) of the reference airport. *Note.— This refers to natural and cultural features that are typically used for pilot orientation in flight. Outlying airports not intended for landing need only provide a reasonable facsimile of runway orientation.*
2.a.14.c	Representative moving airborne traffic (including the capability to present air hazards – e.g. airborne traffic on a possible collision course).
2.b	**Visual scene management.**
2.b.1	Reserved
2.b.2	Airport runway, approach and taxiway lighting and cultural lighting intensity for any approach should be set at an intensity representative of that used in training for the visibility set; all visual scene light points must fade into view appropriately.
2.b.3	Reserved
2.c	**Visual feature recognition.** *Note.— The following are the minimum distances at which runway features should be visible. Distances are measured from runway threshold to an airplane aligned with the runway on an extended 3-degree glide slope in suitable simulated meteorological conditions. For circling approaches, all tests below apply both to the runway used for the initial approach and to the runway of intended landing.*
2.c.1	Runway definition, strobe lights, approach lights, and runway edge white lights from 8 km (5 sm) of the runway threshold.
2.c.2	**Visual approach aids lights.**
2.c.2.a	Reserved
2.c.2.b	Visual approach aids lights from 4.8 km (3 sm) of the runway threshold.
2.c.3	Runway center line lights and taxiway definition from 4.8 km (3 sm).
2.c.4	Threshold lights and touchdown zone lights from 3.2 km (2 sm).
2.c.5	Reserved
2.c.6	For circling approaches, the runway of intended landing and associated lighting must fade into view in a non-distracting manner.
2.d	**Selectable airport visual scene capability for:**

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Table B3E - Functions And Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	**Airport Modeling Requirements**
2.d.1	Night.
2.d.2	Twilight.
2.d.3	Day.
2.d.4	Dynamic effects — the capability to present multiple ground and air hazards such as another airplane crossing the active runway or converging airborne traffic; hazards must be selectable via controls at the instructor station.
2.d.5	Reserved
2.e	**Correlation with airplane and associated equipment.**
2.e.1	Visual cues to relate to actual airplane responses.
2.e.2	**Visual cues during take-off, approach and landing.**
2.e.2.a	Visual cues to assess sink rate and depth perception during landings.
2.e.2.b	Reserved
2.e.3	Accurate portrayal of environment relating to airplane attitudes.
2.e.4	The visual scene must correlate with integrated airplane systems, where fitted (e.g. terrain, traffic and weather avoidance systems and HUD/EFVS).
2.e.5	Reserved
2.f	**Scene quality.**
2.f.1	**Quantization.**
2.f.1.a	Surfaces and textural cues must be free from apparent quantization (aliasing).
2.f.1.b	Reserved
2.f.2	System capable of portraying full color realistic textural cues.
2.f.3	The system light points must be free from distracting jitter, smearing or streaking.
2.f.4	Reserved
2.f.5	System capable of providing light point perspective growth (e.g. relative size of runway and taxiway edge lights increase as the lights are approached).
2.g	**Environmental effects.**
2.g.1	Reserved
2.g.2	Reserved
2.g.3	Reserved
2.g.4	Reserved
2.g.5	Reserved
2.g.6	Reserved
2.g.7	Visibility and RVR measured in terms of distance. Visibility/RVR must be checked at and below a height of 600 m (2 000 ft) above the airport and within a radius of 16 km (10 sm) from the airport.
2.g.8	Reserved
2.g.9	Reserved
2.g.10	Reserved
2.g.11	Reserved
	End QPS Requirement
	Begin Information

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Table B3E - Functions And Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	Airport Modeling Requirements
3.	An example of being able to "combine two airport models to achieve two "in-use" runways: One runway designated as the "in use" runway in the first model of the airport, and the second runway designated as the "in use" runway in the second model of the same airport. For example, the clearance is for the ILS approach to Runway 27, Circle to Land on Runway 18 right. Two airport visual models might be used: the first with Runway 27 designated as the "in use" runway for the approach to runway 27, and the second with Runway 18 Right designated as the "in use" runway. When the pilot breaks off the ILS approach to runway 27, the instructor may change to the second airport visual model in which runway 18 Right is designated as the "in use" runway, and the pilot would make a visual approach and landing. This process is acceptable to the FAA as long as the temporary interruption due to the visual model change is not distracting to the pilot, does not cause changes in navigational radio frequencies, and does not cause undue instructor/evaluator time.
4.	Sponsors are not required to provide every detail of a runway, but the detail that is provided should be correct within the capabilities of the system. **End Information**

Table B3F - Functions and Subjective Tests
Level 7 FTD

QPS REQUIREMENTS	
Entry Number	**Sound System Requirements**
	The following checks are performed during a normal flight profile.
1.	Precipitation.
2.	Reserved
3.	Significant airplane noises perceptible to the pilot during normal operations.
4.	Abnormal operations for which there are associated sound cues including, engine malfunctions, landing gear/tire malfunctions, tail and engine pod strike and pressurization malfunction.
5.	Sound of a crash when the flight simulator is landed in excess of limitations.

Table B3G - Functions and Subjective Tests Level 7 FTD	
QPS REQUIREMENTS	
Entry Number	Instructor Operating Station (IOS) Requirements
	Functions in this table are subject to evaluation only if appropriate for the airplane and/or the system is installed on the specific FTD.
1.	**Simulator Power Switch(es)**
2.	**Airplane conditions.**
2.a.	Gross weight, center of gravity, fuel loading and allocation
2.b.	Airplane systems status.
2.c.	Ground crew functions (e.g., ext. power, push back)
3.	**Airports.**
3.a.	Number and selection.
3.b.	Runway selection.
3.c.	Runway surface condition (e.g., rough, smooth, icy, wet)
3.d.	Preset positions (e.g., ramp, gate, #1 for takeoff, takeoff position, over FAF)
3.e.	Lighting controls.
4.	**Environmental controls.**
4.a	Visibility (statute miles (kilometers)).
4.b.	Runway visual range (in feet (meters)).
4.c.	Temperature.
4.d.	Climate conditions (e.g., ice, snow, rain).
4.e.	Wind speed and direction.
4.f.	Windshear.
4.g.	Clouds (base and tops).
5.	**Airplane system malfunctions** (Inserting and deleting malfunctions into the simulator).
6.	**Locks, Freezes, and Repositioning.**
6.a.	Problem (all) freeze / release.
6.b.	Position (geographic) freeze / release.
6.c.	Repositioning (locations, freezes, and releases).
6.d.	Ground speed control.
7.	Remote IOS. (if installed)
8.	**Sound Controls.** On / off / adjustment
9.	**Control Loading System.**
9.a.	On / off / emergency stop.
10.	**Observer Seats / Stations.** Position / Adjustment

ATTACHMENT 4 TO APPENDIX B TO PART 60—SAMPLE DOCUMENTS

BEGIN INFORMATION

TABLE OF CONTENTS

Title of Sample

ATTACHMENT 4 TO APPENDIX B TO PART 60—FIGURE B4A—SAMPLE LETTER, REQUEST FOR INITIAL, UPGRADE, OR REINSTATEMENT EVALUATION

INFORMATION

Date _______

RE: Request for Initial/Upgrade Evaluation Date

This is to advise you of our intent to request an (initial or upgrade) evaluation of our (FTD Manufacturer), (Aircraft Type/Level) Flight Training Device (FTD), (FAA ID Number, if previously qualified), located in (City, State) at the (Facility) on (Proposed Evaluation Date). (The proposed evaluation date shall not be more than 180 days following the date of this letter.) The FTD will be sponsored by (Name of Training Center/Air Carrier), FAA Designator (4 Letter Code). The FTD will be sponsored as follows; (Select One)

☐ The FTD will be used within the sponsor's FAA approved training program and placed on the sponsor's Training/Operations Specifications.

☐ The FTD will be used for dry lease only.

We agree to provide the formal request for the evaluation to your staff as follows: (check one)

☐ For QTG tests run at the factory, not later, than 45 days prior to the proposed evaluation date with the additional "l/3 on-site" tests provided not later than 14 days prior to the proposed evaluation date.

☐ For QTG tests run on-site, not later than 30 days prior to the proposed evaluation date.

We understand that the formal request will contain the following documents:

1. Sponsor's Letter of Request (*Company Compliance Letter*).
2. Principal Operations Inspector (POI) or Training Center Program Manager's (TCPM) endorsement.
3. Complete QTG.

If we are unable to meet the above requirements, we understand this may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation.

(The sponsor should add additional comments as necessary).

Please contact (Name Telephone and Fax Number of Sponsor's Contact) to confirm the date for this initial evaluation. We understand a member of your National Simulator Program staff will respond to this request within 14 days.

A copy of this letter of intent has been provided to (Name), the Principal Operations Inspector (POI) and/or Training Center Program Manager (TCPM).

Sincerely,

Attachment: FTD Information and Characteristics Form

cc: POI/TCPM

Attachment 4 to Appendix B to Part 60—
Figure B4B – Sample Letter , Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FSTD Information Form
INFORMATION

Date: ____

Section 1. FSTD Information and Characteristics

Sponsor Name:	____	**FSTD Location:**	
Address:	____ ____	**Physical Address:**	____ ____
City:	____	**City:**	____
State:	____	**State:**	____
Country:	____	**Country:**	____
ZIP:	____	**ZIP:**	____
Manager	____		
Sponsor ID No: (Four Letter FAA Designator)	____	**Nearest Airport:** (Airport Designator)	____

Type of Evaluation Requested:	☐ **Initial** ☐ **Upgrade** ☐ **Continuing Qualification** ☐ **Special** ☐ **Reinstatement**
Aircraft Make/model/series:	____

Initial Qualification: (If Applicable)	**Date:** ____ **Level** ____ MM/DD/YYYY	**Manufacturer's Identification or Serial Number**	____________
Upgrade Qualification: (If Applicable)	**Date:** ____ **Level** ____ MM/DD/YYYY	☐ **eMQTG**	

Qualification Basis:____________	☐ **A**	☐ **B**	☐ **Interim C**	☐ **C**	☐ **D**
	☐ **6**	☐ **7**	☐ **Provisional Status**		

Other Technical Information:

FAA FSTD ID No: (If Applicable)	____	**FSTD Manufacturer:**	____
Convertible FSTD:	☐Yes:	**Date of Manufacture:**	____ MM/DD/YYYY
Related FAA ID No. (If Applicable)	____ ____ ____	**Sponsor FSTD ID No:** ________	
Engine model(s) and data revision: ________		**Source of aerodynamic model:** ________	
FMS identification and revision level: ________		**Source of aerodynamic coefficient data:** ________	
Visual system manufacturer/model: ________		**Aerodynamic data revision number:** ________	
Flight control data revision: ________		**Visual system display:** ________	
Mot ion system manufacturer/type: ________		**FSTD computer(s) identification:** ________	

National Aviation Authority (NAA): (If Applicable)	________		
NAA FSTD ID No:	________	**Last NAA Evaluation Date:**	________
NAA Qualification Level:	________		
NAA Qualification Basis:	____		

Visual System Manufacturer and Type:	________	**FSTD Seats Available:** ________	**Motion System Manufacturer and Type:**	________:

Attachment 4 to Appendix B to Part 60—
Figure B4B – Sample Letter , Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FSTD Information Form
INFORMATION

Aircraft Equipment:	**Engine Type(s):**	**Flight Instrumentation:**	**Engine Instrumentation:**
	_____ _____	☐ EFIS ☐ HUD ☐ HGS ☐ EFVS ☐ TCAS ☐ GPWS ☐ Plain View ☐ GPS ☐ FMS Type: __ ☐ WX Radar ☐ Other: __	☐ EICAS ☐ FADEC ☐ Other: __

Airport Models:	3.6.1 _____ Airport Designator	3.6.2_____ Airport Designator	3.6.3 _____ Airport Designator
Circle to Land:	3. 7.1 _____ Airport Designator	3. 7.2_____ Approach	3. 7.3 _____ Landing Runway
Visual Ground Segment	3.8.1 _____ Airport Designator	3.8 .2_____ Approach	3. 8.3 _____ Landing Runway

Section 2. Supplementary Information

FAA Training Program Approval Authority:		☐ **POI** ☐ **TCPM** ☐ **Other:** ______	
Name:	_________	**Office:**	_________
Tel:	_________	**Fax:**	_________
Email:	_________		
FSTD Scheduling Person:			
Name:	_________		
Address 1:	_________	**Address 2**	_________
City:	_________	**State:**	_________
ZIP:	_________	**Email:**	_________
Tel:	_________	**Fax:**	_________
FSTD Technical Contact:			
Name:	_________		
Address 1:	_________	**Address 2**	_________
City:	_________	**State:**	_________
ZIP:	_________	**Email:**	_________
Tel:	_________	**Fax:**	_________

Section 3. Training, Testing and Checking Considerations

Area/Function/Maneuver	**Requested**	**Remarks**
Private Pilot - Training / Checks: (142)	☐	_________
Commercial Pilot - Training /Checks:(142)	☐	_________
Multi-Engine Rating - Training / Checks (142)	☐	_________
Instrument Rating -Training / Checks (142)	☐	_________
Type Rating - Training / Checks (135/121/142)	☐	_________
Proficiency Checks (135/121/142)	☐	_________
CAT I: (RVR 2400/1800 ft. DH200 ft)	☐	_________

Attachment 4 to Appendix B to Part 60—
Figure B4B – Sample Letter , Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FSTD Information Form
INFORMATION

CAT II: (RVR 1200 ft. DH 100 ft)	☐	________
CAT III * (lowest minimum) ________ RVR ________ ft. * State CAT III (≤ 700 ft.), CAT IIIb (≤ 150 ft.), or CAT IIIc (0 ft.)	☐	________
Circling Approach	☐	________
Windshear Training:	☐	________
Windshear Training IAW 121.409(d) (121 Turbojets Only)	☐	________
Generic Unusual Attitudes and Recoveries within the Normal Flight Envelope	☐	________
Specific Unusual Attitudes Recoveries	☐	________
Auto-coupled Approach/Auto Go Around	☐	________
Auto-land / Roll Out Guidance	☐	________
TCAS/ACAS I / II	☐	________
WX-Radar	☐	________
HUD	☐	________
HGS	☐	________
EFVS	☐	________
Future Air Navigation Systems	☐	________
GPWS / EGPWS	☐	________
ETOPS Capability	☐	________
GPS	☐	________
SMGCS	☐	________
Helicopter Slope Landings	☐	________
Helicopter External Load Operations	☐	________
Helicopter Pinnacle Approach to Landings	☐	________
Helicopter Night Vision Maneuvers	☐	________
Helicopter Category A Takeoffs	☐	________

ATTACHMENT 4 TO APPENDIX B TO PART 60—
FIGURE B4C—SAMPLE LETTER OF COMPLIANCE

INFORMATION

(Date)

Mr. (Name of Training Program Approval Authority):
(Name of responsible Flight Standards office)
(Address)
(City/State/Zip)

Dear Mr. (Name of TPAA):

RE: Letter of Compliance

(Operator Sponsor Name) requests evaluation of our (Aircraft Type) FTD for Level (__) qualification. The (FTD Manufacturer Name) FTD with (Visual System Manufacturer Name/Model) system is fully defined on the FTD Information page of the accompanying Qualification Test Guide (QTG). We have completed the tests of the FTD and certify that it meets all applicable requirements of FAR parts 121, 125, or 135), and the guidance of (AC 120-40B or 14 CFR Part 60). Appropriate hardware and software configuration control procedures have been established. Our Pilot(s), (Name(s)), who are qualified on (Aircraft Type) aircraft have assessed the FTD and have found that it conforms to the (Operator/Sponsor) (Aircraft Type) flight deck configuration and that the simulated systems and subsystems function equivalently to those in the aircraft. The above named pilot(s) have also assessed the performance and the flying qualities of the FTD and find that it represents the respective aircraft.

(Added Comments may be placed here)

Sincerely,

(Sponsor Representative)

ATTACHMENT 4 TO APPENDIX B TO PART 60—FIGURE B4D—SAMPLE QUALIFICATION TEST GUIDE COVER PAGE

INFORMATION

SPONSOR NAME

SPONSOR ADDRESS

FAA QUALIFICATION TEST GUIDE

(SPECIFIC AIRPLANE MODEL)
for example
Stratos BA797-320A

(Type of FTD)

(FTD Identification Including Manufacturer, Serial Number, Visual System Used)

(FTD Level)

(Qualification Performance Standard Used)

(FTD Location)

FAA Initial Evaluation

Date: _____________

__________________________ Date: ___________

(Sponsor)

__________________________ Date: ___________

FAA

ER09DE22.106</GPH>

ATTACHMENT 4 TO APPENDIX B TO PART 60—FIGURE B4E—SAMPLE STATEMENT OF QUALIFICATION—CERTIFICATE

INFORMATION

Federal Aviation Administration

Certificate of Qualification

This is to certify that representatives of the FAA
Completed an evaluation of the

Go-Fast Airlines
Farnsworth Z-100 Flight Training Device

FAA Identification Number 998

And pursuant to 14 CFR Part 60 found it to meet its original qualification basis, AC 120-45A (MM/DD/YY)

The Master Qualification Test Guide and the attached
Configuration List and Restrictions List
Provide the Qualification Basis for this device to operate at

Level 6

Until March 31, 2010

Unless sooner rescinded or extended by the FAA

February 15, 2009	*B. Williamson*
(date)	(for the FAA)

Attachment 4 to Appendix B to Part 60—
Figure B4F – Sample Statement of Qualification; Configuration List
INFORMATION

CERTIFICATE OF QUALIFICATION
CONFIGURATION LIST

Date: _____			
Section 1. FSTD Information and Characteristics			
Sponsor Name:	_____	FSTD Location:	
Address:	_____ _____	Physical Address:	_____ _____
City:	_____	City:	_____
State:	_____	State:	_____
Country:	_____	Country:	_____
ZIP:	_____	ZIP:	_____
Manager	_____		
Sponsor ID No: (Four Letter FAA Designator)	_____	Nearest Airport: (Airport Designator)	_____

Type of Evaluation Requested:	☐ Initial ☐ Upgrade ☐ Continuing Qualification ☐ Special ☐ Reinstatement				
Aircraft Make/model/series:	_____				
Initial Qualification: (If Applicable)	Date: _____ Level _____ MM/DD/YYYY	Manufacturer's Identification or Serial Number	_____________		
Upgrade Qualification: (If Applicable)	Date: _____ Level _____ MM/DD/YYYY	☐ eMQTG			
Qualification Basis:______________	☐ A	☐ B	☐ Interim C	☐ C	☐ D
	☐ 6	☐ 7	☐ Provisional Status		

Other Technical Information:			
FAA FSTD ID No: (If Applicable)	_____	FSTD Manufacturer:	_____
Convertible FSTD:	☐Yes:	Date of Manufacture:	_____ MM/DD/YYYY
Related FAA ID No. (If Applicable)	_____ _____ _____	Sponsor FSTD ID No: _________	
Engine model(s) and data revision: _________		Source of aerodynamic model: _________	
FMS identification and revision level: _________		Source of aerodynamic coefficient data: _________	
Visual system manufacturer/model: _________		Aerodynamic data revision number: _________	
Flight control data revision: _________		Visual system display: _________	
Mot ion system manufacturer/type: _________		FSTD computer(s) identification: _________	

National Aviation Authority (NAA): (If Applicable)	_________		
NAA FSTD ID No:	_________	Last NAA Evaluation Date:	_________
NAA Qualification Level:	_________		
NAA Qualification Basis:	_____		

Attachment 4 to Appendix B to Part 60—
Figure B4F – Sample Statement of Qualification; Configuration List
INFORMATION

Visual System Manufacturer and Type:	______	**FSTD Seats Available:** ______	**Motion System Manufacturer and Type:**	______:

Aircraft Equipment:	**Engine Type(s):** ____ ____	**Flight Instrumentation:** ☐ EFIS ☐ HUD ☐ HGS ☐ EFVS ☐ TCAS ☐ GPWS ☐ Plain View ☐ GPS ☐ FMS Type: __ ☐ WX Radar ☐ Other: __	**Engine Instrumentation:** ☐ EICAS ☐ FADEC ☐ Other: __

Airport Models:	3.6.1 ____ Airport Designator	3.6.2____ Airport Designator	3.6.3 ____ Airport Designator
Circle to Land:	3. 7.1 ____ Airport Designator	3. 7.2____ Approach	3. 7.3 ____ Landing Runway
Visual Ground Segment	3.8.1 ____ Airport Designator	3.8 .2____ Approach	3. 8.3 ____ Landing Runway

Section 2. Supplementary Information

FAA Training Program Approval Authority:		☐ **POI** ☐ **TCPM** ☐ **Other:** ______	
Name:	______	**Office:**	______
Tel:	______	**Fax:**	______
Email:	______		
FSTD Scheduling Person:			
Name:	______		
Address 1:	______	**Address 2**	______
City:	______	**State:**	______
ZIP:	______	**Email:**	______
Tel:	______	**Fax:**	______
FSTD Technical Contact:			
Name:	______		
Address 1:	______	**Address 2**	______
City:	______	**State:**	______
ZIP:	______	**Email:**	______
Tel:	______	**Fax:**	______

Section 3. Training, Testing and Checking Considerations

Area/Function/Maneuver	**Requested**	**Remarks**
Private Pilot - Training / Checks: (142)	☐	______
Commercial Pilot - Training /Checks:(142)	☐	______
Multi-Engine Rating - Training / Checks (142)	☐	______
Instrument Rating -Training / Checks (142)	☐	______
Type Rating - Training / Checks (135/121/142)	☐	______

Attachment 4 to Appendix B to Part 60—
Figure B4F – Sample Statement of Qualification; Configuration List
INFORMATION

Proficiency Checks (135/121/142)	☐	________
CAT I: (RVR 2400/1800 ft. DH200 ft)	☐	________
CAT II: (RVR 1200 ft. DH 100 ft)	☐	________
CAT III * (lowest minimum) __________ RVR __________ ft. * State CAT III (≤ 700 ft.), CAT IIIb (≤ 150 ft.), or CAT IIIc (0 ft.)	☐	________
Circling Approach	☐	________
Windshear Training:	☐	________
Windshear Training IAW 121.409(d) (121 Turbojets Only)	☐	________
Generic Unusual Attitudes and Recoveries within the Normal Flight Envelope	☐	________
Specific Unusual Attitudes Recoveries	☐	________
Auto-coupled Approach/Auto Go Around	☐	________
Auto-land / Roll Out Guidance	☐	________
TCAS/ACAS I / II	☐	________
WX-Radar	☐	________
HUD	☐	________
HGS	☐	________
EFVS	☐	________
Future Air Navigation Systems	☐	________
GPWS / EGPWS	☐	________
ETOPS Capability	☐	________
GPS	☐	________
SMGCS	☐	________
Helicopter Slope Landings	☐	________
Helicopter External Load Operations	☐	________
Helicopter Pinnacle Approach to Landings	☐	________
Helicopter Night Vision Maneuvers	☐	________
Helicopter Category A Takeoffs	☐	________

Attachment 4 to Appendix B to Part 60—
Figure B4G – Sample Statement of Qualification;– List of Qualified Tasks
INFORMATION

CERTIFICATE OF QUALIFICATION
List of Qualified Tasks

Go Fast Airline Training -- Farnsworth Z-100 -- Level D -- FAA ID# 999

The FTD is qualified to perform all of the tasks listed in
Appendix 1, Table B1B
for its assigned level of qualification *except* for the following listed tasks.

Qualified for all tasks in Table B1B, for which the sponsor has requested qualification, except for the following:

4.e.	Circling Approach
6. (a)	Emergency Descent (maximum rate)
6. (b)	Inflight Fire and Smoke Removal
6. (c)	Rapid Decompression
6. (d)	Emergency Evacuation

Additional tasks for which this FTD is qualified (i.e., in addition to the list in Table B1B):

NONE

ATTACHMENT 4 TO APPENDIX B TO PART 60—FIGURE B4H [RESERVED]

Attachment 4 to Appendix B to Part 60—
Figure B4I – Sample MQTG Index of Effective FSTD Directives
INFORMATION

Index of Effective FSTD Directives Filed in this Section			
Number	**Effective Date**	**Date of Notification**	**Details**

Continue as Necessary....

[Doc. No. FAA–2002–12461, 73 FR 26490, May 9, 2008, as amended by Docket FAA–2014–0391, Amdt. 60–4, 81 FR 18306, 18307, 18327, and 18376, Mar. 30, 2016; 81 FR 32087, 32110, 32111, and 32165, May 20, 2016; Amdt. 60–6, 83 FR 30275, June 27, 2018; Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75771, Dec. 9, 2022]

APPENDIX C TO PART 60—QUALIFICATION PERFORMANCE STANDARDS FOR HELICOPTER FULL FLIGHT SIMULATORS

BEGIN INFORMATION

This appendix establishes the standards for Helicopter FFS evaluation and qualification. The Flight Standards Service is responsible for the development, application, and implementation of the standards contained within this appendix. The procedures and criteria specified in this appendix will be used by the responsible Flight Standards office when conducting helicopter FFS evaluations.

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aworley on LAPBH6H6L3 with DISTILLER
VerDate Sep<11>2014 14:00 Mar 14, 2024 Jkt 262047 PO 00000 Frm 00287 Fmt 8010 Sfmt 8002 Q:\14\14V2.TXT PC31
ER09MY08.033</GPH>

22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements (§60.33).
23. [Reserved]
24. [Reserved]
25. FFS Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA) (§60.37).

Attachment 1 to Appendix C to Part 60—General Simulator Requirements.
Attachment 2 to Appendix C to Part 60—FFS Objective Tests.
Attachment 3 to Appendix C to Part 60—Simulator Subjective Evaluation.
Attachment 4 to Appendix C to Part 60—Sample Documents.
Attachment 5 to Appendix C to Part 60—FSTD Directives Applicable to Helicopter FFSs

END INFORMATION

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1. INTRODUCTION

BEGIN INFORMATION

a. This appendix contains background information as well as regulatory and informative material as described later in this section. To assist the reader in determining what areas are required and what areas are permissive, the text in this appendix is divided into two sections: ''QPS Requirements'' and ''Information.'' The QPS Requirements sections contain details regarding compliance with the part 60 rule language. These details are regulatory, but are found only in this appendix. The Information sections contain material that is advisory in nature, and designed to give the user general information about the regulation.

b. [Reserved]

c. The responsible Flight Standards office encourages the use of electronic media for all communication, including any record, report, request, test, or statement required by this appendix. The electronic media used must have adequate security provisions and be acceptable to the responsible Flight Standards office.

d. Related Reading References.

(1) 14 CFR part 60.
(2) 14 CFR part 61.
(3) 14 CFR part 63.
(4) 14 CFR part 119.
(5) 14 CFR part 121.
(6) 14 CFR part 125.
(7) 14 CFR part 135.
(8) 14 CFR part 141.
(9) 14 CFR part 142.
(10) AC 120–35, as amended, Flightcrew Member Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.
(11) AC 120–57, as amended, Surface Movement Guidance and Control System (SMGCS).
(12) AC 120–63, as amended, Helicopter Simulator Qualification.
(13) AC 150/5300–13, as amended, Airport Design.
(14) AC 150/5340–1, as amended, Standards for Airport Markings.
(15) AC 150/5340–4, as amended, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.
(16) AC 150/5340–19, as amended, Taxiway Centerline Lighting System.
(17) AC 150/5340–24, as amended, Runway and Taxiway Edge Lighting System.
(18) AC 150/5345–28, as amended, Precision Approach Path Indicator (PAPI) Systems
(19) AC 150/5390–2, as amended, Heliport Design
(20) International Air Transport Association document, ''Flight Simulator Design and Performance Data Requirements,'' as amended.
(21) AC 29–2, as amended, Flight Test Guide for Certification of Transport Category Rotorcraft.
(22) AC 27–1, as amended, Flight Test Guide for Certification of Normal Category Rotorcraft.
(23) International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, as amended.
(24) Airplane Flight Simulator Evaluation Handbook, Volume I, as amended and Volume II, as amended, The Royal Aeronautical Society, London, UK.
(25) FAA Airman Certification Standards and Practical Test Standards for Airline Transport Pilot, Type Ratings, Commercial Pilot, and Instrument Ratings.
(26) The FAA Aeronautical Information Manual (AIM). An electronic version of the AIM is on the Internet at *http://www.faa.gov/atpubs*.
(27) Aeronautical Radio, Inc. (ARINC) document number 436, titled *Guidelines For Electronic Qualification Test Guide* (as amended).
(28) Aeronautical Radio, Inc. (ARINC) document 610, *Guidance for Design and Integration of Aircraft Avionics Equipment in Simulators* (as amended).

END INFORMATION

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2. APPLICABILITY (§§60.1 AND 60.2)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.1, Applicability, or to §60.2, Applicability of sponsor rules to person who are not sponsors and who are engaged in certain unauthorized activities.

END INFORMATION

3. DEFINITIONS (§60.3)

BEGIN INFORMATION

See Appendix F of this part for a list of definitions and abbreviations from part 1 and part 60, including the appropriate appendices of part 60.

END INFORMATION

4. QUALIFICATION PERFORMANCE STANDARDS (§60.4)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.4, Qualification Performance Standards.

END INFORMATION

5. QUALITY MANAGEMENT SYSTEM (§60.5)

BEGIN INFORMATION

See Appendix E of this part for additional regulatory and informational material regarding Quality Management Systems.

END INFORMATION

6. SPONSOR QUALIFICATION REQUIREMENTS (§60.7)

BEGIN INFORMATION

a. The intent of the language in §60.7(b) is to have a specific FFS, identified by the sponsor, used at least once in an FAA-approved flight training program for the helicopter simulated during the 12-month period described. The identification of the specific FFS may change from one 12-month period to the next 12-month period as long as that sponsor sponsors and uses at least one FFS at least once during the prescribed period. There is no minimum number of hours or minimum FFS periods required.

b. The following examples describe acceptable operational practices:

(1) Example One.

(a) A sponsor is sponsoring a single, specific FFS for its own use, in its own facility or elsewhere—this single FFS forms the basis for the sponsorship. The sponsor uses that FFS at least once in each 12-month period in that sponsor's FAA-approved flight training program for the helicopter simulated. This 12-month period is established according to the following schedule:

(i) If the FFS was qualified prior to May 30, 2008, the 12-month period begins on the date of the first continuing qualification evaluation conducted in accordance with §60.19 after May 30, 2008, and continues for each subsequent 12-month period;

(ii) A device qualified on or after May 30, 2008, will be required to undergo an initial or upgrade evaluation in accordance with §60.15. Once the initial or upgrade evaluation is complete, the first continuing qualification evaluation will be conducted within 6 months. The 12 month continuing qualification evaluation cycle begins on that date and continues for each subsequent 12-month period.

(b) There is no minimum number of hours of FFS use required.

(c) The identification of the specific FFS may change from one 12-month period to the next 12-month period as long as that sponsor sponsors and uses at least one FFS at least once during the prescribed period.

(2) Example Two.

(a) A sponsor sponsors an additional number of FFSs, in its facility or elsewhere. Each additionally sponsored FFS must be—

(i) Used by the sponsor in the sponsor's FAA-approved flight training program for the helicopter simulated (as described in §60.7(d)(1)); or

(ii) Used by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the helicopter simulated (as described in §60.7(d)(1)). This 12-month period is established in the same manner as in example one; or

(iii) Provided a statement each year from a qualified pilot, (after having flown the helicopter, not the subject FFS or another FFS, during the preceding 12-month period) stating that the subject FFS's performance and handling qualities represent the helicopter (as described in §60.7(d)(2)). This statement is provided at least once in each 12-month period established in the same manner as in example one.

(b) There is no minimum number of hours of FFS use required.

(3) Example Three.

(a) A sponsor in New York (in this example, a Part 142 certificate holder) establishes ''satellite'' training centers in Chicago and Moscow.

(b) The satellite function means that the Chicago and Moscow centers must operate under the New York center's certificate (in accordance with all of the New York center's practices, procedures, and policies; *e.g.*, instructor and/or technician training/checking requirements, record keeping, QMS program).

(c) All of the FFSs in the Chicago and Moscow centers could be dry-leased (*i.e.*, the certificate holder does not have and use FAA-approved flight training programs for the FFSs in the Chicago and Moscow centers) because—

(i) Each FFS in the Chicago center and each FFS in the Moscow center is used at least once each 12-month period by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the helicopter (as described in § 60.7(d)(1)); OR

(ii) A statement is obtained from a qualified pilot (having flown the helicopter, not the subject FFS or another FFS during the preceding 12-month period) stating that the performance and handling qualities of each FFS in the Chicago and Moscow centers represents the helicopter (as described in § 60.7(d)(2)).

END INFORMATION

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7. Additional Responsibilities of the Sponsor (§ 60.9).

BEGIN INFORMATION

The phrase ''as soon as practicable'' in § 60.9(a) means without unnecessarily disrupting or delaying beyond a reasonable time the training, evaluation, or experience being conducted in the FFS.

END INFORMATION

---

8. FFS USE (§ 60.11)

BEGIN INFORMATION

No additional regulatory or informational material applies to § 60.11, FFS Use.

END INFORMATION

---

9. FFS OBJECTIVE DATA REQUIREMENTS (§ 60.13)

BEGIN QPS REQUIREMENTS

a. Flight test data used to validate FFS performance and handling qualities must have been gathered in accordance with a flight test program containing the following:

(1) A flight test plan consisting of:

(a) The maneuvers and procedures required for aircraft certification and simulation programming and validation

(b) For each maneuver or procedure—

(i) The procedures and control input the flight test pilot and/or engineer used.

(ii) The atmospheric and environmental conditions.

(iii) The initial flight conditions.

(iv) The helicopter configuration, including weight and center of gravity.

(v) The data to be gathered.

(vi) All other information necessary to recreate the flight test conditions in the FFS.

(2) Appropriately qualified flight test personnel.

(3) An understanding of the accuracy of the data to be gathered using appropriate alternative data sources, procedures, and instrumentation that is traceable to a recognized standard as described in Attachment 2, Table C2D of this appendix.

(4) Appropriate and sufficient data acquisition equipment or system(s), including appropriate data reduction and analysis methods and techniques, acceptable to the FAA's Aircraft Certification Service.

b. The data, regardless of source, must be presented:

(1) In a format that supports the FFS validation process;

(2) In a manner that is clearly readable and annotated correctly and completely;

(3) With resolution sufficient to determine compliance with the tolerances set forth in Attachment 2, Table C2A of this appendix.

(4) With any necessary instructions or other details provided, such as Stability Augmentation System (SAS) or throttle position; and

(5) Without alteration, adjustments, or bias. Data may be corrected to address known data calibration errors provided that an explanation of the methods used to correct the errors appears in the QTG. The corrected data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation.

c. After completion of any additional flight test, a flight test report must be submitted in support of the validation data. The report must contain sufficient data and rationale to support qualification of the FFS at the level requested.

d. As required by § 60.13(f), the sponsor must notify the responsible Flight Standards office when it becomes aware that an addition to, an amendment to, or a revision of data that may relate to FFS performance or handling characteristics is available. The data referred to in this paragraph is data used to validate the performance, handling qualities, or other characteristics of the aircraft, including data related to any relevant changes occurring after the type certificate was issued. The sponsor must—

(1) Within 10 calendar days, notify the responsible Flight Standards office of the existence of this data; and

(2) Within 45 calendar days, notify the responsible Flight Standards office of—

(a) The schedule to incorporate this data into the FFS; or

(b) The reason for not incorporating this data into the FFS.

e. In those cases where the objective test results authorize a "snapshot test" or a "series of snapshot test results" in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the "snapshot." The steady state condition must exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snap shot.

END QPS REQUIREMENTS

BEGIN INFORMATION

f. The FFS sponsor is encouraged to maintain a liaison with the manufacturer of the aircraft being simulated (or with the holder of the aircraft type certificate for the aircraft being simulated if the manufacturer is no longer in business), and, if appropriate, with the person who supplied the aircraft data package for the FFS in order to facilitate the notification required by §60.13(f).

g. It is the intent of the responsible Flight Standards office that for new aircraft entering service, at a point well in advance of preparation of the QTG, the sponsor should submit to the responsible Flight Standards office for approval, a descriptive document (see Table C2D, Sample Validation Data Roadmap for Helicopters) containing the plan for acquiring the validation data, including data sources. This document should clearly identify sources of data for all required tests, a description of the validity of these data for a specific engine type and thrust rating configuration, and the revision levels of all avionics affecting the performance or flying qualities of the aircraft. Additionally, this document should provide other information, such as the rationale or explanation for cases where data or data parameters are missing, instances where engineering simulation data are used or where flight test methods require further explanations. It should also provide a brief narrative describing the cause and effect of any deviation from data requirements. The aircraft manufacturer may provide this document.

h. There is no requirement for any flight test data supplier to submit a flight test plan or program prior to gathering flight test data. However, the responsible Flight Standards office notes that inexperienced data gatherers often provide data that is irrelevant, improperly marked, or lacking adequate justification for selection. Other problems include inadequate information regarding initial conditions or test maneuvers. The responsible Flight Standards office has been forced to refuse these data submissions as validation data for an FFS evaluation. It is for this reason that the responsible Flight Standards office recommends that any data supplier not previously experienced in this area review the data necessary for programming and for validating the performance of the FFS, and discuss the flight test plan anticipated for acquiring such data with the responsible Flight Standards office well in advance of commencing the flight tests.

i. The responsible Flight Standards office will consider, on a case-by-case basis, whether to approve supplemental validation data derived from flight data recording systems such as a Quick Access Recorder or Flight Data Recorder.

END INFORMATION

10. SPECIAL EQUIPMENT AND PERSONNEL REQUIREMENTS FOR QUALIFICATION OF THE FFS (§60.14)

BEGIN INFORMATION

a. In the event that the responsible Flight Standards office determines that special equipment or specifically qualified persons will be required to conduct an evaluation, the responsible Flight Standards office will make every attempt to notify the sponsor at least one (1) week, but in no case less than 72 hours, in advance of the evaluation. Examples of special equipment include spot photometers, flight control measurement devices, and sound analyzers. Examples of specially qualified personnel include individuals specifically qualified to install or use any special equipment when its use is required.

b. Examples of a special evaluation include an evaluation conducted after an FFS is moved, at the request of the TPAA, or as a result of comments received from users of the FFS that raise questions about the continued qualification or use of the FFS.

END INFORMATION

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11. INITIAL (AND UPGRADE) QUALIFICATION REQUIREMENTS (§60.15)

BEGIN QPS REQUIREMENTS

a. In order to be qualified at a particular qualification level, the FFS must:

(1) Meet the general requirements listed in Attachment 1 of this appendix;

(2) Meet the objective testing requirements listed in Attachment 2 of this appendix; and

(3) Satisfactorily accomplish the subjective tests listed in Attachment 3 of this appendix.

b. The request described in §60.15(a) must include all of the following:

(1) A statement that the FFS meets all of the applicable provisions of this part and all applicable provisions of the QPS.

(2) A confirmation that the sponsor will forward to the responsible Flight Standards office the statement described in §60.15(b) in such time as to be received no later than 5 business days prior to the scheduled evaluation and may be forwarded to the responsible Flight Standards office via traditional or electronic means.

(3) A QTG, acceptable to the responsible Flight Standards office, that includes all of the following:

(a) Objective data obtained from aircraft testing or another approved source.

(b) Correlating objective test results obtained from the performance of the FFS as prescribed in the appropriate QPS.

(c) The result of FFS subjective tests prescribed in the appropriate QPS.

(d) A description of the equipment necessary to perform the evaluation for initial qualification and the continuing qualification evaluations.

c. The QTG described in paragraph (a)(3) of this section, must provide the documented proof of compliance with the simulator objective tests in Attachment 2, Table C2A of this appendix.

d. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, to the responsible Flight Standards office for review and approval, and must include, for each objective test:

(1) Parameters, tolerances, and flight conditions.

(2) Pertinent and complete instructions for the conduct of automatic and manual tests.

(3) A means of comparing the FFS test results to the objective data.

(4) Any other information as necessary, to assist in the evaluation of the test results.

(5) Other information appropriate to the qualification level of the FFS.

e. The QTG described in paragraphs (a)(3) and (b) of this section, must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see Attachment 4, Figure C4C, of this appendix, for a sample QTG cover page).

(2) A continuing qualification evaluation schedule requirements page. This page will be used by the responsible Flight Standards office to establish and record the frequency with which continuing qualification evaluations must be conducted and any subsequent changes that may be determined by the responsible Flight Standards office in accordance with §60.19. See Attachment 4 of this appendix, Figure C4G, for a sample Continuing Qualification Evaluation Requirements page.

(3) An FFS information page that provides the information listed in this paragraph (see Attachment 4, Figure C4B, of this appendix for a sample FFS information page). For convertible FFSs, the sponsor must submit a separate page for each configuration of the FFS.

(a) The sponsor's FFS identification number or code.

(b) The helicopter model and series being simulated.

(c) The aerodynamic data revision number or reference.

(d) The source of the basic aerodynamic model and the aerodynamic coefficient data used to modify the basic model.

(e) The engine model(s) and its data revision number or reference.

(f) The flight control data revision number or reference.

(g) The flight management system identification and revision level.

(h) The FFS model and manufacturer.

(i) The date of FFS manufacture.

(j) The FFS computer identification.

(k) The visual system model and manufacturer, including display type.

(l) The motion system type and manufacturer, including degrees of freedom.

(4) A Table of Contents.

(5) A log of revisions and a list of effective pages.

(6) List of all relevant data references.

(7) A glossary of terms and symbols used (including sign conventions and units).

(8) Statements of compliance and capability (SOCs) with certain requirements.

(9) Recording procedures or equipment required to accomplish the objective tests.

(10) The following information for each objective test designated in Attachment 2 of this appendix, Table C2A, as applicable to the qualification level sought:

(a) Name of the test.

(b) Objective of the test.

(c) Initial conditions.

(d) Manual test procedures.

(e) Automatic test procedures (if applicable).

(f) Method for evaluating FFS objective test results.

(g) List of all relevant parameters driven or constrained during the automatically conducted test(s).

(h) List of all relevant parameters driven or constrained during the manually conducted test(s).

(i) Tolerances for relevant parameters.

(j) Source of Validation Data (document and page number).

(k) Copy of the Validation Data (if located in a separate binder, a cross reference for the identification and page number for pertinent data location must be provided).

(l) Simulator Objective Test Results as obtained by the sponsor. Each test result must reflect the date completed and must be clearly labeled as a product of the device being tested.

f. A convertible FFS is addressed as a separate FFS for each model and series helicopter to which it will be converted and for the FAA qualification level sought. If a sponsor seeks qualification for two or more models of a helicopter type using a convertible FFS, the sponsor must submit a QTG for each helicopter model, or a QTG for the first helicopter model and a supplement to that QTG for each additional helicopter model. The responsible Flight Standards office will conduct evaluations for each helicopter model.

g. Form and manner of presentation of objective test results in the QTG:

(1) The sponsor's FFS test results must be recorded in a manner acceptable to the responsible Flight Standards office, that allows easy comparison of the FFS test results to the validation data (e.g., use of a multi-channel recorder, line printer, cross plotting, overlays, transparencies).

(2) FFS results must be labeled using terminology common to helicopter parameters as opposed to computer software identifications.

(3) Validation data documents included in a QTG may be photographically reduced only if such reduction will not alter the graphic scaling or cause difficulties in scale interpretation or resolution.

(4) Scaling on graphical presentations must provide the resolution necessary to evaluate the parameters shown in Attachment 2, Table C2A of this appendix.

(5) Tests involving time histories, data sheets (or transparencies thereof) and FFS test results must be clearly marked with appropriate reference points to ensure an accurate comparison between the FFS and the helicopter with respect to time. Time histories recorded via a line printer are to be clearly identified for cross plotting on the helicopter data. Over-plots must not obscure the reference data.

h. The sponsor may elect to complete the QTG objective and subjective tests at the manufacturer's facility or at the sponsor's training facility. If the tests are conducted at the manufacturer's facility, the sponsor must repeat at least one-third of the tests at the sponsor's training facility in order to substantiate FFS performance. The QTG must be clearly annotated to indicate when and where each test was accomplished. Tests conducted at the manufacturer's facility and at the sponsor's training facility must be conducted after the FFS is assembled with systems and sub-systems functional and operating in an interactive manner. The test results must be submitted to the responsible Flight Standards office.

i. The sponsor must maintain a copy of the MQTG at the FFS location.

j. All FFSs for which the initial qualification is conducted after May 30, 2014, must have an electronic MQTG (EmqTG) including all objective data obtained from helicopter testing, or another approved source (reformatted or digitized), together with correlating objective test results obtained from the performance of the FFS (reformatted or digitized) as prescribed in this appendix. ThE EmqTG must also contain the general FFS performance or demonstration results (reformatted or digitized) prescribed in this appendix, and a description of the equipment necessary to perform the initial qualification evaluation and the continuing qualification evaluations. ThE EmqTG must include the original validation data used to validate FFS performance and handling qualities in either the original digitized format from the data supplier or an electronic scan of the original time-history plots that were provided by the data supplier. A copy of thE EmqTG must be provided to the responsible Flight Standards office.

k. All other FFSs not covered in subparagraph "j" must have an electronic copy of the MQTG by May 30, 2014. An electronic copy of the MQTG must be provided to the responsible Flight Standards office. This may be provided by an electronic scan presented in a Portable Document File (PDF), or similar format acceptable to the responsible Flight Standards office.

l. During the initial (or upgrade) qualification evaluation conducted by the responsible Flight Standards office, the sponsor must also provide a person who is a user of the device (e.g., a qualified pilot or instructor pilot with flight time experience in that aircraft) and knowledgeable about the operation of the aircraft and the operation of the FFS.

END QPS REQUIREMENTS

BEGIN INFORMATION

m. Only those FFSs that are sponsored by a certificate holder as defined in Appendix F of this part will be evaluated by the responsible Flight Standards office. However, other FFS evaluations may be conducted on a case-by-case basis as the Administrator deems appropriate, but only in accordance with applicable agreements.

n. The responsible Flight Standards office will conduct an evaluation for each configuration, and each FFS must be evaluated as completely as possible. To ensure a thorough and uniform evaluation, each FFS is subjected to the general simulator requirements in Attachment 1 of this appendix, the objective tests listed in Attachment 2 of this appendix, and the subjective tests listed in Attachment 3 of this appendix. The evaluations described herein will include, but not necessarily be limited to the following:

(1) Helicopter responses, including longitudinal and lateral-directional control responses (see Attachment 2 of this appendix).

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(2) Performance in authorized portions of the simulated helicopter's operating envelope, to include tasks evaluated by the responsible Flight Standards office in the areas of surface operations, takeoff, climb, cruise, descent, approach, and landing as well as abnormal and emergency operations (see Attachment 2 of this appendix).

(3) Control checks (see Attachment 1 and Attachment 2 of this appendix).

(4) Flight deck configuration (see Attachment 1 of this appendix).

(5) Pilot, flight engineer, and instructor station functions checks (see Attachment 1 and Attachment 3 of this appendix).

(6) Helicopter systems and sub-systems (as appropriate) as compared to the helicopter simulated (see Attachment 1 and Attachment 3 of this appendix).

(7) FFS systems and sub-systems, including force cueing (motion), visual, and aural (sound) systems, as appropriate (see Attachment 1 and Attachment 2 of this appendix).

(8) Certain additional requirements, depending upon the qualification level sought, including equipment or circumstances that may become hazardous to the occupants. The sponsor may be subject to Occupational Safety and Health Administration requirements.

o. The responsible Flight Standards office administers the objective and subjective tests, which includes an examination of functions. The tests include a qualitative assessment of the FFS by a pilot from the responsible Flight Standards office. The evaluation team leader may assign other qualified personnel to assist in accomplishing the functions examination and/or the objective and subjective tests performed during an evaluation when required.

(1) Objective tests provide a basis for measuring and evaluating FFS performance and determining compliance with the requirements of this part.

(2) Subjective tests provide a basis for:

(a) Evaluating the capability of the FFS to perform over a typical utilization period;

(b) Determining that the FFS satisfactorily simulates each required task;

(c) Verifying correct operation of the FFS controls, instruments, and systems; and

(d) Demonstrating compliance with the requirements of this part.

p. The tolerances for the test parameters listed in Attachment 2 of this appendix reflect the range of tolerances acceptable to the responsible Flight Standards office for FFS validation and are not to be confused with design tolerances specified for FFS manufacture. In making decisions regarding tests and test results, the responsible Flight Standards office relies on the use of operational and engineering judgment in the application of data (including consideration of the way in which the flight test was flown and way the data was gathered and applied), data presentations, and the applicable tolerances for each test.

q. In addition to the scheduled continuing qualification evaluation, each FFS is subject to evaluations conducted by the responsible Flight Standards office at any time without prior notification to the sponsor. Such evaluations would be accomplished in a normal manner (i.e., requiring exclusive use of the FFS for the conduct of objective and subjective tests and an examination of functions) if the FFS is not being used for flight crewmember training, testing, or checking. However, if the FFS were being used, the evaluation would be conducted in a non-exclusive manner. This non-exclusive evaluation will be conducted by the FFS evaluator accompanying the check airman, instructor, Aircrew Program Designee (APD), or FAA inspector aboard the FFS along with the student(s) and observing the operation of the FFS during the training, testing, or checking activities.

r. Problems with objective test results are handled as follows:

(1) If a problem with an objective test result is detected by the evaluation team during an evaluation, the test may be repeated or the QTG may be amended.

(2) If it is determined that the results of an objective test do not support the level requested but do support a lower level, the responsible Flight Standards office may qualify the FFS at that lower level. For example, if a Level D evaluation is requested and the FFS fails to meet sound test tolerances, it could be qualified at Level C.

s. After an FFS is successfully evaluated, the responsible Flight Standards office issues a certificate of qualification (COQ) to the sponsor. The responsible Flight Standards office recommends the FFS to the TPAA, who will approve the FFS for use in a flight training program. The COQ will be issued at the satisfactory conclusion of the initial or continuing qualification evaluation and will list the tasks for which the FFS is qualified, referencing the tasks described in Table C1B in Attachment 1 of this appendix. However, it is the sponsor's responsibility to obtain TPAA approval prior to using the FFS in an FAA-approved flight training program.

t. Under normal circumstances, the responsible Flight Standards office establishes a date for the initial or upgrade evaluation within ten (10) working days after determining that a complete QTG is acceptable. Unusual circumstances may warrant establishing an evaluation date before this determination is made. A sponsor may schedule an evaluation date as early as 6 months in advance. However, there may be a delay of 45 days or more in rescheduling and completing the evaluation if the sponsor is unable to meet the scheduled date. See Attachment 4, of this appendix, Figure C4A, Sample Request for Initial, Upgrade, or Reinstatement Evaluation.

u. The numbering system used for objective test results in the QTG should closely follow the numbering system set out in Attachment 2, FFS Objective Tests, Table C2A of this appendix.

v. Contact the responsible Flight Standards office for additional information regarding the preferred qualifications of pilots used to meet the requirements of §60.15(d).

w. Examples of the exclusions for which the FFS might not have been subjectively tested by the sponsor or the responsible Flight Standards office and for which qualification might not be sought or granted, as described in §60.15(g)(6), include takeoffs and landing from slopes and pinnacles.

END INFORMATION

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12. ADDITIONAL QUALIFICATIONS FOR A CURRENTLY QUALIFIED FFS (§60.16)

No additional regulatory or informational material applies to §60.16, Additional Qualifications for a Currently Qualified FFS.

13. PREVIOUSLY QUALIFIED FFSS (§60.17)

BEGIN QPS REQUIREMENTS

a. In instances where a sponsor plans to remove an FFS from active status for a period of less than two years, the following procedures apply:

(1) The responsible Flight Standards office must be notified in writing and the notification must include an estimate of the period that the FFS will be inactive.

(2) Continuing Qualification evaluations will not be scheduled during the inactive period.

(3) The responsible Flight Standards office will remove the FFS from the list of qualified FSTDs on a mutually established date not later than the date on which the first missed continuing qualification evaluation would have been scheduled.

(4) Before the FFS is restored to qualified status, it must be evaluated by the responsible Flight Standards office. The evaluation content and the time required to accomplish the evaluation is based on the number of continuing qualification evaluations and sponsor-conducted quarterly inspections missed during the period of inactivity.

(5) The sponsor must notify the responsible Flight Standards office of any changes to the original scheduled time out of service.

b. Simulators qualified prior to May 30, 2008, are not required to meet the general simulation requirements, the objective test requirements, and the subjective test requirements of attachments 1, 2, and 3, of this appendix as long as the simulator continues to meet the test requirements contained in the MQTG developed under the original qualification basis.

c. After May 30, 2009, each visual scene or airport model beyond the minimum required for the FFS qualification level that is installed in and available for use in a qualified FFS must meet the requirements described in Attachment 3 of this appendix.

d. Simulators qualified prior to May 30, 2008, may be updated. If an evaluation is deemed appropriate or necessary by the responsible Flight Standards office after such an update, the evaluation will not require an evaluation to standards beyond those against which the simulator was originally qualified.

END QPS REQUIREMENTS

BEGIN INFORMATION

e. Other certificate holders or persons desiring to use an FFS may contract with FFS sponsors to use FFSs previously qualified at a particular level for a helicopter type and approved for use within an FAA-approved flight training program. Such FFSs are not required to undergo an additional qualification process, except as described in §60.16.

f. Each FFS user must obtain approval from the appropriate TPAA to use any FFS in an FAA-approved flight training program.

g. The intent of the requirement listed in §60.17(b), for each FFS to have an SOQ within 6 years, is to have the availability of that statement (including the configuration list and the limitations to authorizations) to provide a complete picture of the FFS inventory regulated by the FAA. The issuance of the statement will not require any additional evaluation or require any adjustment to the evaluation basis for the FFS.

h. Downgrading of an FFS is a permanent change in qualification level and will necessitate the issuance of a revised SOQ to reflect the revised qualification level, as appropriate. If a temporary restriction is placed on an FFS because of a missing, malfunctioning, or inoperative component or ongoing repairs, the restriction is not a permanent change in qualification level. Instead, the restriction is temporary and is removed when the reason for the restriction has been resolved.

i. The responsible Flight Standards office will determine the evaluation criteria for an FFS that has been removed from active status. The criteria will be based on the number of continuing qualification evaluations and quarterly inspections missed during the period of inactivity. For example, if the FFS were out of service for a 1 year period, it would be necessary to complete the entire QTG, since all of the quarterly evaluations would have been missed. The responsible Flight Standards office will also consider how the FFS was stored, whether parts were removed from the FFS and whether the FFS was disassembled.

j. The FFS will normally be requalified using the FAA-approved MQTG and the criteria that was in effect prior to its removal from qualification. However, inactive periods of 2 years or more will require requalification under the standards in effect and current at the time of requalification.

END INFORMATION

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14. INSPECTION, CONTINUING QUALIFICATION EVALUATION, AND MAINTENANCE REQUIREMENTS (§60.19)

BEGIN QPS REQUIREMENTS

a. The sponsor must conduct a minimum of four evenly spaced inspections throughout the year. The objective test sequence and content of each inspection must be developed by the sponsor and must be acceptable to the responsible Flight Standards office.

b. The description of the functional preflight check must be contained in the sponsor's QMS.

c. Record "functional preflight" in the FFS discrepancy log book or other acceptable location, including any item found to be missing, malfunctioning, or inoperative.

d. During the continuing qualification evaluation conducted by the responsible Flight Standards office, the sponsor must also provide a person knowledgeable about the operation of the aircraft and the operation of the FFS.

e. The responsible Flight Standards office will conduct continuing qualification evaluations every 12 months unless:

(1) The responsible Flight Standards office becomes aware of discrepancies or performance problems with the device that warrants more frequent evaluations; or

(2) The sponsor implements a QMS that justifies less frequent evaluations. However, in no case shall the frequency of a continuing qualification evaluation exceed 36 months.

END QPS REQUIREMENTS

BEGIN INFORMATION

f. The sponsor's test sequence and the content of each quarterly inspection required in §60.19(a)(1) should include a balance and a mix from the objective test requirement areas listed as follows:

(1) Performance.

(2) Handling qualities.

(3) Motion system (where appropriate).

(4) Visual system (where appropriate).

(5) Sound system (where appropriate).

(6) Other FFS systems.

g. If the evaluator plans to accomplish specific tests during a normal continuing qualification evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; but not less than 72 hours. Examples of such tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests.

h. The continuing qualification evaluations, described in §60.19(b), will normally require 4 hours of FFS time. However, flexibility is necessary to address abnormal situations or situations involving aircraft with additional levels of complexity (*e.g.*, computer controlled aircraft). The sponsor should anticipate that some tests may require additional time. The continuing qualification evaluations will consist of the following:

(1) Review of the results of the quarterly inspections conducted by the sponsor since the last scheduled continuing qualification evaluation.

(2) A selection of approximately 8 to 15 objective tests from the MQTG that provide an adequate opportunity to evaluate the performance of the FFS. The tests chosen will be performed either automatically or manually and should be able to be conducted within approximately one-third (1/3) of the allotted FFS time.

(3) A subjective evaluation of the FFS to perform a representative sampling of the tasks set out in attachment 3 of this appendix. This portion of the evaluation should take approximately two-thirds (2/3) of the allotted FFS time.

(4) An examination of the functions of the FFS may include the motion system, visual system, sound system, instructor operating station, and the normal functions and simulated malfunctions of the simulated helicopter systems. This examination is normally accomplished simultaneously with the subjective evaluation requirements.

END INFORMATION

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15. LOGGING FFS DISCREPANCIES (§60.20)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.20. Logging FFS Discrepancies.

END INFORMATION

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16. INTERIM QUALIFICATION OF FFSS FOR NEW HELICOPTER TYPES OR MODELS (§ 60.21)

BEGIN INFORMATION

No additional regulatory or informational material applies to § 60.21, Interim Qualification of FFSs for New Helicopter Types or Models.

END INFORMATION

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17. MODIFICATIONS TO FFSS (§ 60.23)

BEGIN QPS REQUIREMENTS

a. The notification described in § 60.23(c)(2) must include a complete description of the planned modification, with a description of the operational and engineering effect the proposed modification will have on the operation of the FFS and the results that are expected with the modification incorporated.

b. Prior to using the modified FFS:

(1) All the applicable objective tests completed with the modification incorporated, including any necessary updates to the MQTG (*e.g.*, accomplishment of FSTD Directives) must be acceptable to the responsible Flight Standards office; and

(2) The sponsor must provide the responsible Flight Standards office with a statement signed by the MR that the factors listed in § 60.15(b) are addressed by the appropriate personnel as described in that section.

END QPS REQUIREMENTS

BEGIN INFORMATION

(3) FSTD Directives are considered modifications of an FFS. See Attachment 4 of this appendix for a sample index of effective FSTD Directives. See Attachment 6 of this appendix for a list of all effective FSTD Directives applicable to Helicopter FFSs.

END INFORMATION

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18. OPERATION WITH MISSING, MALFUNCTIONING, OR INOPERATIVE COMPONENTS (§ 60.25)

BEGIN INFORMATION

a. The sponsor's responsibility with respect to § 60.25(a) is satisfied when the sponsor fairly and accurately advises the user of the current status of an FFS, including any missing, malfunctioning, or inoperative (MMI) component(s).

b. It is the responsibility of the instructor, check airman, or representative of the administrator conducting training, testing, or checking to exercise reasonable and prudent judgment to determine if any MMI component is necessary for the satisfactory completion of a specific maneuver, procedure, or task.

c. If the 29th or 30th day of the 30-day period described in § 60.25(b) is on a Saturday, a Sunday, or a holiday, the FAA will extend the deadline until the next business day.

d. In accordance with the authorization described in § 60.25(b), the sponsor may develop a discrepancy prioritizing system to accomplish repairs based on the level of impact on the capability of the FFS. Repairs having a larger impact on FFS capability to provide the required training, evaluation, or flight experience will have a higher priority for repair or replacement.

END INFORMATION

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19. AUTOMATIC LOSS OF QUALIFICATION AND PROCEDURES FOR RESTORATION OF QUALIFICATION (§ 60.27)

BEGIN INFORMATION

If the sponsor provides a plan for how the FFS will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems; routine replacement of hydraulic fluid; control of the environmental factors in which the FFS is to be maintained) there is a greater likelihood that the responsible Flight Standards office will be able to determine the amount of testing required for requalification.

END INFORMATION

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20. OTHER LOSSES OF QUALIFICATION AND PROCEDURES FOR RESTORATION OF QUALIFICATION (§ 60.29)

BEGIN INFORMATION

If the sponsor provides a plan for how the FFS will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems; routine replacement of hydraulic fluid; control of the environmental factors in which the FFS is to be maintained) there is a greater likelihood that the responsible Flight Standards office will be able to determine the amount of testing required for requalification.

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END INFORMATION

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21. RECORD KEEPING AND REPORTING (§60.31)

BEGIN QPS REQUIREMENTS

a. FFS modifications can include hardware or software changes. For FFS modifications involving software programming changes, the record required by §60.31(a)(2) must consist of the name of the aircraft system software, aerodynamic model, or engine model change, the date of the change, a summary of the change, and the reason for the change.

b. If a coded form for record keeping is used, it must provide for the preservation and retrieval of information with appropriate security or controls to prevent the inappropriate alteration of such records after the fact.

END QPS REQUIREMENTS

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22. APPLICATIONS, LOGBOOKS, REPORTS, AND RECORDS: FRAUD, FALSIFICATION, OR INCORRECT STATEMENTS (§60.33)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.33, Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements.

23. [RESERVED]

24. [RESERVED]

25. FFS QUALIFICATION ON THE BASIS OF A BILATERAL AVIATION SAFETY AGREEMENT (BASA) (§60.37)

No additional regulatory or informational material applies to §60.37, FFS Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA).

END INFORMATION

ATTACHMENT 1 TO APPENDIX C TO PART 60—GENERAL SIMULATOR REQUIREMENTS

BEGIN QPS REQUIREMENTS

1. REQUIREMENTS

a. Certain requirements included in this appendix must be supported with an SOC as defined in Appendix F of this part, which may include objective and subjective tests. The requirements for SOCs are indicated in the ''General Simulator Requirements'' column in Table C1A of this appendix.

b. Table C1A describes the requirements for the indicated level of FFS. Many devices include operational systems or functions that exceed the requirements outlined in this section. However, all systems will be tested and evaluated in accordance with this appendix to ensure proper operation.

END QPS REQUIREMENTS

BEGIN INFORMATION

2. DISCUSSION

a. This attachment describes the general simulator requirements for qualifying a helicopter FFS. The sponsor should also consult the objective tests in Attachment 2 of this appendix and the examination of functions and subjective tests listed in Attachment 3 of this appendix to determine the complete requirements for a specific level simulator.

b. The material contained in this attachment is divided into the following categories:

(1) General flight deck configuration.

(2) Simulator programming.

(3) Equipment operation.

(4) Equipment and facilities for instructor/evaluator functions.

(5) Motion system.

(6) Visual system.

(7) Sound system.

c. Table C1A provides the standards for the General Simulator Requirements.

d. Table C1B provides the tasks that the sponsor will examine to determine whether the FFS satisfactorily meets the requirements for flight crew training, testing, and experience, and provides the tasks for which the simulator may be qualified.

e. Table C1C provides the functions that an instructor/check airman must be able to control in the simulator.

f. It is not required that all of the tasks that appear on the List of Qualified Tasks (part of the SOQ) be accomplished during the initial or continuing qualification evaluation.

g. Table C1A addresses only Levels B, C, and D helicopter simulators because there are no Level A Helicopter simulators.

END INFORMATION

TABLE C1A—MINIMUM SIMULATOR REQUIREMENTS

Entry No.	QPS requirements	Simulator levels			Information
	General simulator requirements	B	C	D	Notes
1.	**General Flight Deck Configuration**				
1.a.	The simulator must have a flight deck that is a replica of the helicopter being simulated. The simulator must have controls, equipment, observable flight deck indicators, circuit breakers, and bulkheads properly located, functionally accurate and replicating the helicopter. The direction of movement of controls and switches must be identical to that in the helicopter. Pilot seats must afford the capability for the occupant to be able to achieve the design "eye position" established for the helicopter being simulated. Equipment for the operation of the flight deck windows must be included, but the actual windows need not be operable. Fire axes, extinguishers, and spare light bulbs must be available in the FFS but may be relocated to a suitable location as near as practical to the original position. Fire axes, landing gear pins, and any similar purpose instruments need only be represented in silhouette.	X	X	X	For simulator purposes, the flight deck consists of all that space forward of a cross section of the fuselage at the most extreme aft setting of the pilots' seats including additional, required flight crewmember duty stations and those required bulkheads aft of the pilot seats. For clarification, bulkheads containing only items such as landing gear pin storage compartments, fire axes and extinguishers, spare light bulbs, and aircraft documents pouches are not considered essential and may be omitted.
1.b.	Those circuit breakers that affect procedures or result in observable flight deck indications must be properly located and functionally accurate.	X	X	X	
2.	**Programming**				
2.a.	A flight dynamics model that accounts for various combinations of air speed and power normally encountered in flight must correspond to actual flight conditions, including the effect of change in helicopter attitude, aerodynamic and propulsive forces and moments, altitude, temperature, mass, center of gravity location, and configuration. An SOC is required	X	X	X	
2.b.	The simulator must have the computer capacity, accuracy, resolution, and dynamic response needed to meet the qualification level sought. An SOC is required	X	X	X	
2.c.	Ground handling (where appropriate) and aerodynamic programming must include the following:.				
2.c.1.	Ground effect Level B does not require hover programming An SOC is required	X	X	X	Applicable areas include flare and touch down from a running landing as well as for in-ground-effect (IGE) hover. A reasonable simulation of ground effect includes modeling of lift, drag, pitching moment, trim, and power while in ground effect.
2.c.2.	Ground reaction Level B does not require hover programming An SOC is required	X	X	X	Reaction of the helicopter upon contact with the landing surface during landing (e.g., strut deflection, tire or skid friction, side forces) may differ with changes in gross weight, airspeed, rate of descent on touchdown, and slide slip.

TABLE C1A—MINIMUM SIMULATOR REQUIREMENTS—Continued

Entry No.	QPS requirements	Simulator levels			Information
	General simulator requirements	B	C	D	Notes
2.d.	The simulator must provide for manual and automatic testing of simulator hardware and software programming to determine compliance with simulator objective tests as prescribed in Attachment 2 of this appendix. An SOC is required		X	X	This may include an automated system, which could be used for conducting at least a portion of the QTG tests. Automatic ''flagging'' of out-of-tolerance situations is encouraged.
2.e.	The relative responses of the motion system, visual system, and flight deck instruments must be measured by latency tests or transport delay tests. Motion onset must occur before the end of the scan of that video field. Instrument response may not occur prior to motion onset. Test results must be within the following limits:				The intent is to verify that the simulator provides instrument, motion, and visual cues that are like the helicopter responses within the stated time delays. It is preferable motion onset occur before the start of the visual scene change (the start of the scan of the first video field containing different information). For helicopter response, acceleration in the appropriate corresponding rotational axis is preferred.
2.e.1.	Response must be within 150 milliseconds of the helicopter response.	X			
2.e.2.	Response must be within 100 milliseconds of the helicopter response.		X	X	
2.f.	The simulator must simulate brake and tire failure dynamics (including antiskid failure, if appropriate). An SOC is required.		X	X	The simulator should represent the motion (in the appropriate axes) and the directional control characteristics of the helicopter when experiencing simulated brake or tire failures.
2.g.	The aerodynamic modeling in the simulator must include:. (1) Ground effect, (2) Effects of airframe and rotor icing (if applicable), (3) Aerodynamic interference effects between the rotor wake and fuselage, (4) Influence of the rotor on control and stabilization systems, (5) Representations of settling with power, and (6) Retreating blade stall. An SOC is required.		X	X	See Attachment 2 of this appendix for further information on ground effect.
2.h.	The simulator must provide for realistic mass properties, including gross weight, center of gravity, and moments of inertia as a function of payload and fuel loading. An SOC is required.	X	X	X	
3.	**Equipment Operation**				
3.a.	All relevant instrument indications involved in the simulation of the helicopter must automatically respond to control movement or external disturbances to the simulated helicopter; e.g., turbulence or windshear. Numerical values must be presented in the appropriate units.	X	X	X	
3.b.	Communications, navigation, caution, and warning equipment must be installed and operate within the tolerances applicable for the helicopter being simulated.	X	X	X	See Attachment 3 of this appendix for further information regarding long-range navigation equipment.
3.c.	Simulated helicopter systems must operate as the helicopter systems operate under normal, abnormal, and emergency operating conditions on the ground and in flight.	X	X	X	

TABLE C1A—MINIMUM SIMULATOR REQUIREMENTS—Continued

Entry No.	QPS requirements	Simulator levels			Information
	General simulator requirements	B	C	D	Notes
3.d.	The simulator must provide pilot controls with control forces and control travel that correspond to the simulated helicopter. The simulator must also react in the same manner as the helicopter under the same flight conditions.	X	X	X	
3.e.	Simulator control feel dynamics must replicate the helicopter simulated. This must be determined by comparing a recording of the control feel dynamics of the simulator to helicopter measurements. For initial and upgrade evaluations, the control dynamic characteristics must be measured and recorded directly from the flight deck controls, and must be accomplished in takeoff, cruise, and landing conditions and configurations.		X	X	
4.	**Instructor/Evaluator Facilities**				
4.a.	In addition to the flight crewmember stations, the simulator must have at least two suitable seats for the instructor/check airman and FAA inspector. These seats must provide adequate vision to the pilot's panel and forward windows. All seats other than flight crew seats need not represent those found in the helicopter but must be adequately secured to the floor and equipped with similar positive restraint devices.	X	X	X	The responsible Flight Standards office will consider alternatives to this standard for additional seats based on unique flight deck configurations.
4.b.	The simulator must have controls that enable the instructor/evaluator to control all required system variables and insert all abnormal or emergency conditions into the simulated helicopter systems as described in the sponsor's FAA-approved training program, or as described in the relevant operating manual as appropriate.	X	X	X	
4.c.	The simulator must have instructor controls for all environmental effects expected to be available at the IOS; e.g., clouds, visibility, icing, precipitation, temperature, storm cells, and wind speed and direction.	X	X	X	
4.d.	The simulator must provide the instructor or evaluator the ability to present ground and air hazards.		X	X	For example, another aircraft crossing the active runway and converging airborne traffic.
4.e.	The simulator must provide the instructor or evaluator the ability to present the effect of re-circulating dust, water vapor, or snow conditions that develop as a result of rotor downwash.		X	X	This is a selectable condition that is not required for all operations on or near the surface.
5.	**Motion System**				
5.a.	The simulator must have motion (force) cues perceptible to the pilot that are representative of the motion in a helicopter.	X	X	X	For example, touchdown cues should be a function of the rate of descent (RoD) of the simulated helicopter.
5.b.	The simulator must have a motion (force cueing) system with a minimum of three degrees of freedom (at least pitch, roll, and heave). An SOC is required.	X			

TABLE C1A—MINIMUM SIMULATOR REQUIREMENTS—Continued

Entry No.	QPS requirements	Simulator levels			Information
	General simulator requirements	B	C	D	Notes
5.c.	The simulator must have a motion (force cueing) system that produces cues at least equivalent to those of a six-degrees-of-freedom, synergistic platform motion system (i.e., pitch, roll, yaw, heave, sway, and surge). An SOC is required.		X	X	
5.d.	The simulator must provide for the recording of the motion system response time. An SOC is required.	X	X	X	
5.e.	The simulator must provide motion effects programming to include the following:.				
	(1) Runway rumble, oleo deflections, effects of ground speed, uneven runway, characteristics. (2) Buffets due to transverse flow effects. (3) Buffet during extension and retraction of landing gear. (4) Buffet due to retreating blade stall. (5) Buffet due to vortex ring (settling with power). (6) Representative cues resulting from touchdown. (7) High speed rotor vibrations.	X	X	X	
	(8) Tire failure dynamics (9) Engine malfunction and engine damage (10) Airframe ground strike		X	X	
	(11) Motion vibrations that result from atmospheric disturbances.			X	For air turbulence, general purpose disturbance models are acceptable if, when used, they produce test results that approximate demonstrable flight test data.
5.f.	The simulator must provide characteristic motion vibrations that result from operation of the helicopter (for example, retreating blade stall, extended landing gear, settling with power) in so far as vibration marks an event or helicopter state, which can be sensed in the flight deck.			X	The simulator should be programmed and instrumented in such a manner that the characteristic buffet modes can be measured and compared to helicopter data.
6.	**Visual System**				Additional horizontal field-of-view capability may be added at the sponsor's discretion provided the minimum field-of-view is retained.
6.a.	The simulator must have a visual system providing an out-of-the-flight deck view.	X	X	X	
6.b.	The simulator must provide a continuous field-of-view of at least 75° horizontally and 30° vertically per pilot seat. Both pilot seat visual systems must be operable simultaneously. The minimum horizontal field-of-view coverage must be plus and minus one-half (½) of the minimum continuous field-of-view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. An SOC must explain the geometry of the installation. An SOC is required.	X			

TABLE C1A—MINIMUM SIMULATOR REQUIREMENTS—Continued

Entry No.	QPS requirements	Simulator levels			Information
	General simulator requirements	B	C	D	Notes
6.c.	The simulator must provide a continuous visual field-of-view of at least 146° horizontally and 36° vertically per pilot seat. Both pilot seat visual systems must be operable simultaneously. Horizontal field-of-view is centered on the zero degree azimuth line relative to the aircraft fuselage. The minimum horizontal field-of-view coverage must be plus and minus one-half (½) of the minimum continuous field-of-view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. An SOC must explain the geometry of the installation. Capability for a field-of-view in excess of the minimum is not required for qualification at Level C. However, where specific tasks require extended fields of view beyond the 146° by 36° (e.g., to accommodate the use of "chin windows" where the accommodation is either integral with or separate from the primary visual system display), then the extended fields of view must be provided. When considering the installation and use of augmented fields of view, the sponsor must meet with the NSPM to determine the training, testing, checking, and experience tasks for which the augmented field-of-view capability may be required. An SOC is required.	......	X	......	Optimization of the vertical field-of-view may be considered with respect to the specific helicopter flight deck cut-off angle. The sponsor may request the responsible Flight Standards office to evaluate the FFS for specific authorization(s) for the following: (1) Specific areas within the database needing higher resolution to support landings, takeoffs and ground cushion exercises and training away from a heliport, including elevated heliport, helidecks and confined areas. (2) For cross-country flights, sufficient scene details to allow for ground to map navigation over a sector length equal to 30 minutes at an average cruise speed. (3) For offshore airborne radar approaches (ARA), harmonized visual/radar representations of installations.
6.d.	The simulator must provide a continuous visual field-of-view of at least 176° horizontally and 56° vertically per pilot seat. Both pilot seat visual systems must be operable simultaneously. Horizontal field-of-view is centered on the zero degree azimuth line relative to the aircraft fuselage. The minimum horizontal field-of-view coverage must be plus and minus one-half (½) of the minimum continuous field-of-view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. An SOC must explain the geometry of the installation. Capability for a field-of-view in excess of the minimum is not required for qualification at Level D. However, where specific tasks require extended fields of view beyond the 176° by 56° (e.g., to accommodate the use of "chin windows" where the accommodation is either integral with or separate from the primary visual system display), then the extended fields of view must be provided. When considering the installation and use of augmented fields of view, the sponsor must meet with the responsible Flight Standards office to determine the training, testing, checking, and experience tasks for which the augmented field-of-view capability may be required. An SOC is required.	......	......	X	Optimization of the vertical field-of-view may be considered with respect to the specific helicopter flight deck cut-off angle. The sponsor may request the responsible Flight Standards office to evaluate the FFS for specific authorization(s) for the following: (1) Specific areas within the database needing higher resolution to support landings, takeoffs and ground cushion exercises and training away from a heliport, including elevated heliport, helidecks and confined areas. (2) For cross-country flights, sufficient scene details to allow for ground to map navigation over a sector length equal to 30 minutes at an average cruise speed. (3) For offshore airborne radar approaches (ARA), harmonized visual/radar representations of installations.
6.e.	The visual system must be free from optical discontinuities and artifacts that create non-realistic cues.	X	X	X	Nonrealistic cues might include image "swimming" and image "roll-off," that may lead a pilot to make incorrect assessments of speed, acceleration and/or situational awareness.

TABLE C1A—MINIMUM SIMULATOR REQUIREMENTS—Continued

Entry No.	QPS requirements	Simulator levels			Information
	General simulator requirements	B	C	D	Notes
6.f.	The simulator must have operational landing lights for night scenes.Where used, dusk (or twilight) scenes require operational landing lights..	X	X	X	
6.g.	The simulator must have instructor controls for the following: (1) Visibility in statute miles (kilometers) and runway visual range (RVR) in ft. (meters). (2) Airport or landing area selection (3) Airport or landing area lighting	X	X	X	
6.h.	Each airport scene displayed must include the following: (1) Airport runways and taxiways (2) Runway definition (a) Runway surface and markings (b) Lighting for the runway in use, including runway threshold, edge, centerline, touchdown zone, VASI (or PAPI), and approach lighting of appropriate colors, as appropriate (c) Taxiway lights	X	X	X	
6.i.	The simulator must provide visual system compatibility with dynamic response programming.	X	X	X	
6.j.	The simulator must show that the segment of the ground visible from the simulator flight deck is the same as from the helicopter flight deck (within established tolerances) when at the correct airspeed and altitude above the touchdown zone.	X	X	X	This will show the modeling accuracy of the scene with respect to a predetermined position from the end of the runway "in use."
6.k.	The simulator must provide visual cues necessary to assess rate of change of height, height AGL, and translational displacement and rates during takeoffs and landings.	X			
6.l.	The simulator must provide visual cues necessary to assess rate of change of height, height AGL, as well as translational displacement and rates during takeoff, low altitude/low airspeed maneuvering, hover, and landing.		X	X	
6.m.	The simulator must provide for accurate portrayal of the visual environment relating to the simulator attitude.	X	X	X	Visual attitude vs. simulator attitude is a comparison of pitch and roll of the horizon as displayed in the visual scene compared to the display on the attitude indicator.
6.n	The simulator must provide for quick confirmation of visual system color, RVR, focus, and intensity. An SOC is required.		X	X	
6.o.	The simulator must be capable of producing at least 10 levels of occulting.		X	X	

TABLE C1A—MINIMUM SIMULATOR REQUIREMENTS—Continued

Entry No.	QPS requirements	Simulator levels			Information
	General simulator requirements	B	C	D	Notes
6.p.	Night Visual Scenes. The simulator must provide night visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Night scenes, as a minimum, must provide presentations of sufficient surfaces with appropriate textural cues that include self-illuminated objects such as road networks, ramp lighting, and airport signage, to conduct a visual approach, a landing, and airport movement (taxi). Scenes must include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by helicopter landing lights.	X	X	X	
6.q.	Dusk (Twilight) Visual Scenes. The simulator must provide dusk (or twilight) visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. Dusk (or twilight) scenes, as a minimum, must provide full color presentations of reduced ambient intensity, sufficient surfaces with appropriate textural cues that include self-illuminated objects such as road networks, ramp lighting and airport signage, to conduct a visual approach, landing and airport movement (taxi). Scenes must include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by representative aircraft lighting (e.g., landing lights). If provided, directional horizon lighting must have correct orientation and be consistent with surface shading effects. Total scene content must be comparable in detail to that produced by 10,000 visible textured surfaces and 15,000 visible lights with sufficient system capacity to display 16 simultaneously moving objects. An SOC is required.		X	X	
6.r.	Daylight Visual Scenes. The simulator must have daylight visual scenes with sufficient scene content to recognize the airport, the terrain, and major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing. No ambient lighting may "washout" the displayed visual scene. Total scene content must be comparable in detail to that produced by 10,000 visible textured surfaces and 6,000 visible lights with sufficient system capacity to display 16 simultaneously moving objects. The visual display must be free of apparent and distracting quantization and other distracting visual effects while the simulator is in motion. An SOC is required.		X	X	
6.s	The simulator must provide operational visual scenes that portray physical relationships known to cause landing illusions to pilots.		X	X	For example: short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path, unique topographic features.

TABLE C1A—MINIMUM SIMULATOR REQUIREMENTS—Continued

Entry No.	QPS requirements	Simulator levels			Information
	General simulator requirements	B	C	D	Notes
6.t.	The simulator must provide special weather representations of light, medium, and heavy precipitation near a thunderstorm on takeoff and during approach and landing. Representations need only be presented at and below an altitude of 2,000 ft. (610 m) above the airport surface and within 10 miles (16 km) of the airport.		X	X	
6.u.	The simulator must present visual scenes of wet and snow-covered runways, including runway lighting reflections for wet conditions, and partially obscured lights for snow conditions.		X	X	The responsible Flight Standards office will consider suitable alternative effects.
6.v.	The simulator must present realistic color and directionality of all airport lighting.		X	X	
7.	**Sound System**				
7.a.	The simulator must provide flight deck sounds that result from pilot actions that correspond to those that occur in the helicopter.	X	X	X	
7.b.	Volume control, if installed, must have an indication of the sound level setting.	X	X	X	
7.c.	The simulator must accurately simulate the sound of precipitation, windshield wipers, and other significant helicopter noises perceptible to the pilot during normal and abnormal operations, and include the sound of a crash (when the simulator is landed in an unusual attitude or in excess of the structural gear limitations); normal engine sounds; and the sounds of gear extension and retraction. An SOC is required.		X	X	
7.d.	The simulator must provide realistic amplitude and frequency of flight deck noises and sounds. Simulator performance must be recorded, compared to amplitude and frequency of the same sounds recorded in the helicopter, and made a part of the QTG.			X	

TABLE C1B—TABLE OF TASKS VS. SIMULATOR LEVEL

QPS requirements					Information
Entry No.	Subjective requirements The simulator must be able to perform the tasks associated with that level of qualification.	Simulator levels			Notes
		B	C	D	
1. Preflight Procedures					
1.a.	Preflight Inspection (Flight deck Only) switches, indicators, systems, and equipment.	X	X	X	
1.b.	APU/Engine start and run-up.				
1.b.1.	Normal start procedures	X	X	X	
1.b.2.	Alternate start procedures	X	X	X	
1.b.3.	Abnormal starts and shutdowns (hot start, hung start)	X	X	X	
1.c.	Taxiing—Ground	X	X	X	
1.d.	Taxiing—Hover	X	X	X	

TABLE C1B—TABLE OF TASKS VS. SIMULATOR LEVEL—Continued

QPS requirements					Information
Entry No.	Subjective requirements The simulator must be able to perform the tasks associated with that level of qualification.	Simulator levels			Notes
		B	C	D	
1.e.	Pre-takeoff Checks	X	X	X	
2. Takeoff and Departure Phase					
2.a.	Normal takeoff.				
2.a.1.	From ground	X	X	X	
2.a.2.	From hover		X	X	
2.a.3.	Running	X	X	X	
2.b.	Instrument	X	X	X	
2.c.	Powerplant Failure During Takeoff	X	X	X	
2.d.	Rejected Takeoff	X	X	X	
2.e.	Instrument Departure	X	X	X	
3. Climb					
3.a.	Normal	X	X	X	
3.b.	Obstacle clearance	X	X	X	
3.c.	Vertical	X	X	X	
3.d.	One engine inoperative	X	X	X	
4. In-flight Maneuvers					
4.a.	Turns (timed, normal, steep)	X	X	X	
4.b.	Powerplant Failure—Multiengine Helicopters	X	X	X	
4.c.	Powerplant Failure—Single-Engine Helicopters	X	X	X	
4.d.	Recovery From Unusual Attitudes	X	X	X	
4.e.	Settling with Power	X	X	X	
4.f.	Specific Flight Characteristics incorporated into the user's FAA approved flight training program.	A	A	A	
5. Instrument Procedures					
5.a.	Instrument Arrival	X	X	X	
5.b.	Holding	X	X	X	
5.c.	Precision Instrument Approach.				
5.c.1.	Normal—All engines operating	X	X	X	
5.c.2.	Manually controlled—One or more engines inoperative	X	X	X	
5.d.	Non-precision Instrument Approach	X	X	X	
5.e.	Missed Approach.				
5.e.1.	All engines operating	X	X	X	
5.e.2.	One or more engines inoperative	X	X	X	
5.e.3.	Stability augmentation system failure	X	X	X	
6. Landings and Approaches to Landings					

TABLE C1B—TABLE OF TASKS VS. SIMULATOR LEVEL—Continued

QPS requirements					Information
Entry No.	Subjective requirements The simulator must be able to perform the tasks associated with that level of qualification.	Simulator levels			Notes
		B	C	D	
6.a.	Visual Approaches (normal, steep, shallow)	X	X	X	
6.b.	Landings.				
6.b.1.	Normal/crosswind.				
6.b.1.a.	Running	X	X	X	
6.b.1.b.	From Hover		X	X	
6.b.2.	One or more engines inoperative	X	X	X	
6.b.3.	Rejected Landing	X	X	X	
7. Normal and Abnormal Procedures					
7.a.	Powerplant	X	X	X	
7.b.	Fuel System	X	X	X	
7.c.	Electrical System	X	X	X	
7.d.	Hydraulic System	X	X	X	
7.e.	Environmental System(s)	X	X	X	
7.f.	Fire Detection and Extinguisher Systems	X	X	X	
7.g.	Navigation and Aviation Systems	X	X	X	
7.h.	Automatic Flight Control System, Electronic Flight Instrument System, and Related Subsystems.	X	X	X	
7.i.	Flight Control Systems	X	X	X	
7.j.	Anti-ice and Deice Systems	X	X	X	
7.k.	Aircraft and Personal Emergency Equipment	X	X	X	
7.l.	Special Missions tasks (e.g., Night Vision goggles, Forward Looking Infrared System, External Loads and as listed on the SOQ).	A	A	X	
8. Emergency procedures (as applicable)					
8.a.	Emergency Descent	X	X	X	
8.b.	Inflight Fire and Smoke Removal	X	X	X	
8.c.	Emergency Evacuation	X	X	X	
8.d.	Ditching	X	X	X	
8.e.	Autorotative Landing	X	X	X	
8.f.	Retreating blade stall recovery	X	X	X	
8.g.	Mast bumping	X	X	X	
8.h.	Loss of tail rotor effectiveness	X	X	X	
8.i.	Vortex recovery	X	X	X	
9. Postflight Procedures					
9.a	After-Landing Procedures	X	X	X	
9.b.	Parking and Securing.				

TABLE C1B—TABLE OF TASKS VS. SIMULATOR LEVEL—Continued

QPS requirements					Information
Entry No.	Subjective requirements The simulator must be able to perform the tasks associated with that level of qualification.	Simulator levels			Notes
		B	C	D	
9.b.1.	Rotor brake operation	X	X	X	
9.b.2.	Abnormal/emergency procedures	X	X	X	

Note: An "A" in the table indicates that the system, task, or procedure may be examined if the appropriate aircraft system or control is simulated in the FFS and is working properly

TABLE C1C—TABLE OF TASKS VS. SIMULATOR LEVEL

QPS requirements					Information
Entry No.	Subjective requirements The simulator must be able to perform the tasks associated with that level of qualification.	Simulator levels			Notes
		B	C	D	
1.	**Instructor Operating Station (IOS), as appropriate**				
1.a.	Power switch(es)	X	X	X	
1.b.	Helicopter conditions	X	X	X	e.g., GW, CG, Fuel loading, Systems, Ground Crew.
1.c.	Airports/Heliports/Helicopter Landing Areas	X	X	X	e.g., Selection, Surface, Presets, Lighting controls
1.d.	Environmental controls.	X	X	X	e.g., Clouds, Visibility, RVR, Temp, Wind, Ice, Snow, Rain, and Windshear.
1.e.	Helicopter system malfunctions (Insertion/deletion)	X	X	X	
1.f.	Locks, Freezes, and Repositioning	X	X	X	
2.	**Sound Controls.**				
2.a.	On/off/adjustment	X	X	X	
3.	**Motion/Control Loading System**				
3.a.	On/off/emergency stop	X	X	X	
4.	**Observer Seats/Stations**				
4.a.	Position/Adjustment/Positive restraint system	X	X	X	

ATTACHMENT 2 TO APPENDIX C TO PART 60—FFS OBJECTIVE TESTS

BEGIN INFORMATION

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1. INTRODUCTION

a. If relevant winds are present in the objective data, the wind vector (magnitude and direction) should be clearly noted as part of the data presentation, expressed in conventional terminology, and related to the runway being used for the test.

b. The responsible Flight Standards office will not evaluate any simulator unless the required SOC indicates that the motion system is designed and manufactured to safely operate within the simulator's maximum excursion, acceleration, and velocity capabilities (see Motion System in the following table).

c. Table C2A addresses helicopter simulators at Levels B, C, and D because there are no Level A Helicopter simulators.

END INFORMATION

BEGIN QPS REQUIREMENTS

2. TEST REQUIREMENTS

a. The ground and flight tests required for qualification are listed in Table of C2A, FFS Objective Tests. Computer-generated simulator test results must be provided for each test except where an alternative test is specifically authorized by the responsible Flight Standards office. If a flight condition or operating condition is required for the test but does not apply to the helicopter being simulated or to the qualification level sought, it may be disregarded (*e.g.*, an engine out missed approach for a single-engine helicopter, or a hover test for a Level B simulator). Each test result is compared against the validation data described in § 60.13 and in this appendix. Although use of a driver program designed to automatically accomplish the tests is encouraged for all simulators and required for Level C and Level D simulators, each test must be able to be accomplished manually while recording all appropriate parameters. The results must be produced on an appropriate recording device acceptable to the responsible Flight Standards office and must include simulator number, date, time, conditions, tolerances, and appropriate dependent variables portrayed in comparison to the validation data. Time histories are required unless otherwise indicated in Table C2A. All results must be labeled using the tolerances and units given.

b. Table C2A sets out the test results required, including the parameters, tolerances, and flight conditions for simulator validation. Tolerances are provided for the listed tests because mathematical modeling and acquisition/development of reference data are often inexact. All tolerances listed in the following tables are applied to simulator performance. When two tolerance values are given for a parameter, the less restrictive value may be used unless otherwise indicated. In those cases where a tolerance is expressed only as a percentage, the tolerance percentage applies to the maximum value of that parameter within its normal operating range as measured from the neutral or zero position unless otherwise indicated.

c. Certain tests included in this attachment must be supported with an SOC. In Table C2A, requirements for SOCs are indicated in the "Test Details" column.

d. When operational or engineering judgment is used in making assessments for flight test data applications for simulator validity, such judgment may not be limited to a single parameter. For example, data that exhibit rapid variations of the measured parameters may require interpolations or a "best fit" data selection. All relevant parameters related to a given maneuver or flight condition must be provided to allow overall interpretation. When it is difficult or impossible to match simulator to helicopter data throughout a time history, differences must be justified by providing a comparison of other related variables for the condition being assessed.

e. The FFS may not be programmed so that the mathematical modeling is correct only at the validation test points. Unless noted otherwise, simulator tests must represent helicopter performance and handling qualities at operating weights and centers of gravity (CG) typical of normal operation. If a test is supported by helicopter data at one extreme weight or CG, another test supported by helicopter data at mid-conditions or as close as possible to the other extreme must be included. Certain tests that are relevant only at one extreme CG or weight condition need not be repeated at the other extreme. Tests of handling qualities must include validation of augmentation devices.

f. When comparing the parameters listed to those of the helicopter, sufficient data must also be provided to verify the correct flight condition and helicopter configuration changes. For example, to show that control force is within ±0.5 pound (0.22 daN) in a static stability test, data to show the correct airspeed, power, thrust or torque, helicopter configuration, altitude, and other appropriate datum identification parameters must also be given. If comparing short period dynamics, normal acceleration may be used to establish a match to the helicopter, but airspeed, altitude, control input, helicopter configuration, and other appropriate data must also be given. All airspeed values must be properly annotated (e.g., indicated versus calibrated). In addition, the same variables must be used for comparison (e.g., compare inches to inches rather than inches to centimeters).

g. The QTG provided by the sponsor must clearly describe how the simulator will be set up and operated for each test. Each simulator subsystem may be tested independently, but overall integrated testing of the simulator must be accomplished to assure that the total simulator system meets the prescribed standards. A manual test procedure with explicit and detailed steps for completing each test must also be provided.

h. For previously qualified simulators, the tests and tolerances of this attachment may be used in subsequent continuing qualification evaluations for any given test if the sponsor has submitted a proposed MQTG revision to the responsible Flight Standards office and has received responsible Flight Standards office approval.

i. Motion System Tests:

(a) The minimum excursions, accelerations, and velocities for pitch, roll, and yaw must be measurable about a single, common reference point and must be achieved by driving one degree of freedom at a time.

(b) The minimum excursions, accelerations, and velocities for heave, sway, and surge may be measured about different, identifiable reference points and must be achieved by driving one degree of freedom at a time.

j. Tests of handling qualities must include validation of augmentation devices. FFSs for highly augmented helicopters will be validated both in the unaugmented configuration (or failure state with the maximum permitted degradation in handling qualities) and the augmented configuration. Where various levels of handling qualities result from failure states, validation of the effect of the failure is necessary. For those performance and static handling qualities tests where the primary concern is control position in the unaugmented configuration, unaugmented data are not required if the design of the system precludes any affect on control position. In those instances where the unaugmented helicopter response is divergent and non-repeatable, it may not be feasible to meet the specified tolerances. Alternative requirements for testing will be mutually agreed upon by the sponsor and the responsible Flight Standards office on a case-by-case basis.

k. Some tests will not be required for helicopters using helicopter hardware in the simulator flight deck (e.g., ‘‘helicopter modular controller’’). These exceptions are noted in Table C2A of this attachment. However, in these cases, the sponsor must provide a statement that the helicopter hardware meets the appropriate manufacturer's specifications and the sponsor must have supporting information to that fact available for responsible Flight Standards office review.

l. In cases where light-class helicopters are being simulated, prior coordination with the responsible Flight Standards office on acceptable weight ranges is required. The terms ‘‘light’’, ‘‘medium’’, and ‘‘near maximum’’, as defined in Appendix F of this part, may not be appropriate for the simulation of light-class helicopters.

END QPS REQUIREMENTS

BEGIN INFORMATION

m. In those cases where the objective test results authorize a ‘‘snapshot test’’ or a ‘‘series of snapshot test results’’ in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the ‘‘snapshot’’. The steady state condition must exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snap shot.

n. For references on basic operating weight, see AC 120–27, Aircraft Weight and Balance; and FAA–H–8083–1, Aircraft Weight and Balance Handbook.

END INFORMATION

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS

QPS requirements									Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level			Notes
Entry No.	Title				B	C	D	
1. Performance								
1.a.	Engine Assessment							
1.a.1.	Start Operations							
1.a.1.a	Engine start and acceleration (transient).	Light Off Time—±10% or ±1 sec., Torque—±5%, Rotor Speed—±3%, Fuel Flow—±10%, Gas Generator Speed—±5%, Power Turbine Speed—±5%, Gas Turbine Temp.—±30 °C.	Ground with the Rotor Brake Used and Not Used, if applicable.	Record each engine start from the initiation of the start sequence to steady state idle and from steady state idle to operating RPM.	X	X	X	
1.a.1.b.	Steady State Idle and Operating RPM conditions.	Torque—±3%, Rotor Speed—±1.5%, Fuel Flow—±5%, Gas Generator Speed—±2%, Power Turbine Speed—±2%, Turbine Gas Temp.—±20 °C.	Ground	Record both steady state idle and operating RPM conditions. May be a series of snapshot tests.	X	X	X	
1.a.2.	Power Turbine Speed Trim	±10% of total change of power turbine speed, or ±0.5% change of rotor speed.	Ground	Record engine response to trim system actuation in both directions.	X	X	X	
1.a.3.	Engine and Rotor Speed Governing.	Torque—±5%, Rotor Speed—1.5%.	Climb and descent	Record results using a step input to the collective. May be conducted concurrently with climb and descent performance tests.	X	X	X	
1.b.	Surface Operations							
1.b.1.	Minimum Radius Turn	±3 ft. (0.9m) or 20% of helicopter turn radius.	Ground	If brakes are used, brake pedal position and brake system pressure must be matched to the helicopter flight test value.	X	X	X	

1.b.2.	Rate of Turn vs. Pedal Deflection, Brake Application, or Nosewheel Angle, as applicable.	±10% or ±2°/sec. Turn Rate.	Ground Takeoff	If brakes are used, brake pedal position and brake system pressure must be matched to the helicopter flight test value.	X	X	X	
1.b.3.	Taxi	Pitch Angle—±1.5°, Torque—±3%, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	Ground	Record results for control position and pitch attitude during ground taxi for a specific ground speed, wind speed and direction, and density altitude.	X	X	X	
1.b.4.	Brake Effectiveness	±10% of time and distance.	Ground		X	X	X	
1.c.	Takeoff When the speed range for the following tests is less than 40 knots, the applicable airspeed tolerance may be applied to either airspeed or ground speed, as appropriate.							
1.c.1.	All Engines	Airspeed—±3 kt, Altitude—±20 ft (6.1m), Torque—±3%, Rotor Speed—±1.5%, Vertical Velocity—±100 fpm (0.50m/sec) or 10%, Pitch Attitude—±1.5°, Bank Attitude—±2°, Heading—±2°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Ground/Takeoff and Initial Segment of Climb.	Record results of takeoff flight path as appropriate to helicopter model simulated (running takeoff for Level B, takeoff from a hover for Level C and D). For Level B, the criteria apply only to those segments at airspeeds above effective translational lift. Results must be recorded from the initiation of the takeoff to at least 200 ft (61m) AGL.	X	X	X	
1.c.2.	One Engine Inoperative continued takeoff.	Airspeed—±3 kt, Altitude—±20 ft (6.1m), Torque—±3%, Rotor Speed—±1.5%, Vertical Velocity—±100 fpm (0.50m/sec) or 10%, Pitch Attitude—±1.5°, Bank Attitude—±2°, Heading—±2°, Longitudinal Control Position—±10% Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Ground/Takeoff; and Initial Segment of Climb.	Record takeoff flight path as appropriate to helicopter model simulated. Results must be recorded from the initiation of the takeoff to at least 200 ft (61m) AGL.	X	X	X	Because several kinds of takeoff procedures can be performed, the specific type of takeoff profile should be recorded to ensure the proper takeoff profile comparison test is used.

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements									Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level				Notes
Entry No.	Title				B	C	D		
1.c.3.	One Engine inoperative, rejected take off.	Airspeed—±3 kt, Altitude—±20 ft (6.1m), Torque—±3%, Rotor Speed—±1.5%, Pitch Attitude—±1.5°, Roll angle—±1.5°, Heading—±2°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%, Distance—±7.5% or ±30m (100ft).	Ground, Takeoff	Time history from the take off point to touch down. Test conditions near limiting performance.		X	X		
1.d.	Hover								
	Performance	Torque—±3%, Pitch Attitude—±1.5°, Bank Attitude—±1.5°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	In Ground Effect (IGE); and Out of Ground Effect (OGE).	Record results for light and heavy gross weights. May be a series of snapshot tests.		X	X		
1.e.	Vertical Climb								
	Performance	Vertical Velocity—±100 fpm (0.50 m/sec) or ±10%, Directional Control Position—±5%, Collective Control Position—±5%.	From OGE Hover	Record results for light and heavy gross weights. May be a series of snapshot tests.		X	X		
1.f.	Level Flight								

	Performance and Trimmed Flight Control Positions.	Torque—±3%, Pitch Attitude—±1.5°, Sideslip Angle—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	Cruise (Augmentation On and Off).	Record results for two gross weight and CG combinations with varying trim speeds throughout the airspeed envelope. May be a series of snapshot tests.	X	X	X	This test validates performance at speeds above maximum endurance airspeed.
1.g.	Climb							
	Performance and Trimmed Flight Control Positions.	Vertical Velocity—±100 fpm (6.1m/sec) or ±10%, Pitch Attitude—±1.5°, Sideslip Angle—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	All engines operating; One engine inoperative; Augmentation System(s) On and Off.	Record results for two gross weight and CG combinations. The data presented must be for normal climb power conditions. May be a series of snapshot tests.	X	X	X	
1.h.	Descent							
1.h.1.	Descent Performance and Trimmed Flight Control Positions.	Torque—±3%, Pitch Attitude—±1.5°, Sideslip Angle—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	At or near 1,000 fpm (5 m/sec) rate of descent (RoD) at normal approach speed. Augmentation System(s) On and Off.	Results must be recorded for two gross weight and CG combinations. May be a series of snapshot tests.	X	X	X	
1.h.2.	Autorotation Performance and Trimmed Flight Control Positions.	Pitch Attitude—±1.5°, Sideslip Angle—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%, Vertical Velocity—±100 fpm or 10%, Rotor Speed—±1.5%.	Steady descents. Augmentation System(s) On and Off.	Record results for two gross weight conditions. Data must be recorded for normal operating RPM. (Rotor speed tolerance applies only if collective control position is full down.) Data must be recorded for speeds from 50 kts, ±5 kts, through at least maximum glide distance airspeed, or maximum allowable autorotation airspeed, whichever is slower. May be a series of snapshot tests.	X	X	X	
1.i.	Autorotation							

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements									Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level			Notes
Entry No.	Title				B	C	D	
	Entry	Rotor Speed—±3%, Pitch Attitude—±2°, Roll Attitude—±3°, Yaw Attitude—±5°, Airspeed—±5 kts., Vertical Velocity—±200 fpm (1.00 m/sec) or 10%.	Cruise or Climb	Record results of a rapid throttle reduction to idle. If the cruise condition is selected, comparison must be made for the maximum range airspeed. If the climb condition is selected, comparison must be made for the maximum rate of climb airspeed at or near maximum continuous power.		X	X	
1.j.	Landing When the speed range for tests 1.j.1., 1.j.2., or 1.j.3. is less than 40 knots, the applicable airspeed tolerance may be applied to either airspeed or ground speed, as appropriate.							
1.j.1.	All Engines	Airspeed—±3 kts., Altitude—±20 ft. (6.1m), Torque—±3%, Rotor Speed—±1.5%, Pitch Attitude—±1.5°, Bank Attitude—±1.5°, Heading—±2°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Approach	Record results of the approach and landing profile as appropriate to the helicopter model simulated (running landing for Level B, or approach to a hover for Level C and D). For Level B, the criteria apply only to those segments at airspeeds above effective translational lift.	X	X	X	
1.j.2.	One Engine Inoperative.	Airspeed—±3 kts., Altitude—±20 ft. (6.1m), Torque—±3%, Rotor Speed—±1.5%, Pitch Attitude—±1.5°, Bank Attitude—±1.5°, Heading—±2°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Approach	Record results for both Category A and Category B approaches and landing as appropriate to helicopter model simulated. For Level B, the criteria apply only to those segments at airspeeds above effective translational lift.	X	X	X	

1.j.3.	Balked Landing	Airspeed—±3 kts, Altitude—±20 ft. (6.1m), Torque—±3%, Rotor Speed—±1.5%, Pitch Attitude—±1.5°, Bank Attitude—±1.5°, Heading—±2°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Approach	Record the results for the maneuver initiated from a stabilized approach at the landing decision point (LDP).	X	X	X	
1.j.4.	Autorotational Landing	Torque—±3%, Rotor Speed—±3%, Vertical Velocity—±100 fpm (0.50m/sec) or 10%, Pitch Attitude—±2°, Bank Attitude—±2°, Heading—±5°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Landing	Record the results of an autorotational deceleration and landing from a stabilized autorotational descent, to touch down If flight test data containing all required parameters for a complete power-off landing is not available from the aircraft manufacturer for this test and other qualified flight test personnel are not available to acquire this data, the sponsor may coordinate with the responsible Flight Standards office to determine if it is appropriate to accept alternative testing means.		X	X	Alternative approaches for acquiring this data may be acceptable, depending on the aircraft as well as the personnel and the data recording, reduction, and interpretation facilities to be used, are: (1) a simulated autorotational flare and reduction of rate of descent (ROD) at altitude; or (2) a power-on termination following an autorotational approach and flare.
2. Handling Qualities								
2.a.	Control System Mechanical Characteristics							
	For simulators requiring Static or Dynamic tests at the controls (*i.e.,* cyclic, collective, and pedal), special test fixtures will not be required during initial or upgrade evaluations if the sponsor's QTG/MQTG shows both test fixture results and the results of an alternative approach, such as computer plots produced concurrently showing satisfactory agreement. Repeat of the alternative method during the initial or upgrade evaluation satisfies this test requirement. For initial and upgrade evaluations, the control dynamic characteristics must be measured at and recorded directly from the flight deck controls, and must be accomplished in hover, climb, cruise, and autorotation							Contact the responsible Flight Standards office for clarification of any issue regarding helicopters with reversible controls or where the required validation data is not attainable.

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level			Notes
Entry No.	Title				B	C	D	
2.a.1.	Cyclic	Breakout—±0.25 lbs. (0.112 daN) or 25%; Force—±1.0 lb. (0.224 daN) or 10%.	Ground; Static conditions with the hydraulic system (if applicable) pressurized; supplemental hydraulic pressurization system may be used. Trim On and Off. Friction Off Augmentation (if applicable) On and Off.	Record results for an uninterrupted control sweep to the stops. (This test does not apply if aircraft hardware modular controllers are used.)	X	X	X	Flight Test Data for this test does not require the rotor to be engaged/turning. The phrase "if applicable" regarding stability augmentation systems means if an augmentation system is available and if this system may be operational on the ground under static conditions as described here.
2.a.2.	Collective/Pedals	Breakout—±0.5 lb. (0.224 daN) or 25%; Force—±1.0 lb. (0.224 daN) or 10%.	Ground; Static conditions with the hydraulic system (if applicable) pressurized; supplemental hydraulic pressurization system may be used. Trim On and Off. Friction Off. Augmentation (if applicable) On and Off.	Record results for an uninterrupted control sweep to the stops.	X	X	X	Flight Test Data for this test does not require the rotor to be engaged/turning. The phrase "if applicable" regarding stability augmentation system means if a stability augmentation system is available and if this system may be operational on the ground under static conditions as described here.
2.a.3.	Brake Pedal Force vs. Position.	±5 lbs. (2.224 daN) or 10%.	Ground; Static conditions.		X	X	X	
2.a.4.	Trim System Rate (all applicable systems).	Rate—±10%.	Ground; Static conditions. Trim On, Friction Off.	The tolerance applies to the recorded value of the trim rate.	X	X	X	

2.a.5.	Control Dynamics (all axes) ..	±10% of time for first zero crossing and ±10 (N + 1)% of period thereafter, ±10% of amplitude of first overshoot, 20% of amplitude of 2nd and subsequent overshoots greater than 5% of initial displacement, ±1 overshoot.	Hover/Cruise, Trim On, Friction Off.	Results must be recorded for a normal control displacement in both directions in each axis.		X	X	Typically, control displacement of 25% to 50% is necessary for proper excitation. Control Dynamics for irreversible control systems may be evaluated in a ground/static condition. Additional information on control dynamics is found later in this attachment. "N" is the sequential period of a full cycle of oscillation.
2.a.6.	Control System Freeplay	±0.10 inches (±2.5 mm).	Ground; Static conditions; with the hydraulic system (if applicable) pressurized; supplemental hydraulic pressurization system may be used.	Record and compare results for all controls.	X	X	X	Flight Test Data for this test does not require the rotor to be engaged/turning.
2.b.	Low Airspeed Handling Qualities							
2.b.1.	Trimmed Flight Control Positions.	Torque—±3%, Pitch Attitude—±1.5°, Bank Attitude—±2°, Longitudinal Control Position—±5%. Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	Translational Flight IGE—Sideward, rearward, and forward flight. Augmentation On and Off.	Record results for several airspeed increments to the translational airspeed limits and for 45 kts. forward airspeed. May be a series of snapshot tests.		X	X	
2.b.2.	Critical Azimuth	Torque—±3%, Pitch Attitude—±1.5°, Bank Attitude—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	Stationary Hover. Augmentation On and Off.	Record results for three relative wind directions (including the most critical case) in the critical quadrant. May be a series of snapshot tests.		X	X	
2.b.3.	Control Response							
2.b.3.a.	Longitudinal	Pitch Rate—±10% or ±2°/sec., Pitch Attitude Change—±10% or 1.5°.	Hover Augmentation On and Off.	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.		X	X	This is a "short time" test conducted in a hover, in ground effect, without entering translational flight, to provide better visual reference.

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements									Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level				Notes
Entry No.	Title				B	C	D		
2.b.3.b.	Lateral	Roll Rate—±10% or ±3°/sec., Roll Attitude Change—±10% or ±3°.	Hover Augmentation On and Off.	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.		X	X		This is a "short time" test conducted in a hover, in ground effect, without entering translational flight, to provide better visual reference.
2.b.3.c.	Directional	Yaw Rate—±10% or ±2°/sec., Heading Change—±10% or ±2°.	Hover Augmentation On and Off.	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.		X	X		This is a "short time" test conducted in a hover, in ground effect, without entering translational flight, to provide better visual reference.
2.b.3.d.	Vertical	Normal Acceleration—±0.1 g.	Hover Augmentation On and Off.	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.		X	X		
2.c.	Longitudinal Handling Qualities								
2.c.1.	Control Response	Pitch Rate—±10% or ±2°/sec., Pitch Attitude Change—±10% or ±1.5°.	Cruise Augmentation On and Off.	Results must be recorded for two cruise airspeeds to include minimum power required speed. Record data for a step control input. The Off-axis response must show correct trend for unaugmented cases.	X	X	X		
2.c.2.	Static Stability	Longitudinal Control Position: ±10% of change from trim or ±0.25 in. (6.3 mm) or Longitudinal Control Force : ±0.5 lb. (0.223 daN) or ±10%.	Cruise or Climb. Autorotation. Augmentation On and Off.	Record results for a minimum of two speeds on each side of the trim speed. May be a series of snapshot tests.	X	X	X		
2.c.3.	Dynamic Stability								

2.c.3.a.	Long-Term Response.	±10% of calculated period, ±10% of time to ½ or double amplitude, or ±0.02 of damping ratio.For non-periodic responses, the time history must be matched within ±3° pitch; and ±5 kts airspeed over a 20 sec period following release of the controls.	Cruise Augmentation On and Off.	For periodic responses, record results for three full cycles (6 overshoots after input completed) or that sufficient to determine time to ½ or double amplitude, whichever is less. The test may be terminated prior to 20 sec. if the test pilot determines that the results are becoming uncontrollably divergent.	X	X	X	The response may be unrepeatable throughout the stated time for certain helicopters. In these cases, the test should show at least that a divergence is identifiable. For example: Displacing the cyclic for a given time normally excites this test or until a given pitch attitude is achieved and then return the cyclic to the original position. For non-periodic responses, results should show the same convergent or divergent character as the flight test data.
2.c.3.b.	Short-Term Response.	±1.5° Pitch or ±2°/sec. Pitch Rate. ±0.1 g Normal Acceleration.	Cruise or Climb. Augmentation On and Off.	Record results for at least two airspeeds.	X	X	X	A control doublet inserted at the natural frequency of the aircraft normally excites this test. However, while input doublets are preferred over pulse inputs for Augmentation-Off tests, for Augmentation-On tests, when the short-term response exhibits 1st-order or deadbeat characteristics, longitudinal pulse inputs may produce a more coherent response.
2.c.4.	Maneuvering Stability.	Longitudinal Control Position—±10% of change from trim or ±0.25 in. (6.3 mm) or Longitudinal Control Forces—±0.5 lb. (0.223 daN) or ±10%.	Cruise or Climb. Augmentation On and Off.	Record results for at least two airspeeds at 30°–45° roll angle. The force may be shown as a cross plot for irreversible systems. May be a series of snapshot tests.	X	X	X	
2.d.	Lateral and Directional Handling Qualities							
2.d.1.	Control Response							

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements									Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level			Notes
Entry No.	Title				B	C	D	
2.d.1.a	Lateral	Roll Rate—±10% or ±3°/sec., Roll Attitude Change—±10% or ±3°.	Cruise Augmentation On and Off.	Record results for at least two airspeeds, including the speed at or near the minimum power required airspeed. Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.	X	X	X	
2.d.1.b.	Directional	Yaw Rate—±10% or ±2°/sec., Yaw Attitude Change—±10% or ±2°.	Cruise Augmentation On and Off.	Record data for at least two airspeeds, including the speed at or near the minimum power required airspeed. Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.	X	X	X	
2.d.2.	Directional Static Stability.	Lateral Control Position—±10% of change from trim or ±0.25 in. (6.3 mm) or Lateral Control Force—±0.5 lb. (0.223 daN) or 10%, Roll Attitude—±1.5, Directional Control Position—±10% of change from trim or ±0.25 in. (6.3 mm) or Directional Control Force—±1 lb. (0.448 daN) or 10%, Longitudinal Control Position—±10% of change from trim or ±0.25 in. (6.3 mm), Vertical Velocity—±100 fpm (0.50m/sec) or 10%.	Cruise; or Climb (may use Descent instead of Climb if desired), Augmentation On and Off.	Record results for at least two sideslip angles on either side of the trim point. The force may be shown as a cross plot for irreversible systems. May be a series of snapshot tests.	X	X	X	This is a steady heading sideslip test at a fixed collective position.

2.d.3.	Dynamic Lateral and Directional Stability							
2.d.3.a.	Lateral-Directional Oscillations.	±0.5 sec. or ±10% of period, ±10% of time to ½ or double amplitude or ±0.02 of damping ratio, ±20% or ±1 sec of time difference between peaks of bank and sideslip. For non-periodic responses, the time history must be matched within ±10 knots Airspeed; ±5°/s Roll Rate or ±5° Roll Attitude; ±4°/s Yaw Rate or ±4° Yaw Angle over a 20 sec period roll angle following release of the controls.	Cruise or Climb. Augmentation On and Off.	Record results for at least two airspeeds. The test must be initiated with a cyclic or a pedal doublet input. Record results for six full cycles (12 overshoots after input completed) or that sufficient to determine time to ½ or double amplitude, whichever is less. The test may be terminated prior to 20 sec if the test pilot determines that the results are becoming uncontrollably divergent.	X	X	X	
2.d.3.b.	Spiral Stability.	±2° or ±10% roll angle.	Cruise or Climb. Augmentation On and Off.	Record the results of a release from pedal only or cyclic only turns for 20 sec. Results must be recorded from turns in both directions. Terminate check at zero roll angle or when the test pilot determines that the attitude is becoming uncontrollably divergent.	X	X	X	
2.d.3.c.	Adverse/Proverse Yaw.	Correct Trend, ±2° transient sideslip angle.	Cruise or Climb. Augmentation On and Off.	Record the time history of initial entry into cyclic only turns, using only a moderate rate for cyclic input. Results must be recorded for turns in both directions.	X	X	X	
3. Motion System								
3.a.	Frequency response							
		Based on Simulator Capability.	N/A	Required as part of the MQTG. The test must demonstrate frequency response of the motion system as specified by the applicant for flight simulator qualification.	X	X	X	

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level			Notes
Entry No.	Title				B	C	D	
3.b.	Leg Balance							
	Leg Balance	Based on Simulator Capability.	N/A	Required as part of the MQTG. The test must demonstrate motion system leg balance as specified by the applicant for flight simulator qualification.	X	X	X	
3.c.	Turn Around							
	Turn Around	Based on Simulator Capability.	N/A	Required as part of the MQTG. The test must demonstrate a smooth turnaround (shift to opposite direction of movement) of the motion system as specified by the applicant for flight simulator qualification.	X	X	X	
3.d.	Motion system repeatability							
		With the same input signal, the test results must be repeatable to within ±0.05g actual platform linear acceleration in each axis.	Accomplished in both the "ground" mode and in the "flight" mode of the motion system operation.	Required as part of the MQTG. The test is accomplished by injecting a motion signal to generate movement of the platform. The input must be such that the rotational accelerations, rotational rates, and linear accelerations are inserted before the transfer from helicopter center of gravity to the pilot reference point with a minimum amplitude of 5°/sec/sec, 10°/sec and 0.3g, respectively.	X	X	X	See Paragraph 6.c. in this attachment for additional information. Note: if there is no difference in the model for "ground" and "flight" operation of the motion system, this should be described in an SOC and will not require tests in both modes.
3.e.	Motion cueing performance signature							

				Required as part of MQTG. These tests must be run with the motion buffet mode disabled.				See paragraph 6.d., of this attachment, Motion cueing performance signature.
3.e.1.	Takeoff (all engines).	As specified by the sponsor for flight simulator qualification.	Ground	Pitch attitude due to initial climb must dominate over cab tilt due to longitudinal acceleration.	X	X	X	Associated to test number 1.c.1.
3.e.2.	Hover performance (IGE and OGE).	As specified by the sponsor for flight simulator qualification.	Ground			X	X	Associated to test number 1.d.
3.e.3.	Autorotation (entry).	As specified by the sponsor for flight simulator qualification.	Flight			X	X	Associated to test number 1.i.
3.e.4.	Landing (all engines).	As specified by the sponsor for flight simulator qualification.	Flight		X	X	X	Associated to test number 1.j.1.
3.e.5.	Autorotation (landing).	As specified by the sponsor for flight simulator qualification.	Flight			X	X	Associated to test number 1.j.4.
3.e.6.	Control Response							
3.e.6.a.	Longitudinal	As specified by the sponsor for flight simulator qualification.	Flight		X	X	X	Associated to test number 2.c.1.
3.e.6.b.	Lateral.	As specified by the sponsor for flight simulator qualification.	Ground		X	X	X	Associated to test number 2.d.1.a.
3.e.6.c.	Directional	As specified by the sponsor for flight simulator qualification.			X	X	X	Associated to test number 2.d.1.c.
3.f.	Characteristic Motion (Vibration) Cues—For all of the following tests, the simulator test results must exhibit the overall appearance and trends of the helicopter data, with at least three (3) of the predominant frequency "spikes" being present within ±2 Hz.				....	....	....	Characteristic motion cues may be separate from the "main" motion system.

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements									Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level			Notes
Entry No.	Title				B	C	D	
3.f.1.	Vibrations—to include 1/Rev and n/Rev vibrations (where "n" is the number of main rotor blades).	+ 3db to − 6db or ±10% of nominal vibration level in flight cruise and correct trend (see comment).	(a) On ground (idle); (b) In flight	Characteristic vibrations include those that result from operation of the helicopter (for example, high airspeed, retreating blade stall, extended landing gear, vortex ring or settling with power) in so far as vibration marks an event or helicopter state, which can be sensed in the flight deck. [See Table C1A, table entries 5.e. and 5.f.]			X	Correct trend refers to a comparison of vibration amplitudes between different maneuvers; e.g., if the 1/rev vibration amplitude in the helicopter is higher during steady state turns than in level flight this increasing trend should be demonstrated in the simulator. Additional examples of vibrations may include: (a) Low & High speed transition to and from hover; (b) Level flight; (c) Climb and descent (including vertical climb; (d) Auto-rotation; (e) Steady Turns.
3.f.2.	Buffet—Test against recorded results for characteristic buffet motion that can be sensed in the flight deck.	+ 3db to − 6db or ±10% of nominal vibration level in flight cruise and correct trend (see comment).	On ground and in flight.	Characteristic buffets include those that result from operation of the helicopter (for example, high airspeed, retreating blade stall, extended landing gear, vortex ring or settling with power) in so far as a buffet marks an event or helicopter state, which can be sensed in the flight deck. [See Table C1A, table entries 5.e. and 5.f.]			X	The recorded test results for characteristic buffets should allow the checking of relative amplitude for different frequencies. For atmospheric disturbance, general purpose models are acceptable which approximate demonstrable flight test data.
4. Visual System								
4.a.	Visual System Response Time: (Choose either test 4.a.1. or 4.a.2. to satisfy test 4.a., Visual System Response Time Test. This test is also sufficient for motion system response timing and flight deck instrument response timing.)							
4.a.1.	Latency							

		150 ms (or less) after helicopter response.	Takeoff, climb, and descent.	One test is required in each axis (pitch, roll and yaw) for each of the three conditions (take-off, cruise, and approach or landing).	X			
		100 ms (or less) after helicopter response.	Climb, cruise, descent, and hover.	One test is required in each axis (pitch, roll and yaw) for each of the three conditions (take-off, cruise, and approach or landing).		X	X	
4.a.2.	Transport Delay							
								If Transport Delay is the chosen method to demonstrate relative responses, the sponsor and the responsible Flight Standards office will use the latency values to ensure proper simulator response when reviewing those existing tests where latency can be identified (*e.g.*, short period, roll response, rudder response).
4.b.	Field-of-view							

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level			Notes
Entry No.	Title				B	C	D	
4.b.1.	Continuous field-of-view.	The simulator must provide a continuous field-of-view of at least 75° horizontally and 30° vertically per pilot seat or the number of degrees necessary to meet the visual ground segment requirement, whichever is greater. Both pilot seat visual systems must be operable simultaneously. Wide-angle systems providing cross-flight deck viewing (for both pilots simultaneously) must provide a minimum field-of-view of at least 146° horizontally and 36° vertically. Any geometric error between the Image Generator eye point and the pilot eye point must be 8° or less.	N/A	An SOC is required and must explain the geometry of the installation. Additional horizontal field-of-view capability may be added at the sponsor's discretion provided the minimum field-of-view is retained.	X			Horizontal field-of-view is centered on the zero degree azimuth line relative to the aircraft fuselage. Field-of-view may be measured using a visual test pattern filling the entire visual scene (all channels) with a matrix of black and white 5° squares.

4.b.2.	Continuous field-of-view.	The simulator must provide a continuous field-of-view of at least 146° horizontally and 36° vertically or the number of degrees necessary to meet the visual ground segment requirement, whichever is greater. The minimum horizontal field-of-view coverage must be plus and minus one-half (½) of the minimum continuous field-of-view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. Any geometric error between the Image Generator eye point and the pilot eye point must be 8° or less.	N/A	An SOC is required and must explain the geometry of the installation. Horizontal field-of-view of at least 146° (including not less than 73° measured either side of the center of the design eye point). Additional horizontal field-of-view capability may be added at the sponsor's discretion provided the minimum field-of-view is retained. Vertical field-of-view of at least 36° measured from the pilot's and co-pilot's eye point.		X		Horizontal field-of-view is centered on the zero degree azimuth line relative to the aircraft fuselage. Field-of-view may be measured using a visual test pattern filling the entire visual scene (all channels) with a matrix of black and white 5° squares.
4.b.3.	Continuous field-of-view.	Continuous field-of-view of at least 176° horizontal and 56° vertical field-of-view for each pilot simultaneously. Any geometric error between the Image Generator eye point and the pilot eye point must be 8° or less.	N/A	An SOC is required and must explain the geometry of the installation. Horizontal field-of-view is centered on the zero degree azimuth line relative to the aircraft fuselage. Horizontal field-of-view must be at least 176° (including not less than 88° either side of the center of the design eye point). Additional horizontal field-of-view capability may be added at the sponsor's discretion provided the minimum field-of-view is retained. Vertical field-of-view must not be less than a total of 56° measured from the pilot's and co-pilot's eye point.			X	The horizontal field-of-view is traditionally described as a 180° field-of-view. However, the field-of-view is technically no less than 176°. Field-of-view may be measured using a visual test pattern filling the entire visual scene (all channels) with a matrix of black and white 5° squares.

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level			Notes
Entry No.	Title				B	C	D	
4.c.	Surface contrast ratio.	Not less than 5:1.	N/A	The ratio is calculated by dividing the brightness level of the center, bright square (providing at least 2 foot-lamberts or 7 cd/m^2) by the brightness level of any adjacent dark square.			X	Measurements may be made using a 1° spot photometer and a raster drawn test pattern filling the entire visual scene (all channels) with a test pattern of black and white squares, 5 per square, with a white square in the center of each channel. During contrast ratio testing, simulator aft-cab and flight deck ambient light levels should be zero.
4.d.	Highlight brightness.	Not less than six (6) foot-lamberts (20 cd/m^2).	N/A	Measure the brightness of the center, white square while superimposing a highlight on that white square. The use of calligraphic capabilities to enhance the raster brightness is acceptable; however, measuring light points is not acceptable.			X	Measurements may be made using a 1° spot photometer and a raster drawn test pattern filling the entire visual scene (all channels) with a test pattern of black and white squares, 5 per square, with a white square in the center of each channel.

4.e.	Surface resolution.	Not greater than two (2) arc minutes.	N/A	An SOC is required and must include the appropriate calculations and an explanation of those calculations. Level B requires surface resolution not greater than three (3) arc minutes.		X	X	When the eye is positioned on a 3° glide slope at the slant range distances indicated with white runway markings on a black runway surface, the eye will subtend two (2) arc minutes: (1) A slant range of 6,876 ft with stripes 150 ft long and 16 ft wide, spaced 4 ft apart. (2) For Configuration A, a slant range of 5,157 feet with stripes 150 ft long and 12 ft wide, spaced 3 ft apart. (3) For Configuration B, a slant range of 9,884 feet, with stripes 150 ft long and 5.75 ft wide, spaced 5.75 ft apart.
4.f.	Light point size	Not greater than five (5) arc minutes.	N/A	An SOC is required and must include the relevant calculations and an explanation of those calculations.		X	X	Light point size may be measured using a test pattern consisting of a centrally located single row of light points reduced in length until modulation is just discernible in each visual channel. A row of 48 lights will form a 4° angle or less.
4.g.	Light point contrast ratio.							A 1° spot photometer may be used to measure a square of at least 1° filled with light points (where light point modulation is just discernible) and compare the results to the measured adjacent background. During contrast ratio testing, simulator aft-cab and flight deck ambient light levels should be zero.
4.g.1.		Not less than 10:1	N/A	An SOC is required and must include the relevant calculations.	X			

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level			Notes
Entry No.	Title				B	C	D	
4.g.2.		Not less than 25:1	N/A	An SOC is required and must include the relevant calculations.		X	X	
4.h.	Visual ground segment							
		The visible segment in the simulator must be ±20% of the segment computed to be visible from the helicopter flight deck. This tolerance may be applied at the far end of the displayed segment. However, lights and ground objects computed to be visible from the helicopter flight deck at the near end of the visible segment must be visible in the simulator.	Landing configuration, with the aircraft trimmed for the appropriate airspeed, where the MLG are at 100 ft (30 m) above the plane of the touchdown zone, on the electronic glide slope with an RVR value set at 1,200 ft (350 m).	The QTG must contain appropriate calculations and a drawing showing the data used to establish the helicopter location and the segment of the ground that is visible considering design eye point, the helicopter attitude, flight deck cut-off angle, and a visibility of 1200 ft (350 m) RVR. Simulator performance must be measured against the QTG calculations. The data submitted must include at least the following:	X	X	X	Pre-positioning for this test is encouraged, and may be achieved via manual or autopilot control to the desired position.

				(1) Static helicopter dimensions as follows: (i) Horizontal and vertical distance from main landing gear (MLG) to glideslope reception antenna. (ii) Horizontal and vertical distance from MLG to pilot's eyepoint. (iii) Static flight deck cutoff angle. (2) Approach data as follows: (i) Identification of runway. (ii) Horizontal distance from runway threshold to glideslope intercept with runway. (iii) Glideslope angle. (iv) Helicopter pitch angle on approach. (3) Helicopter data for manual testing: (i) Gross weight. (ii) Helicopter configuration. (iii) Approach airspeed. If non-homogenous fog is used to obscure visibility, the vertical variation in horizontal visibility must be described and be included in the slant range visibility calculation used in the computations.				
5.	Sound system							
	The sponsor will not be required to repeat the helicopter tests (i.e., tests 5.a.1. through 5.a.8. (or 5.b.1. through 5.b.9.) and 5.c., as appropriate) during continuing qualification evaluations if frequency response and background noise test results are within tolerance when compared to the initial qualification evaluation results, and the sponsor shows that no software changes have occurred that will affect the helicopter test results. If the frequency response test method is chosen and fails, the sponsor may elect to fix the frequency response problem and repeat the test or the sponsor may elect to repeat the helicopter tests. If the helicopter tests are repeated during continuing qualification evaluations, the results may be compared against initial qualification evaluation results or helicopter master data. All tests in this section must be presented using an unweighted ⅓-octave band format from band 17 to 42 (50 Hz to 16 kHz). A minimum 20 second average must be taken at the location corresponding to the helicopter data set. The helicopter and flight simulator results must be produced using comparable data analysis techniques.							
5.a.	Basic requirements							

TABLE C2A—FULL FLIGHT SIMULATOR (FFS) OBJECTIVE TESTS—Continued

QPS requirements									Information
Test		Tolerance(s)	Flight condition	Test details	Simulator level				Notes
Entry No.	Title				B	C	D		
5.a.1.	Ready for engine start.	±5 dB per 1/3 octave band.	Ground	Normal condition prior to engine start. The APU must be on if appropriate.			X		
5.a.2.	All engines at idle; rotor not turning (if applicable) and rotor turning.	±5 dB per 1/3 octave band.	Ground	Normal condition prior to lift-off.			X		
5.a.3.	Hover	±5 dB per 1/3 octave band.	Hover				X		
5.a.4.	Climb	±5 dB per 1/3 octave band.	En-route climb	Medium altitude			X		
5.a.5.	Cruise	±5 dB per 1/3 octave band.	Cruise	Normal cruise configuration.			X		
5.a.6.	Final approach	±5 dB per 1/3 octave band.	Landing	Constant airspeed, gear down.			X		
5.b.	Special cases								
		±5 dB per 1/3 octave band.	As appropriate				X		These special cases are identified as particularly significant during critical phases of flight and ground operations for a specific helicopter type or model.
5.c.	Background noise								
		±3 dB per 1/3 octave band.	As appropriate	Results of the background noise at initial qualification must be included in the MQTG. Measurements must be made with the simulation running, the sound muted, and a "dead" flight deck.			X		The simulated sound will be evaluated to ensure that the background noise does not interfere with training, testing, or checking.
5.d.	Frequency response								

		±5 dB on three (3) consecutive bands when compared to initial evaluation; and ±2 dB when comparing the average of the absolute differences between initial and continuing qualification evaluation.		Applicable only to Continuing Qualification Evaluations. If frequency response plots are provided for each channel at the initial evaluation, these plots may be repeated at the continuing qualification evaluation with the following tolerances applied: (a) The continuing qualification ⅓ octave band amplitudes must not exceed ±5 dB for three consecutive bands when compared to initial results. (b) The average of the sum of the absolute differences between initial and continuing qualification results must not exceed 2 dB (refer to table C2C in Appendix C).			X	Measurements are compared to those taken during initial qualification evaluation.

BEGIN INFORMATION

3. GENERAL

a. If relevant winds are present in the objective data, the wind vector should be clearly noted as part of the data presentation, expressed in conventional terminology, and related to the runway being used for test near the ground.

b. The reader is encouraged to review the Airplane Flight Simulator Evaluation Handbook, Volumes I and II, published by the Royal Aeronautical Society, London, UK, and FAA AC 25–7, as amended, Flight Test Guide for Certification of Transport Category Airplanes, and AC 23–8, as amended, Flight Test Guide for Certification of Part 23 Airplanes, for references and examples regarding flight testing requirements and techniques.

4. CONTROL DYNAMICS

a. General. The characteristics of a helicopter flight control system have a major effect on the handling qualities. A significant consideration in pilot acceptability of a helicopter is the ''feel'' provided through the flight controls. Considerable effort is expended on helicopter feel system design so that pilots will be comfortable and will consider the helicopter desirable to fly. In order for an FFS to be representative, it should ''feel'' like the helicopter being simulated. Compliance with this requirement is determined by comparing a recording of the control feel dynamics of the FFS to actual helicopter measurements in the hover and cruise configurations.

(1) Recordings such as free response to an impulse or step function are classically used to estimate the dynamic properties of electromechanical systems. In any case, it is only possible to estimate the dynamic properties as a result of only being able to estimate true inputs and responses. Therefore, it is imperative that the best possible data be collected since close matching of the FFS control loading system to the helicopter system is essential. The required dynamic control tests are described in Table C2A of this attachment.

(2) For initial and upgrade evaluations, the QPS requires that control dynamics characteristics be measured and recorded directly from the flight controls (Handling Qualities—Table C2A). This procedure is usually accomplished by measuring the free response of the controls using a step or impulse input to excite the system. The procedure should be accomplished in the hover and cruise flight conditions and configurations.

(3) For helicopters with irreversible control systems, measurements may be obtained on the ground if proper pitot-static inputs are provided to represent airspeeds typical of those encountered in flight. Likewise, it may be shown that for some helicopters, hover, climb, cruise, and autorotation have like effects. Thus, one may suffice for another. If either or both considerations apply, engineering validation or helicopter manufacturer rationale should be submitted as justification for ground tests or for eliminating a configuration. For FFSs requiring static and dynamic tests at the controls, special test fixtures will not be required during initial and upgrade evaluations if the QTG shows both test fixture results and the results of an alternate approach (e.g., computer plots that were produced concurrently and show satisfactory agreement). Repeat of the alternate method during the initial evaluation satisfies this test requirement.

b. Control Dynamics Evaluations. The dynamic properties of control systems are often stated in terms of frequency, damping, and a number of other classical measurements. In order to establish a consistent means of validating test results for FFS control loading, criteria are needed that will clearly define the measurement interpretation and the applied tolerances. Criteria are needed for underdamped, critically damped and overdamped systems. In the case of an underdamped system with very light damping, the system may be quantified in terms of frequency and damping. In critically damped or overdamped systems, the frequency and damping are not readily measured from a response time history. Therefore, the following suggested measurements may be used:

(1) For Levels C and D simulators. Tests to verify that control feel dynamics represent the helicopter should show that the dynamic damping cycles (free response of the controls) match those of the helicopter within specified tolerances. The responsible Flight Standards office recognizes that several different testing methods may be used to verify the control feel dynamic response. The responsible Flight Standards office will consider the merits of testing methods based on reliability and consistency. One acceptable method of evaluating the response and the tolerance to be applied is described below for the underdamped and critically damped cases. A sponsor using this method to comply with the QPS requirements should perform the tests as follows:

(a) Underdamped Response. Two measurements are required for the period, the time to first zero crossing (in case a rate limit is present) and the subsequent frequency of oscillation. It is necessary to measure cycles on an individual basis in case there are nonuniform periods in the response. Each period will be independently compared to the respective period of the helicopter control system and, consequently, will enjoy the full tolerance specified for that period. The damping tolerance will be applied to overshoots on an individual basis. Care should be taken when applying the tolerance to small overshoots since the significance of such overshoots becomes questionable. Only those overshoots larger than 5 percent of the total initial displacement should be considered significant. The residual band, labeled $T(A_d)$ on Figure C2A is ±5 percent of the initial displacement amplitude A_d from the steady state value of the oscillation. Only oscillations outside the residual band are considered significant. When comparing FFS data to helicopter data, the process should begin by overlaying or aligning the FFS and helicopter steady state values and then comparing amplitudes of oscillation peaks, the time of the first zero crossing, and individual periods of oscillation. The FFS should show the same number of significant overshoots to within one when compared against the helicopter data. The procedure for evaluating the response is illustrated in Figure C2A.

(b) Critically damped and Overdamped Response. Due to the nature of critically damped and overdamped responses (no overshoots), the time to reach 90 percent of the steady state (neutral point) value should be the same as the helicopter within ±10 percent. The simulator response must be critically damped also. Figure C2B illustrates the procedure.

(c) Special considerations. Control systems that exhibit characteristics other than classical overdamped or underdamped responses should meet specified tolerances. In addition, special consideration should be given to ensure that significant trends are maintained.

(2) Tolerances.

(a) The following summarizes the tolerances, ''T'' for underdamped systems, and ''n'' is the sequential period of a full cycle of oscillation. See Figure C2A of this attachment for an illustration of the referenced measurements.

$T(P_0)$	±10% of P_0
$T(P_1)$	±20% of P_1
$T(P_2)$	±30% of P_2
$T(P_n)$	±10(n + 1)% of P_n
$T(A_n)$	±10% of A_1, ±20% of Subsequent Peaks
$T(A_d)$	±5% of A_d = residual band

Significant overshoots. First overshoot and ±1 subsequent overshoots

(b) The following tolerance applies to critically damped and overdamped systems only. See Figure C2B for an illustration of the reference measurements:

$T(P_0)$ .... ±10% of P_0

END INFORMATION

BEGIN QPS REQUIREMENT

c. Alternative method for control dynamics evaluation.

(1) An alternative means for validating control dynamics for aircraft with hydraulically powered flight controls and artificial feel systems is by the measurement of control force and rate of movement. For each axis of pitch, roll, and yaw, the control must be forced to its maximum extreme position for the following distinct rates. These tests are conducted under normal flight and ground conditions.

(a) Static test—Slowly move the control so that a full sweep is achieved within 95–105 seconds. A full sweep is defined as movement of the controller from neutral to the stop, usually aft or right stop, then to the opposite stop, then to the neutral position.

(b) Slow dynamic test—Achieve a full sweep within 8–12 seconds.

(c) Fast dynamic test—Achieve a full sweep in within 3–5 seconds.

NOTE: Dynamic sweeps may be limited to forces not exceeding 100 lbs. (44.5 daN).

(d) Tolerances

(i) Static test—see Table C2A, FFS Objective Tests, Entries 2.a.1., 2.a.2., and 2.a.3.

(ii) Dynamic test—±2 lbs (0.9 daN) or ±10% on dynamic increment above static test.

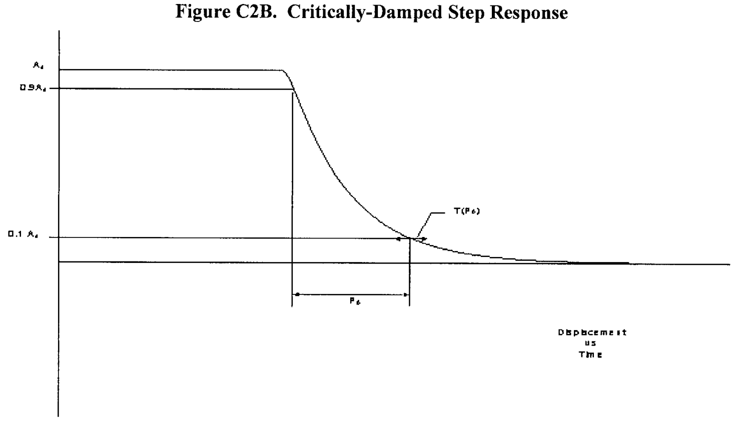
END QPS REQUIREMENT

BEGIN INFORMATION

d. The FAA is open to alternative means that are justified and appropriate to the application. For example, the method described here may not apply to all manufacturers systems and certainly not to aircraft with reversible control systems. Each case is considered on its own merit on an ad hoc basis. If the FAA finds that alternative methods do not result in satisfactory performance, more conventionally accepted methods will have to be used.

Attachment 2 to Appendix C to Part 60—
Figure C2A. Under-Damped Step Response

Attachment 2 to Appendix C to Part 60—
Figure C2B. Critically-Damped Step Response



END INFORMATION

5. [RESERVED]

BEGIN INFORMATION

6. MOTION SYSTEM.

a. General.

(1) Pilots use continuous information signals to regulate the state of the helicopter. In concert with the instruments and outside-world visual information, whole-body motion feedback is essential in assisting the pilot to

control the helicopter dynamics, particularly in the presence of external disturbances. The motion system should meet basic objective performance criteria, and be subjectively tuned at the pilot's seat position to represent the linear and angular accelerations of the helicopter during a prescribed minimum set of maneuvers and conditions. The response of the motion cueing system should be repeatable.

(2) The Motion System tests in Section 3 of Table C2A are intended to qualify the FFS motion cueing system from a mechanical performance standpoint. Additionally, the list of motion effects provides a representative sample of dynamic conditions that should be present in the flight simulator. An additional list of representative, training-critical maneuvers, selected from Section 1, (Performance tests) and Section 2, (Handling Qualities tests) in Table C2A, that should be recorded during initial qualification (but without tolerance) to indicate the flight simulator motion cueing performance signature have been identified (reference Section 3.e). These tests are intended to help improve the overall standard of FFS motion cueing.

b. Motion System Checks. The intent of test 3a, Frequency Response, test 3b, Leg Balance, and test 3c, Turn-Around Check, as described in the Table of Objective Tests, is to demonstrate the performance of the motion system hardware, and to check the integrity of the motion set-up with regard to calibration and wear. These tests are independent of the motion cueing software and should be considered robotic tests.

c. Motion System Repeatability. The intent of this test is to ensure that the motion system software and motion system hardware have not degraded or changed over time. This diagnostic test should be completed during continuing qualification checks in lieu of the robotic tests. This will allow an improved ability to determine changes in the software or determine degradation in the hardware. The following information delineates the methodology that should be used for this test.

(1) Input: The inputs should be such that rotational accelerations, rotational rates, and linear accelerations are inserted before the transfer from helicopter center of gravity to pilot reference point with a minimum amplitude of 5 deg/sec/sec, 10 deg/sec and 0.3 g, respectively, to provide adequate analysis of the output.

(2) Recommended output:

(a) Actual platform linear accelerations; the output will comprise accelerations due to both the linear and rotational motion acceleration;

(b) Motion actuators position.

d. Motion Cueing Performance Signature.

(1) Background. The intent of this test is to provide quantitative time history records of motion system response to a selected set of automated QTG maneuvers during initial qualification. It is not intended to be a comparison of the motion platform accelerations against the flight test recorded accelerations (i.e., not to be compared against helicopter cueing). If there is a modification to the initially qualified motion software or motion hardware (e.g., motion washout filter, simulator payload change greater than 10%) then a new baseline may need to be established.

(2) Test Selection. The conditions identified in Section 3.e. in Table C2A are those maneuvers where motion cueing is the most discernible. They are general tests applicable to all types of helicopters and should be completed for motion cueing performance signature at any time acceptable to the responsible Flight Standards office prior to or during the initial qualification evaluation, and the results included in the MQTG.

(3) Priority. Motion system should be designed with the intent of placing greater importance on those maneuvers that directly influence pilot perception and control of the helicopter motions. For the maneuvers identified in section 3.e. in Table C2A, the flight simulator motion cueing system should have a high tilt co-ordination gain, high rotational gain, and high correlation with respect to the helicopter simulation model.

(4) Data Recording. The minimum list of parameters provided should allow for the determination of the flight simulator's motion cueing performance signature for the initial qualification evaluation. The following parameters are recommended as being acceptable to perform such a function:

(a) Flight model acceleration and rotational rate commands at the pilot reference point;

(b) Motion actuators position;

(c) Actual platform position;

(d) Actual platform acceleration at pilot reference point.

e. Motion Vibrations.

(1) Presentation of results. The characteristic motion vibrations may be used to verify that the flight simulator can reproduce the frequency content of the helicopter when flown in specific conditions. The test results should be presented as a Power Spectral Density (PSD) plot with frequencies on the horizontal axis and amplitude on the vertical axis. The helicopter data and flight simulator data should be presented in the same format with the same scaling. The algorithms used for generating the flight simulator data should be the same as those used for the helicopter data. If they are not the same then the algorithms used for the flight simulator data should be proven to be sufficiently comparable. As a minimum the results along the dominant axes should be presented and a rationale for not presenting the other axes should be provided.

(2) Interpretation of results. The overall trend of the PSD plot should be considered

while focusing on the dominant frequencies. Less emphasis should be placed on the differences at the high frequency and low amplitude portions of the PSD plot. During the analysis, certain structural components of the flight simulator have resonant frequencies that are filtered and may not appear in the PSD plot. If filtering is required, the notch filter bandwidth should be limited to 1 Hz to ensure that the buffet feel is not adversely affected. In addition, a rationale should be provided to explain that the characteristic motion vibration is not being adversely affected by the filtering. The amplitude should match helicopter data as described below. However, if the PSD plot was altered for subjective reasons, a rationale should be provided to justify the change. If the plot is on a logarithmic scale it may be difficult to interpret the amplitude of the buffet in terms of acceleration. For example, a 1×10^{-3} g-rms²/Hz would describe a heavy buffet and may be seen in the deep stall regime. Alternatively, a 1×10^{-6} g-rms²/Hz buffet is almost imperceptable, but may represent a flap buffet at low speed. The previous two examples differ in magnitude by 1000. On a PSD plot this represents three decades (one decade is a change in order of magnitude of 10, and two decades is a change in order of magnitude of 100).

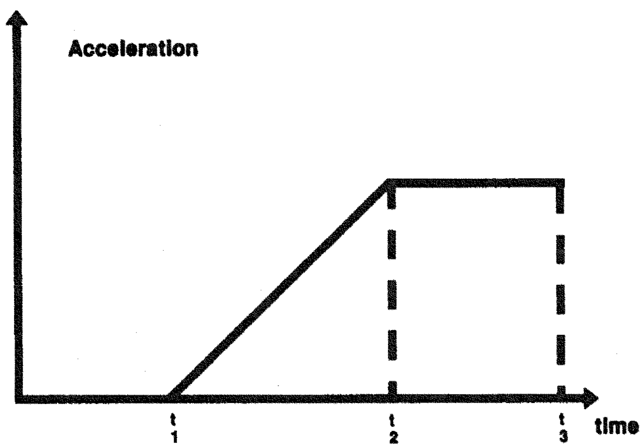
NOTE: In the example, ''g-rms²'' is the mathematical expression for ''g's root mean squared.''

f. Table C2B, Motion System Recommendations for Level C and Level D Helicopter Simulators, contains a description of the parameters that should be present in simulator motion systems to provide adequate onset motion cues to helicopter pilots. The information provided covers the six axes of motion (pitch, roll, yaw, vertical, lateral, and longitudinal) and addresses displacement, velocity, and acceleration. Also included is information about the parameters for initial rotational and linear acceleration. The parameters listed in this table apply only to Level C and Level D simulators, and are presented here as recommended targets for motion system capability. They are not requirements.

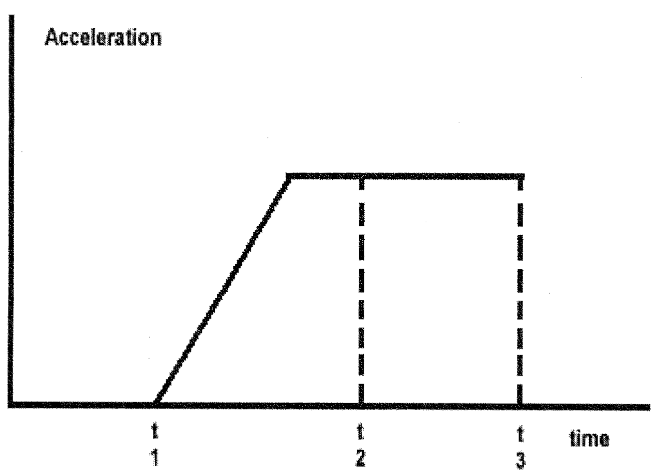
TABLE C2B—MOTION SYSTEM RECOMMENDATIONS FOR LEVEL C AND LEVEL D HELICOPTER SIMULATORS

a.	Motion System Envelope	
a.1.	Pitch	
a.1.a.	Displacement	±25°
a.1.b.	Velocity	±20°/sec
a.1.c.	Acceleration	±100°/sec²
a.2.	Roll	
a.2.a.	Displacement	±25°
a.2.b.	Velocity	±20°/sec
a.2.c.	Acceleration	±100°/sec²
a.3.	Yaw	
a.3.a.	Displacement	±25°
a.3.b.	Velocity—	±20°/sec
a.3.c.	Acceleration	±100°/sec²
a.4.	Vertical	
a.4.a.	Displacement	±34 in.
a.4.b.	Velocity	±24 in.
a.4.c.	Acceleration	±0.8 g.
a.5.	Lateral	
a.5.a.	Displacement	±45 in.
a.5.b.	Velocity	±28 in/sec.
a.5.c.	Acceleration	±0.6 g.
a.6.	Longitudinal	
a.6.a.	Displacement	±34 in.
a.6.b.	Velocity	±28 in/sec.
a.6.c.	Acceleration	±0.6 g.
a.7.	Initial Rotational Acceleration Ratio.	All axes 300°/ sec²/sec
a.8.	Initial Linear Acceleration Ratio.	
a.8.a.	Vertical	±6g/sec
a.8.b.	Lateral	±3g/sec
a.8.c.	Longitudinal	±3g/sec

Attachment 2 to Appendix C to Part 60—
Figure C2C. Acceleration Test Signals



Attachment 2 to Appendix C to Part 60—
Figure C2D. Test Signal Characteristics



NOTE: Motion system baseline performance repeatability tests should be repeated if the simulator weight changes for any reason (i.e., visual change or structural change). The new results should be used for future comparison.

7. SOUND SYSTEM

a. General. The total sound environment in the helicopter is very complex, and changes with atmospheric conditions, helicopter configuration, airspeed, altitude, and power settings. Flight deck sounds are an important component of the flight deck operational environment and provide valuable information to the flight crew. These aural cues can either assist the crew (as an indication of an abnormal situation), or hinder the crew (as a distraction or nuisance). For effective training, the flight simulator should provide flight deck sounds that are perceptible to the pilot during normal and abnormal operations, and that are comparable to those of the helicopter. The flight simulator operator should carefully evaluate background noises in the location where the device will be installed. To demonstrate compliance with the sound requirements, the objective or validation tests in this attachment were selected to provide a representative sample of normal static conditions typically experienced by a pilot.

b. Alternate propulsion. For FFS with multiple propulsion configurations, any condition listed in Table C2A in this attachment should be presented for evaluation as part of the QTG if identified by the helicopter manufacturer or other data supplier as significantly different due to a change in propulsion system (engine or propeller).

c. Data and Data Collection System.

(1) Information provided to the flight simulator manufacturer should comply be presented in the format suggested by the ''International Air Transport Association (IATA) Flight Simulator Design and Performance Data Requirements,'' as amended. This information should contain calibration and frequency response data.

(2) The system used to perform the tests listed in Table C2A should comply with the following standards:

(a) The specifications for octave, half octave, and third octave band filter sets may be found in American National Standards Institute (ANSI) S1.11–1986.

(b) Measurement microphones should be type WS2 or better, as described in International Electrotechnical Commission (IEC) 1094–4–1995.

(3) Headsets. If headsets are used during normal operation of the helicopter they should also be used during the flight simulator evaluation.

(4) Playback equipment. Playback equipment and recordings of the QTG conditions should be provided during initial evaluations.

(5) Background noise.

(a) Background noise is the noise in the flight simulator that is not associated with the helicopter, but is caused by the flight simulator's cooling and hydraulic systems and extraneous noise from other locations in the building. Background noise can seriously impact the correct simulation of helicopter sounds, and should be kept below the helicopter sounds. In some cases, the sound level of the simulation can be increased to compensate for the background noise. However, this approach is limited by the specified tolerances and by the subjective acceptability of the sound environment to the evaluation pilot.

(b) The acceptability of the background noise levels is dependent upon the normal sound levels in the helicopter being represented. Background noise levels that fall below the lines defined by the following points, may be acceptable:

(i) 70 dB @ 50 Hz;

(ii) 55 dB @ 1000 Hz;

(iii) 30 dB @ 16 kHz.

(NOTE: These limits are for unweighted ⅓ octave band sound levels. Meeting these limits for background noise does not ensure an acceptable flight simulator. Helicopter sounds that fall below this limit require careful review and may require lower limits on background noise.)

(6) Validation testing. Deficiencies in helicopter recordings should be considered when applying the specified tolerances to ensure that the simulation is representative of the helicopter. Examples of typical deficiencies are:

(a) Variation of data between tail numbers.

(b) Frequency response of microphones.

(c) Repeatability of the measurements.

TABLE C2C—EXAMPLE OF CONTINUING QUALIFICATION FREQUENCY RESPONSE TEST TOLERANCE

Band center frequency	Initial results (DbsPL)	Continuing qualification results (DbsPL)	Absolute difference
50	75.0	73.8	1.2
63	75.9	75.6	0.3
80	77.1	76.5	0.6
100	78.0	78.3	0.3
125	81.9	81.3	0.6
160	79.8	80.1	0.3
200	83.1	84.9	1.8
250	78.6	78.9	0.3
315	79.5	78.3	1.2
400	80.1	79.5	0.9
500	80.7	79.8	0.9
630	81.9	80.4	1.5
800	73.2	74.1	0.9
1000	79.2	80.1	0.9
1250	80.7	82.8	2.1
1600	81.6	78.6	3.0
2000	76.2	74.4	1.8
2500	79.5	80.7	1.2
3150	80.1	77.1	3.0
4000	78.9	78.6	0.3
5000	80.1	77.1	3.0
6300	80.7	80.4	0.3
8000	84.3	85.5	1.2
10000	81.3	79.8	1.5
12500	80.7	80.1	0.6
16000	71.1	71.1	0.0
	Average		1.1

8. ADDITIONAL INFORMATION ABOUT FLIGHT SIMULATOR QUALIFICATION FOR NEW OR DERIVATIVE HELICOPTERS

a. Typically, a helicopter manufacturer's approved final data for performance, handling qualities, systems or avionics is not available until well after a new or derivative helicopter has entered service. However, flight crew training and certification often begins several months prior to the entry of the first helicopter into service. Consequently, it may be necessary to use preliminary data provided by the helicopter manufacturer for interim qualification of flight simulators.

b. In these cases, the responsible Flight Standards office may accept certain partially validated preliminary helicopter and systems data, and early release (''red label'') avionics data in order to permit the necessary program schedule for training, certification, and service introduction.

c. Simulator sponsors seeking qualification based on preliminary data should consult the responsible Flight Standards office to make special arrangements for using preliminary data for flight simulator qualification. The sponsor should also consult the helicopter and flight simulator manufacturers to develop a data plan and flight simulator qualification plan.

d. The procedure to be followed to gain the responsible Flight Standards office acceptance of preliminary data will vary from case to case and between helicopter manufacturers. Each helicopter manufacturer's new helicopter development and test program is designed to suit the needs of the particular project and may not contain the same events or sequence of events asanother manufacturer's program or even the same manufacturer's program for a different helicopter. Therefore, there cannot be a prescribed invariable procedure for acceptance of preliminary data; instead there should be a statement describing the final sequence of events, data sources, and validation procedures agreed by the simulator sponsor, the helicopter manufacturer, the flight simulator manufacturer, and the responsible Flight Standards office.

NOTE: A description of helicopter manufacturer-provided data needed for flight simulator modeling and validation is to be found in the ''Royal Aeronautical Society Data Package Requirements for Design and Performance Evaluation of Rotary Wing Synthetic Training Devices.''

e. The preliminary data should be the manufacturer's best representation of the helicopter, with assurance that the final data will not deviate significantly from the preliminary estimates. Data derived from these predictive or preliminary techniques should be validated by available sources including, at least, the following:

(1) Manufacturer's engineering report. The report should explain the predictive method used and illustrate past success of the method on similar projects. For example, the manufacturer could show the application of the method to an earlier helicopter model or predict the characteristics of an earlier model and compare the results to final data for that model.

(2) Early flight test results. This data is often derived from helicopter certification tests and should be used to maximum advantage for early flight simulator validation. Certain critical tests that would normally be done early in the helicopter certification program should be included to validate essential pilot training and certification maneuvers. These tests include cases where a pilot is expected to cope with a helicopter failure mode or an engine failure. The early data available will depend on the helicopter manufacturer's flight test program design and may not be the same in each case. The flight test program of the helicopter manufacturer should include provisions for generation of very early flight tests results for flight simulator validation.

f. The use of preliminary data is not indefinite. The helicopter manufacturer's final data should be available within 12 months after the helicopter first entry into service or as agreed by the responsible Flight Standards office, the simulator sponsor, and the helicopter manufacturer. When applying for interim qualification using preliminary data, the simulator sponsor and the responsible Flight Standards office should agree on the update program. This includes specifying that the final data update will be installed in the flight simulator within a period of 12 months following the final data release, unless special conditions exist and a different schedule is acceptable. The flight simulator performance and handling validation would then be based on data derived from flight tests. Initial helicopter systems data should be updated after engineering tests. Final helicopter systems data should also be used for flight simulator programming and validation.

g. Flight simulator avionics should stay essentially in step with helicopter avionics (hardware and software) updates. The permitted time lapse between helicopter and flight simulator updates should be minimal. It may depend on the magnitude of the update and whether the QTG and pilot training and certification are affected. Differences in helicopter and flight simulator avionics versions and the resulting effects on flight simulator qualification should be agreed between the simulator sponsor and the responsible Flight Standards office. Consultation with the flight simulator manufacturer is desirable throughout the qualification process.

h. The following describes an example of the design data and sources that might be used in the development of an interim qualification plan.

(1) The plan should consist of the development of a QTG based upon a mix of flight test and engineering simulation data. For data collected from specific helicopter flight tests or other flights the required design model or data changes necessary to support an acceptable Proof of Match (POM) should be generated by the helicopter manufacturer.

(2) For proper validation of the two sets of data, the helicopter manufacturer should compare their simulation model responses against the flight test data, when driven by the same control inputs and subjected to the same atmospheric conditions as recorded in the flight test. The model responses should result from a simulation where the following systems are run in an integrated fashion and are consistent with the design data released to the flight simulator manufacturer:

(a) Propulsion.

(b) Aerodynamics.

(c) Mass properties.

(d) Flight controls.

(e) Stability augmentation.

(f) Brakes/landing gear.

i. A qualified test pilot should be used to assess handling qualities and performance evaluations for the qualification of flight simulators of new helicopter types.

END INFORMATION

BEGIN QPS REQUIREMENT

9. ENGINEERING SIMULATOR—VALIDATION DATA

a. When a fully validated simulation (i.e., validated with flight test results) is modified due to changes to the simulated helicopter configuration, the helicopter manufacturer or other acceptable data supplier must coordinate with the responsible Flight Standards office to supply validation data from an ''audited'' engineering simulator/simulation to selectively supplement flight test data. The responsible Flight Standards office must be provided an opportunity to audit the use of the engineering simulation or the engineering simulator during the acquisition of the data that will be used as validation data. Audited data may be used for changes that are incremental in nature. Manufacturers or other data suppliers must be able to demonstrate that the predicted changes in helicopter performance are based on acceptable aeronautical principles with proven success history and valid outcomes. This must include comparisons of predicted and flight test validated data.

b. Helicopter manufacturers or other acceptable data suppliers seeking to use an engineering simulator for simulation validation data as an alternative to flight-test derived validation data, must contact the responsible Flight Standards office and provide the following:

(1) A description of the proposed aircraft changes, a description of the proposed simulation model changes, and the use of an integral configuration management process, including an audit of the actual simulation model modifications that includes a step-by-step description leading from the original model(s) to the current model(s).

(2) A schedule for review by the responsible Flight Standards office of the proposed plan and the subsequent validation data to establish acceptability of the proposal.

(3) Validation data from an audited engineering simulator/simulation to supplement specific segments of the flight test data.

c. To be qualified to supply engineering simulator validation data, for aerodynamic, engine, flight control, or ground handling models, a helicopter manufacturer or other acceptable data supplier must:

(1) Be able to verify their ability to:

(a) Develop and implement high fidelity simulation models; and

(b) Predict the handling and performance characteristics of a helicopter with sufficient accuracy to avoid additional flight test activities for those handling and performance characteristics.

(2) Have an engineering simulator that:

(a) Is a physical entity, complete with a flight deck representative of the simulated class of helicopter;

(b) Has controls sufficient for manual flight;

(c) Has models that run in an integrated manner;

(d) Had fully flight-test validated simulation models as the original or baseline simulation models;

(e) Has an out-of-the-flight deck visual system;

(f) Has actual avionics boxes interchangeable with the equivalent software simulations to support validation of released software;

(g) Uses the same models as released to the training community (which are also used to produce stand-alone proof-of-match and checkout documents);

(h) Is used to support helicopter development and certification; and

(i) Has been found to be a high fidelity representation of the helicopter by the manufacturer's pilots (or other acceptable data supplier), certificate holders, and the responsible Flight Standards office.

(3) Use the engineering simulator to produce a representative set of integrated proof-of-match cases.

(4) Use a configuration control system covering hardware and software for the operating components of the engineering simulator.

(5) Demonstrate that the predicted effects of the change(s) are within the provisions of

sub-paragraph ‘‘a’’ of this section, and confirm that additional flight test data are not required.

d. Additional Requirements for Validation Data

(1) When used to provide validation data, an engineering simulator must meet the simulator standards currently applicable to training simulators except for the data package.

(2) The data package used must be:

(a) Comprised of the engineering predictions derived from the helicopter design, development, or certification process;

(b) Based on acceptable aeronautical principles with proven success history and valid outcomes for aerodynamics, engine operations, avionics operations, flight control applications, or ground handling;

(c) Verified with existing flight-test data; and

(d) Applicable to the configuration of a production helicopter, as opposed to a flight-test helicopter.

(3) Where engineering simulator data are used as part of a QTG, an essential match must exist between the training simulator and the validation data.

(4) Training flight simulator(s) using these baseline and modified simulation models must be qualified to at least internationally recognized standards, such as contained in the ICAO Document 9625, the ‘‘Manual of Criteria for the Qualification of Flight Simulators.’’

END QPS REQUIREMENT

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10. [RESERVED]

11. VALIDATION TEST TOLERANCES

BEGIN INFORMATION

a. Non-Flight-Test Tolerances. If engineering simulator data or other non-flight-test data are used as an allowable form of reference validation data for the objective tests listed in Table C2A of this attachment, the data provider must supply a well-documented mathematical model and testing procedure that enables a replication of the engineering simulation results within 20% of the corresponding flight test tolerances.

b. Background

(1) The tolerances listed in Table C2A of this attachment are designed to measure the quality of the match using flight-test data as a reference.

(2) Good engineering judgment should be applied to all tolerances in any test. A test is failed when the results fall outside of the prescribed tolerance(s).

(3) Engineering simulator data are acceptable because the same simulation models used to produce the reference data are also used to test the flight training simulator (i.e., the two sets of results should be ‘‘essentially’’ similar).

(4) The results from the two sources may differ for the following reasons:

(a) Hardware (avionics units and flight controls);

(b) Iteration rates;

(c) Execution order;

(d) Integration methods;

(e) Processor architecture;

(f) Digital drift, including:

(i) Interpolation methods;

(ii) Data handling differences;

(iii) Auto-test trim tolerances.

(5) The tolerance limit between the reference data and the flight simulator results is generally 20% of the corresponding ‘‘flight-test’’ tolerances. However, there may be cases where the simulator models used are of higher fidelity, or the manner in which they are cascaded in the integrated testing loop have the effect of a higher fidelity, than those supplied by the data provider. Under these circumstances, it is possible that an error greater than 20% may be generated. An error greater than 20% may be acceptable if the simulator sponsor can provide an adequate explanation.

(6) Guidelines are needed for the application of tolerances to engineering-simulator-generated validation data because:

(a) Flight-test data are often not available due to sound technical reasons;

(b) Alternative technical solutions are being advanced; and

(c) The costs are high.

12. VALIDATION DATA ROADMAP

a. Helicopter manufacturers or other data suppliers should supply a validation data roadmap (VDR) document as part of the data package. A VDR document contains guidance material from the helicopter validation data supplier recommending the best possible sources of data to be used as validation data in the QTG. A VDR is of special value when requesting interim qualification, qualification of simulators for helicopters certificated prior to 1992, and qualification of alternate engine or avionics fits. A sponsor seeking to have a device qualified in accordance with the standards contained in this QPS appendix should submit a VDR to the responsible Flight Standards office as early as possible in the planning stages. The NSPM is the final authority to approve the data to be used as validation material for the QTG. The responsible Flight Standards office and the Joint Aviation Authorities' Synthetic Training Devices Advisory Board have committed to maintain a list of agreed VDRs.

b. The VDR should identify (in matrix format) sources of data for all required tests. It should also provide guidance regarding the validity of these data for a specific engine type, thrust rating configuration, and the revision levels of all avionics affecting helicopter handling qualities and performance. The VDR should include rationale or explanation in cases where data or parameters are missing, engineering simulation data are to be used, flight test methods require explanation, or where there is any deviation from data requirements. Additionally, the document should refer to other appropriate sources of validation data (e.g., sound and vibration data documents).

c. The Sample Validation Data Roadmap (VDR) for helicopters, shown in Table C2D, depicts a generic roadmap matrix identifying sources of validation data for an abbreviated list of tests. This sample document uses fixed wing parameters instead of helicopter values. It is merely a sample and does not provide actual data. A complete matrix should address all test conditions for helicopter application and provide actual data and data sources.

d. Two examples of rationale pages are presented in Appendix F of IATA Flight Simulator Design and Performance Data Requirements document. These illustrate the type of helicopter and avionics configuration information and descriptive engineering rationale used to describe data anomalies or provide an acceptable basis for using alternative data for QTG validation requirements.

END INFORMATION

ICAO or IATA #	Test Description		Validation Source		Validation Document						Comments
Notes: 1. Only one page is shown; and some test conditions were deleted for brevity. 2. Relevant regulatory material should be consulted and all applicable tests addressed. 3. Validation source, document and comments provided herein are for reference only and do not constitute approval for use. 4. CCA mode must be described for each test condition. 5. If more than one aircraft type (e.g., derivative and baseline) are used as validation data more columns may be necessary.		CCA Mode	Aircraft Flight Test Data	Engineering Simulator Data (DEF-73 Engines)	Aerodynamics POM Doc.#xxx123, Rev. A	Flight Controls POM Doc.#xxx456, NEW	Ground Handling POM Doc. #xxx789, Rev. B	Propulsion POM Doc. #321, Rev. C	Integrated POM Doc. #xxx654, Rev. A	Appendix to this VDR Doc. #xxx987, NEW	*Legend:* D71 = Engine Type (Thrust Rating of 71.5K) D73 = Engine Type (Thrust Rating of 73K) Bold upper case = primary validation source. Lower case, within parentheses = alternative validation source. R = Rationale included in the data package Appendix.
1.a.1.	Minimum Radius Turn.		**X**				**D71**				
1.a.2.	Rate of Turn vs. Nosewheel Angle (2 speeds).		**X**				**D71**				
1.b.1.	Ground Acceleration Time and Distance.		**X**				(d73)		**D73**		Primary data contained in IPOM.
1.b.2.	Minimum Control Speed, Ground (Vmcg).		(x)	**X**	(d71)					**D73**	See engineering rationale for test data in VDR.
1.b.3.	Minimum Unstick Speed (Vmu).		**X**		**D71**						
1.b.4.	Normal Takeoff.		**X**		(d73)				**D73**		Primary data contained in IPOM.
1.b.5.	Critical Engine Failure on Takeoff.		**X**		(d71)					**D73**	Alternative engine thrust rating flight test data in VDR.
1.b.6.	Crosswind Takeoff.		**X**		(d71)					**D73**	Alternative engine thrust rating flight test data in VDR.
1.b.7.	Rejected Takeoff.		**X**		**D71**					**R**	Test procedure anomaly; see rationale.
1.b.8.	Dynamic Engine Failure After Takeoff.			**X**						**D73**	No flight test data available; see rationale.
1.c.1.	Normal Climb – All Engines.		**X**		(d71)				**D71**		Primary data contained in IPOM.
1.c.2.	Climb – Engine-out, Second Segment.		**X**		(d71)					**D73**	Alternative engine thrust rating flight test data in VDR.
1.c.3.	Climb – Engine-out, Enroute.		**X**		(d71)					**D73**	AFM data available (73K).
1.c.4.	Engine-out, Approach Climb.		**X**		**D71**						
1.c.5.a.	Level Flight Acceleration.		(x)	**X**	(d73)					**D73**	Eng sim data w/ modified EEC accel rate in VDR.
1.c.5.b.	Level Flight Deceleration.		(x)	**X**	(d73)					**D73**	Eng sim data w/ modified EEC accel rate in VDR.
1.d.1.	Cruise Performance.		**X**		**D71**						
1.e.1.a.	Stopping Time & Distance (Wheel brakes / Light weight).			**X**	**D71**					(d73)	No flight test data available; see rationale.
1.e.1.b.	Stopping Time & Distance (Wheel brakes/ Med. weight).		**X**	(x)	**D71**					(d73)	
1.e.1.c.	Stopping Time & Distance (Wheel brakes / Heavy weight).		**X**	(x)	**D71**					(d73)	
1.e.2.a.	Stopping Time & Distance (Reverse thrust / Light weight).		**X**	(x)	**D71**					(d73)	
1.e.2.b.	Stopping Time & Distance (Reverse thrust / Med. Weight).			**X**	(d71)					**D73**	No flight test data available; see rationale.

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BEGIN INFORMATION

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13. [RESERVED]

14. ACCEPTANCE GUIDELINES FOR ALTERNATIVE AVIONICS (FLIGHT-RELATED COMPUTERS AND CONTROLLERS)

a. Background

(1) For a new helicopter type, the majority of flight validation data are collected on the first helicopter configuration with a ''baseline'' flight-related avionics ship-set; (see subparagraph b.(2) of this section). These data are then used to validate all flight simulators representing that helicopter type.

(2) Additional validation data may be needed for flight simulators representing a helicopter with avionics of a different hardware design than the baseline, or a different software revision than that of previously validated configurations.

(3) When a flight simulator with additional or alternate avionics configurations is to be qualified, the QTG should contain tests against validation data for selected cases where avionics differences are expected to be significant.

b. Approval Guidelines For Validating Alternate Avionics

(1) The following guidelines apply to flight simulators representing helicopters with a revised avionics configuration, or more than one avionics configuration.

(2) The baseline validation data should be based on flight test data, except where other data are specifically allowed (e.g., engineering flight simulator data).

(3) The helicopter avionics can be segmented into two groups, systems or components whose functional behavior contributes to the aircraft response presented in the QTG results, and systems that do not. The following avionics are examples of contributory systems for which hardware design changes or software revisions may lead to significant differences in the aircraft response relative to the baseline avionics configuration: Flight control computers and controllers for engines, autopilot, braking system, and nosewheel steering system, if applicable. Related avionics such as augmentation systems should also be considered.

(4) The acceptability of validation data used in the QTG for an alternative avionics fit should be determined as follows:

(a) For changes to an avionics system or component that do not affect QTG validation test response, the QTG test can be based on validation data from the previously validated avionics configuration.

(b) For an avionics change to a contributory system, where a specific test is not affected by the change (e.g., the avionics change is a Built In Test Equipment (BITE) update or a modification in a different flight phase), the QTG test can be based on validation data from the previously-validated avionics configuration. The QTG should include authoritative justification (e.g., from the helicopter manufacturer or system supplier) that this avionics change does not affect the test.

(c) For an avionics change to a contributory system, the QTG may be based on validation data from the previously-validated avionics configuration if no new functionality is added and the impact of the avionics change on the helicopter response is based on acceptable aeronautical principles with proven success history and valid outcomes. This should be supplemented with avionics-specific validation data from the helicopter manufacturer's engineering simulation, generated with the revised avionics configuration. The QTG should include an explanation of the nature of the change and its effect on the helicopter response.

(d) For an avionics change to a contributory system that significantly affects some tests in the QTG, or where new functionality is added, the QTG should be based on validation data from the previously validated avionics configuration and supplemental avionics-specific flight test data sufficient to validate the alternate avionics revision. Additional flight test validation data may not be needed if the avionics changes were certified without the need for testing with a comprehensive flight instrumentation package. The helicopter manufacturer should coordinate flight simulator data requirements in advance with the responsible Flight Standards office.

(5) A matrix or ''roadmap'' should be provided with the QTG indicating the appropriate validation data source for each test. The roadmap should include identification of the revision state of those contributory avionics systems that could affect specific test responses.

15. TRANSPORT DELAY TESTING

a. This paragraph describes how to determine the introduced transport delay through the flight simulator system so that it does not exceed a specific time delay. The transport delay should be measured from control inputs through the interface, through each of the host computer modules and back through the interface to motion, flight instrument, and visual systems. The transport delay should not exceed the maximum allowable interval.

b. Four specific examples of transport delay are:

(1) Simulation of classic non-computer controlled aircraft;

(2) Simulation of Computer Controlled Aircraft using real helicopter black boxes;

(3) Simulation of Computer Controlled Aircraft using software emulation of helicopter boxes;

(4) Simulation using software avionics or rehosted instruments.

c. Figure C2C illustrates the total transport delay for a non-computer-controlled helicopter or the classic transport delay test. Since there are no helicopter-induced delays for this case, the total transport delay is equivalent to the introduced delay.

d. Figure C2D illustrates the transport delay testing method using the real helicopter controller system.

e. To obtain the induced transport delay for the motion, instrument and visual signal, the delay induced by the helicopter controller should be subtracted from the total transport delay. This difference represents the introduced delay and should not exceed the standards prescribed in Table C1A.

f. Introduced transport delay is measured from the flight deck control input to the reaction of the instruments and motion and visual systems (See Figure C2C).

g. The control input may also be introduced after the helicopter controller system input and the introduced transport delay may be measured directly from the control input to the reaction of the instruments, and simulator motion and visual systems (See Figure C2D).

h. Figure C2E illustrates the transport delay testing method used on a flight simulator that uses a software emulated helicopter controller system.

i. It is not possible to measure the introduced transport delay using the simulated helicopter controller system architecture for the pitch, roll and yaw axes. Therefore, the signal should be measured directly from the pilot controller. The flight simulator manufacturer should measure the total transport delay and subtract the inherent delay of the actual helicopter components because the real helicopter controller system has an inherent delay provided by the helicopter manufacturer. The flight simulator manufacturer should ensure that the introduced delay does not exceed the standards prescribed in Table C1A.

j. Special measurements for instrument signals for flight simulators using a real helicopter instrument display system instead of a simulated or re-hosted display. For flight instrument systems, the total transport delay should be measured and the inherent delay of the actual helicopter components subtracted to ensure that the introduced delay does not exceed the standards prescribed in Table C1A.

(1) Figure C2FA illustrates the transport delay procedure without helicopter display simulation. The introduced delay consists of the delay between the control movement and the instrument change on the data bus.

(2) Figure C2FB illustrates the modified testing method required to measure introduced delay due to software avionics or rehosted instruments. The total simulated instrument transport delay is measured and the helicopter delay should be subtracted from this total. This difference represents the introduced delay and should not exceed the standards prescribed in Table C1A. The inherent delay of the helicopter between the data bus and the displays is indicated in figure C2FA. The display manufacturer should provide this delay time.

k. Recorded signals. The signals recorded to conduct the transport delay calculations should be explained on a schematic block diagram. The flight simulator manufacturer should also provide an explanation of why each signal was selected and how they relate to the above descriptions.

l. Interpretation of results. Flight simulator results vary over time from test to test due to ''sampling uncertainty.'' All flight simulators run at a specific rate where all modules are executed sequentially in the host computer. The flight controls input can occur at any time in the iteration, but these data will not be processed before the start of the new iteration. For example, a flight simulator running at 60 Hz may have a difference of as much as 16.67 msec between results. This does not mean that the test has failed. Instead, the difference is attributed to variation in input processing. In some conditions, the host simulator and the visual system do not run at the same iteration rate, so the output of the host computer to the visual system will not always be synchronized.

m. The transport delay test should account for both daylight and night modes of operation of the visual system. In both cases, the tolerances prescribed in Table C1A should be met and the motion response should occur before the end of the first video scan containing new information.

Figure C2E
Transport Delay for simulation of classic non-Computer Controlled Aircraft.

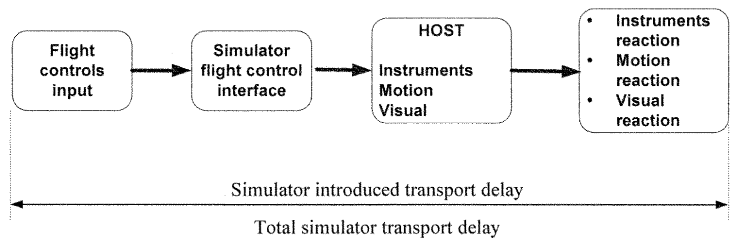


Figure C2F
Transport Delay for simulation of Computer Controlled Aircraft using real helicopter black boxes

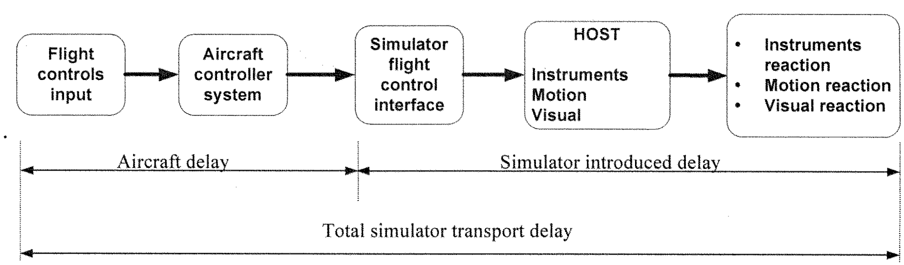


Figure C2G
Transport Delay for simulation of Computer Controlled Aircraft using software emulation of helicopter boxes

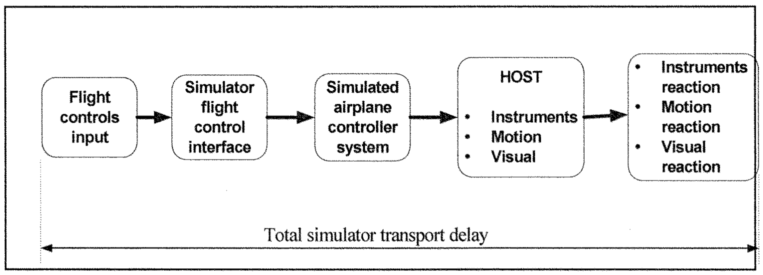
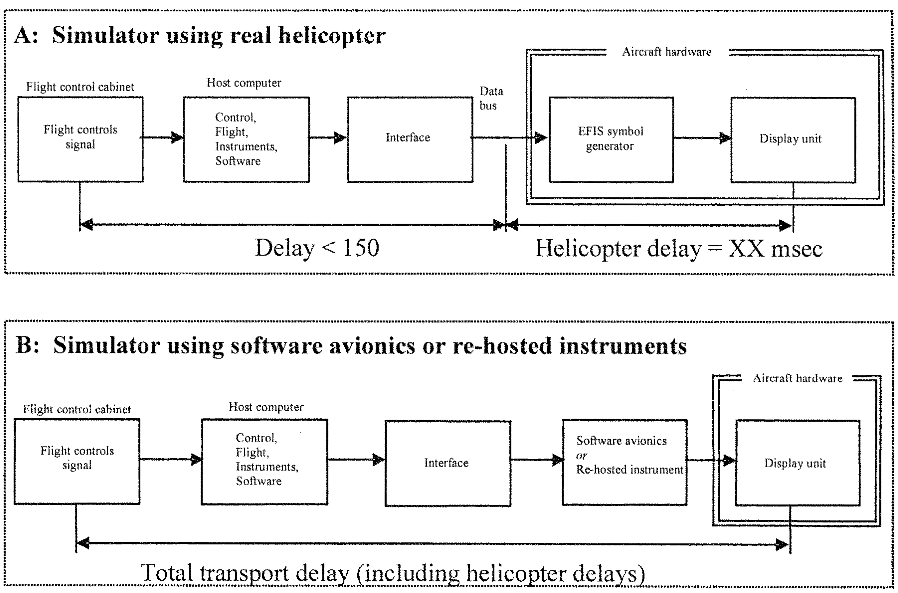


Figure C2HA and C2HB
Transport delay for simulation of helicopters using real or re-hosted instrument drivers



16. Continuing Qualification Evaluations—Validation Test Data Presentation

a. Background

(1) The MQTG is created during the initial evaluation of a flight simulator. This is the master document, as amended, to which flight simulator continuing qualification evaluation test results are compared.

(2) The currently accepted method of presenting continuing qualification evaluation test results is to provide flight simulator results over-plotted with reference data. Test results are carefully reviewed to determine if the test is within the specified tolerances. This can be a time consuming process, particularly when reference data exhibits rapid variations or an apparent anomaly requiring engineering judgment in the application of

the tolerances. In these cases, the solution is to compare the results to the MQTG. The continuing qualification results are compared to the results in the MQTG for acceptance. The flight simulator operator and the responsible Flight Standards office should look for any change in the flight simulator performance since initial qualification.

b. Continuing Qualification Evaluation Test Results Presentation

(1) Flight simulator operators are encouraged to over-plot continuing qualification validation test results with MQTG flight simulator results recorded during the initial evaluation and as amended. Any change in a validation test will be readily apparent. In addition to plotting continuing qualification validation test and MQTG results, operators may elect to plot reference data.

(2) There are no suggested tolerances between flight simulator continuing qualification and MQTG validation test results. Investigation of any discrepancy between the MQTG and continuing qualification flight simulator performance is left to the discretion of the flight simulator operator and the responsible Flight Standards office.

(3) Differences between the two sets of results, other than variations attributable to repeatability issues that cannot be explained should be investigated.

(4) The flight simulator should retain the ability to over-plot both automatic and manual validation test results with reference data.

END INFORMATION

BEGIN QPS REQUIREMENTS

17. ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION: LEVEL B SIMULATORS ONLY

a. Sponsors are not required to use the alternative data sources, procedures, and instrumentation. However, any sponsor choosing to use alternative sources must comply with the requirements in Table C2E.

END QPS REQUIREMENTS

BEGIN INFORMATION

b. It has become standard practice for experienced simulator manufacturers to use such techniques as a means of establishing data bases for new simulator configurations while awaiting the availability of actual flight test data. The data generated from the aerodynamic modeling techniques is then compared to the flight test data when it becomes available. The results of such comparisons have become increasingly consistent, indicating that these techniques, applied with appropriate experience, are dependable and accurate for the development of aerodynamic models for use in Level B simulators.

c. Based on this history of successful comparisons, the responsible Flight Standards office has concluded that those who are experienced in the development of aerodynamic models for simulator application can successfully use these modeling techniques to alter the method for acquiring flight test data for Level B simulators.

d. The information in Table C2E (Alternative Data Sources, Procedures, and Information) is presented to describe an acceptable alternative to data sources for simulator modeling and validation and an acceptable alternative to the procedures and instrumentation traditionally used to gather such modeling and validation data.

(1) Alternative data sources that may be used for part or all of a data requirement are the Helicopter Maintenance Manual, the Rotorcraft Flight Manual (RFM), Helicopter Design Data, the Type Inspection Report (TIR), Certification Data or acceptable supplemental flight test data.

(2) The sponsor should coordinate with the responsible Flight Standards office prior to using alternative data sources in a flight test or data gathering effort.

e. The responsible Flight Standards office position on the use of these alternative data sources, procedures, and instrumentation is based on the use of a rigorously defined and fully mature simulation controls system model that includes accurate gearing and cable stretch characteristics (where applicable), determined from actual aircraft measurements. The model does not require control surface position measurements in the flight test objective data in these limited applications.

f. Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated helicopter instruments, including the inclinometer; the force/position measurements of flight deck controls; and a clear visual directional reference for a known magnetic bearing (e.g., a runway centerline). Ground track and wind corrected heading may be used for sideslip angle.

g. The sponsor is urged to contact the responsible Flight Standards office for clarification of any issue regarding helicopters with reversible control systems. This table is not applicable to Computer Controlled Aircraft flight simulators.

h. Use of these alternate data sources, procedures, and instrumentation does not relieve the sponsor from compliance with the balance of the information contained in this document relative to Level B FFSs.

i. The term ''inertial measurement system'' is used in table C2E includes the use of a functional global positioning system (GPS).

j. Synchronized video for the use of alternative data sources, procedures, and instrumentation should have:

(1) sufficient resolution to allow magnification of the display to make appropriate measurement and comparisons; and

(2) sufficient size and incremental marking to allow similar measurement and comparison. The detail provided by the video should provide sufficient clarity and accuracy to measure the necessary parameter(s) to at least ½ of the tolerance authorized for the specific test being conducted and allow an integration of the parameter(s) in question to obtain a rate of change.

END INFORMATION

TABLE C2E—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION

[The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix C are not used]

QPS requirements			Information
Table of objective tests Test entry number and title	Level By only	Alternative data sources, procedures, and instrumentation	Notes
1.a.1.a. Performance. Engine Start and Accelerations.	X	Data may be acquired using a synchronized video recording of all engine instruments, start buttons, means for fuel introduction and means for moving from "idle" to "flight." A stopwatch is necessary.	
1.a.1.b. Performance. Steady State Idle and Operating RPM Conditions.	X	Data may be acquired using a synchronized video recording of all engine instruments, and include the status of the means for moving from "idle" to "flight.".	
1.a.2. Performance. Power Turbine Speed Trim.	X	Data may be acquired using a synchronized video recording of all engine instruments. Speed trim actuator position may be hand recorded.	
1.a.3. Performance. Engine and Rotor Speed Governing.	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
1.b.1. Performance. On Surface Taxi. Minimum Radius Turn.	X	TIR, AFM, or Design data may be used.	
1.b.2. Performance. On Surface Taxi Rate of Turn vs. Nosewheel Steering Angle.	X	Data may be acquired by using a constant tiller position (measured with a protractor), or full pedal application for steady state turn, and synchronized video of heading indicator. If less than full pedal is used, pedal position must be recorded..	A single procedure may not be adequate for all rotorcraft steering systems. Appropriate measurement procedures must be devised and proposed for responsible Flight Standards office concurrence.
1.b.3. Performance. Taxi ...	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
1.b.4. Performance. Brake	X	Data may be acquired using a stopwatch and a means for measuring distance such as runway distance markers conforming with runway distance marker standards.	
1.c.1. Performance. Running Takeoff.	X	Preliminary certification data may be used. Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls. Collective, cyclic, and pedal position time history must be recorded from the start of collective movement through to normal climb. Indicated torque settings may be hand recorded at the moment of lift-off and in a steady normal climb.	
1.c.2. Performance. One Engine Inoperative (OEI), continued takeoff.	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls. Collective, cyclic, and pedal position time history must be recorded from the start of collective movement through to normal OEI climb. Indicated torque settings may be hand recorded at the moment of lift-off and in a steady normal OEI climb.	
1.f. Performance. Level Flight. Trimmed Flight Control Positions.	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
1.g. Performance. Normal Climb. Trimmed Flight Control Positions.	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	

TABLE C2E—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION—Continued

[The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix C are not used]

QPS requirements			Information
Table of objective tests Test entry number and title	Level By only	Alternative data sources, procedures, and instrumentation	Notes
1.h.1. Descent Performance and Trimmed Flight Control Positions.	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
1.h.2. Autorotation Performance and Trimmed Flight Control Positions.	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
1.j.1. Performance. Running Landing All Engines.	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
1.j.2. Performance. Running Landing One Engine Inoperative.	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
1.j.3. Performance. Balked Landing.	X	Data may be acquired by using a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls. The synchronized video must record the time of the "balk landing" decision.	
2.a.1. Handling Qualities. Static Control Checks. Cyclic Controller Position vs. Force.	X	Control positions can be obtained using continuous control position recordings. Force data may be acquired by using a hand held force gauge so that the forces can be cross-plotted against control position in each of the control axes.	
2.a.2. Handling Qualities. Static Control Checks. Collective/Pedals vs. Force.	X	Control positions can be obtained using continuous control position recordings. Force data may be acquired by using a hand held force gauge so that the forces can be cross-plotted against control position in each of the control axes.	
2.a.3. Handling Qualities. Brake Pedal Force vs. Position.	X	Brake pedal positions can be obtained using continuous position recordings. Force data may be acquired by using a hand held force gauge so that the forces can be cross-plotted against brake pedal position.	
2.a.4. Handling Qualities. Trim System Rate (all applicable systems).	X	Control positions can be obtained using continuous control position recordings plotted against time to provide rate in each applicable system.	
2.a.6. Handling Qualities. Control System Freeplay.	X	Data may be acquired by direct measurement.	
2.c.1. Longitudinal Handling Qualities. Control Response.	X	Data may be acquired by using an inertial measurement system, a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
2.c.2. Longitudinal Handling Qualities. Static Stability.	X	Data may be acquired by using an inertial measurement system, a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
2.c.3.a. Longitudinal Handling Qualities. Dynamic Stability, Long Term Response.	X	Data may be acquired by using an inertial measurement system, a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
2.c.3.b. Longitudinal Handling Qualities. Dynamic Stability, Short Term Response.	X	Data may be acquired by using an inertial measurement system, a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
2.c.4. Longitudinal Handling Qualities. Maneuvering stability.	X	Data may be acquired by using an inertial measurement system, a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
2.d.1.a. Lateral Handling Qualities. Control Response.	X	Data may be acquired by using an inertial measurement system, a synchronized video of the calibrated helicopter instruments and the force/position measurements of flight deck controls.	
2.d.1.b Directional Handling Qualities. Control Response..	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated helicopter instruments and force/position measurements of flight deck directional controls.	
2.d.2. Handling Qualities. Directional Static Stability.	X	Data may be acquired by using an inertial measurement system and a synchronized video of calibrated helicopter instruments and force/position measurements of flight deck directional controls.	
2.d.3.a. Handling Qualities. Dynamic Lateral and Directional Stability Lateral-Directional Oscillations.	X	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated helicopter instruments, the force/position measurements of flight deck controls, and a stop watch.	
2.d.3.b. Handling Qualities. Dynamic Lateral and Directional Stability Spiral Stability.	X	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated helicopter instruments, the force/position measurements of flight deck controls, and a stop watch.	

TABLE C2E—ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION—Continued

[The standards in this table are required if the data gathering methods described in paragraph 9 of Appendix C are not used]

QPS requirements			Information
Table of objective tests / Test entry number and title	Level By only	Alternative data sources, procedures, and instrumentation	Notes
2.d.3.c. Handling Qualities. Dynamic Lateral and Directional Stability. Adverse/Proverse Yaw.	X	Data may be acquired by using an inertial measurement system and a synchronized video of the calibrated helicopter instruments, the force/position measurements of flight deck controls.	

BEGIN INFORMATION

18. VISUAL DISPLAY SYSTEMS.

a. Basic principles of a FFS collimated display:

(1) The essential feature of a collimated display is that light rays coming from a given point in a picture are parallel. There are two main implications of the parallel rays:

(a) The viewer's eyes focus at infinity and have zero convergence, providing a cue that the object is distant; and

(b) The angle to any given point in the picture does not change when viewed from a different position so the object behaves geometrically as though it were located at a significant distance from the viewer. These cues are self-consistent, and are appropriate for any object that has been modeled as being at a significant distance from the viewer.

(2) In an ideal situation the rays are perfectly parallel, but most implementations provide only an approximation to the ideal. Typically, an FFS display provides an image located not closer than about 20–33 ft (6–10 m) from the viewer, with the distance varying over the field-of-view. A schematic representation of a collimated display is provided in Figure C2A.

(3) Collimated displays are well suited to many simulation applications as the area of interest is relatively distant from the observer so the angles to objects should remain independent of viewing position. Consider the view of the runway seen by the flight crew lined up on an approach. In the real world, the runway is distant and the light rays from the runway to the eyes are parallel. The runway appears to be straight ahead to both crew members. This situation is well simulated by a collimated display and is presented in Figure C2B. Note that the distance to the runway has been shortened for clarity. If drawn to scale, the runway would be farther away and the rays from the two seats would be closer to being parallel.

(4) While the horizontal field-of-view of a collimated display can be extended to approximately 210°–220°, the vertical field-of-view has been limited to about 40°–45°. These limitations result from tradeoffs in optical quality and interference between the display components and flight deck structures, but were sufficient to meet FFS regulatory approval for Helicopter FFSs. However, recent designs have been introduced with vertical fields of view of up to 60° for helicopter applications.

b. Basic principles of a FFS dome (or non-collimated) display:

(1) The situation in a dome display is shown in Figure C2C. As the angles can be correct for only one eye point at a time, the visual system in the figure has been aligned for the right seat eye point position. The runway appears to be straight ahead of the aircraft for this viewer. For the left seat viewer, however, the runway appears to be somewhat to the right of the aircraft. As the aircraft is still moving towards the runway, the perceived velocity vector will be directed towards the runway and this will be interpreted as the aircraft having some yaw offset.

(2) The situation is substantially different for near field objects encountered in helicopter operations close to the ground. In those cases, objects that should be interpreted as being close to the viewer will be misinterpreted as being distant in a collimated display. The errors can actually be reduced in a dome display.

(3) The field-of-view possible with a dome display can be larger than that of a collimated display. Depending on the configuration, a field-of-view of 240° by 90° is possible and can be exceeded.

c. Additional display considerations

(1) While the situations described above are for discrete viewing positions, the same arguments can be extended to moving eye points produced by the viewer's head movement. In the real world, the parallax effects resulting from head movement provide distance cues. The effect is particularly strong for relative movement of flight deck structure in the near field and modeled objects in the distance. Collimated displays will provide accurate parallax cues for distant objects, but increasingly inaccurate cues for

near field objects. The situation is reversed for dome displays.

(2) Stereopsis cues resulting from the different images presented to each eye for objects relatively close to the viewer also provide depth cues. Again, the collimated and dome displays provide more or less accurate cues depending on the modeled distance of the objects being viewed.

d. Training implications

(1) In view of the basic principles described above, it is clear that neither display approach provides a completely accurate image for all possible object distances. The sponsor should consider the training role of the FFS when configuring the display system to make the optimum choice. Factors that should be considered include relative importance of training tasks at low altitudes, the role of the two crew members in the flying tasks, and the field-of-view required for specific training tasks.

Plan Views of Collimated and Dome (or Non-collimated) Visual Display Systems

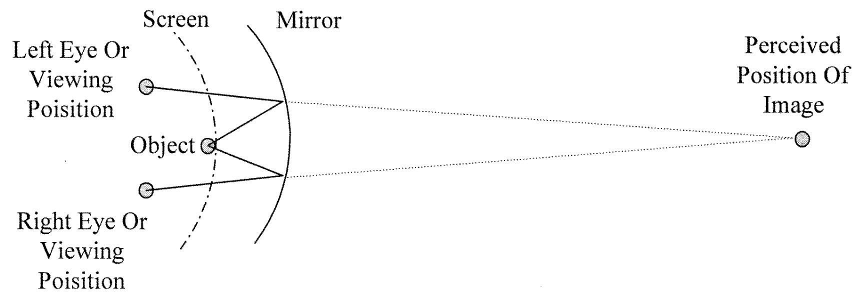


Figure C2I - Collimated display

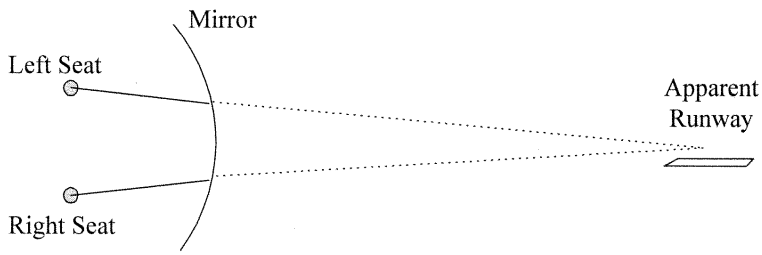


Figure C2J - Runway view in a collimated display

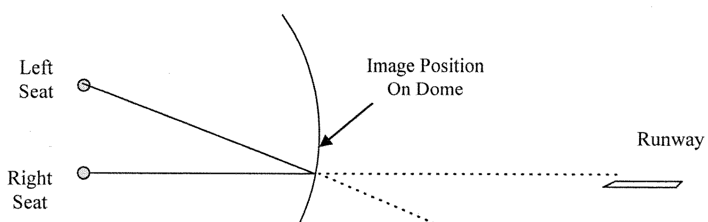


Figure C2K - Runway view in a dome display

End Information

ATTACHMENT 3 TO APPENDIX C TO PART 60—SIMULATOR SUBJECTIVE EVALUATION

BEGIN QPS REQUIREMENTS

1. REQUIREMENTS

a. Except for special use airport models, all airport models required by this part must be representations of real-world, operational airports or representations of fictional airports and must meet the requirements set out in Tables C3B or C3C of this attachment, as appropriate.

b. If fictional airports are used, the sponsor must ensure that navigational aids and all appropriate maps, charts, and other navigational reference material for the fictional airports (and surrounding areas as necessary) are compatible, complete, and accurate with respect to the visual presentation and airport model of this fictional airport. An SOC must be submitted that addresses navigation aid installation and performance and other criteria (including obstruction clearance protection) for all instrument approaches to the fictional airports that are available in the simulator. The SOC must reference and account for information in the terminal instrument procedures manual and the construction and availability of the required maps, charts, and other navigational material. This material must be clearly marked "for training purposes only."

c. When the simulator is being used by an instructor or evaluator for purposes of training, checking, or testing under this chapter, only airport models classified as Class I, Class II, or Class III may be used by the instructor or evaluator. Detailed descriptions/definitions of these classifications are found in Appendix F of this part.

d. When a person sponsors an FFS maintained by a person other than a U.S. certificate holder, the sponsor is accountable for that FFS originally meeting, and continuing to meet, the criteria under which it was originally qualified and the appropriate Part 60 criteria, including the visual scenes and airport models that may be used by instructors or evaluators for purposes of training, checking, or testing under this chapter.

e. Neither Class II nor Class III airport visual models are required to appear on the SOQ, and the method used for keeping instructors and evaluators apprised of the airport models that meet Class II or Class III requirements on any given simulator is at the option of the sponsor, but the method used must be available for review by the TPAA.

f. When an airport model represents a real world airport and a permanent change is made to that real world airport (e.g., a new runway, an extended taxiway, a new lighting system, a runway closure) without a written extension grant from the responsible Flight Standards office (described in paragraph 1.g., of this section), an update to that airport model must be made in accordance with the following time limits:

(1) For a new airport runway, a runway extension, a new airport taxiway, a taxiway extension, or a runway/taxiway closure—within 90 days of the opening for use of the new airport runway, runway extension, new airport taxiway, or taxiway extension; or within 90 days of the closure of the runway or taxiway.

(2) For a new or modified approach light system—within 45 days of the activation of the new or modified approach light system.

(3) For other facility or structural changes on the airport (e.g., new terminal, relocation of Air Traffic Control Tower)—within 180 days of the opening of the new or changed facility or structure.

g. If a sponsor desires an extension to the time limit for an update to a visual scene or airport model or has an objection to what must be updated in the specific airport model requirement, the sponsor must provide a written extension request to the responsible Flight Standards office stating the reason for the update delay and a proposed completion date or provide an explanation for the objection, explaining why the identified airport change will not have an impact on flight training, testing, or checking. A copy of this request or objection must also be sent to the POI/TCPM. The responsible Flight Standards office will send the official response to the sponsor and a copy to the POI/TCPM; however, if there is an objection, after consultation with the appropriate POI/TCPM regarding the training, testing, or checking impact, the responsible Flight Standards office will send the official response to the sponsor and a copy to the POI/TCPM.

END QPS REQUIREMENTS

BEGIN INFORMATION

2. DISCUSSION

a. The subjective tests provide a basis for evaluating the capability of the simulator to perform over a typical utilization period; determining that the simulator competently simulates each required maneuver, procedure, or task; and verifying correct operation of the simulator controls, instruments, and systems. The items listed in the following Tables are for simulator evaluation purposes only. They may not be used to limit or exceed the authorizations for use of a given level of simulator as described on the SOQ or as approved by the TPAA. All items in the following paragraphs are subject to an examination.

b. The tests in Table C3A, Operations Tasks, in this attachment address pilot functions, including maneuvers and procedures (called flight tasks), and are divided by flight phases. The performance of these tasks by the responsible Flight Standards office includes an operational examination of the visual system and special effects. There are flight tasks included to address some features of advanced technology helicopters and innovative training programs.

c. The tests in Table C3A, Operations Tasks, and Table C3G, Instructor Operating Station, in this attachment address the overall function and control of the simulator including the various simulated environmental conditions; simulated helicopter system operation (normal, abnormal, and emergency); visual system displays; and special effects necessary to meet flight crew training, evaluation, or flight experience requirements.

d. All simulated helicopter systems functions will be assessed for normal and, where appropriate, alternate operations. Normal, abnormal, and emergency operations associated with a flight phase will be assessed during the evaluation of flight tasks or events within that flight phase. Simulated helicopter systems are listed separately under ''Any Flight Phase'' to ensure appropriate attention to systems checks. Operational navigation systems (including inertial navigation systems, global positioning systems, or other long-range systems) and the associated electronic display systems will be evaluated if installed. The pilot will include in his report to the TPAA, the effect of the system operation and any system limitation.

e. Simulators demonstrating a satisfactory circling approach will be qualified for the circling approach maneuver and may be approved for such use by the TPAA in the sponsor's FAA-approved flight training program. To be considered satisfactory, the circling approach will be flown at maximum gross weight for landing, with minimum visibility for the helicopter approach category, and must allow proper alignment with a landing runway at least 90° different from the instrument approach course while allowing the pilot to keep an identifiable portion of the airport in sight throughout the maneuver (reference—14 CFR 91.175(e)).

f. At the request of the TPAA, the Pilot may assess the simulator for a special aspect of a sponsor's training program during the functions and subjective portion of an evaluation. Such an assessment may include a portion of a Line Oriented Flight Training (LOFT) scenario or special emphasis items in the sponsor's training program. Unless directly related to a requirement for the qualification level, the results of such an evaluation would not affect the qualification of the simulator.

g. This appendix addresses helicopter simulators at Levels B, C, and D because there are no Level A Helicopter simulators.

h. The FAA intends to allow the use of Class III airport models on a limited basis when the sponsor provides the TPAA (or other regulatory authority) an appropriate analysis of the skills, knowledge, and abilities (SKAs) necessary for competent performance of the tasks in which this particular media element is used. The analysis should describe the ability of the FFS/visual media to provide an adequate environment in which the required SKAs are satisfactorily performed and learned. The analysis should also include the specific media element, such as the visual scene or airport model.

i. The TPAA may accept Class III airport models without individual observation provided the sponsor provides the TPAA with an acceptable description of the process for determining the acceptability of a specific airport model, outlines the conditions under which such an airport model may be used, and adequately describes what restrictions will be applied to each resulting airport or landing area model. Examples of situations that may warrant Class III model designation by the TPAA include the following:

(a) Training, testing, or checking on very low visibility operations, including SMGCS operations.

(b) Instrument operations training (including instrument takeoff, departure, arrival, approach, and missed approach training, testing, or checking) using—

(i) A specific model that has been geographically ''moved'' to a different location and aligned with an instrument procedure for another airport.

(ii) A model that does not match changes made at the real-world airport (or landing area for helicopters) being modeled.

(iii) A model generated with an ''off-board'' or an ''on-board'' model development tool (by providing proper latitude/longitude reference; correct runway or landing area orientation, length, width, marking, and lighting information; and appropriate adjacent taxiway location) to generate a facsimile of a real world airport or landing area.

j. Previously qualified simulators with certain early generation Computer Generated Image (CGI) visual systems, are limited by the capability of the Image Generator or the display system used. These systems are:

(1) Early CGI visual systems that are exempt from the necessity of including runway numbers as a part of the specific runway marking requirements are:

(a) Link NVS and DNVS.

(b) Novoview 2500 and 6000.

(c) FlightSafety VITAL series up to, and including, VITAL III, but not beyond.

(d) Redifusion SP1, SP1T, and SP2.

(2) Early CGI visual systems are excepted from the necessity of including runway numbers unless the runway is used for LOFT training sessions. These LOFT airport models require runway numbers, but only for the specific runway end (one direction) used in the LOFT session. The systems required to display runway numbers only for LOFT scenes are:

(a) FlightSafety VITAL IV.

(b) Redifusion SP3 and SP3T.

(c) Link-Miles Image II.

(3) The following list of previously qualified CGI and display systems are incapable of generating blue lights. These systems are not required to have accurate taxi-way edge lighting are:

(a) Redifusion SP1 and SP1T.

(b) FlightSafety Vital IV.

(c) Link-Miles Image II and Image IIT

(d) XKD displays (even though the XKD image generator is capable of generating blue colored lights, the display cannot accommodate that color).

END INFORMATION

TABLE C3A—FUNCTIONS AND SUBJECTIVE TESTS

QPS requirements				
Entry No.	Operations tasks	Simulator level		
		B	C	D
Tasks in this table are subject to evaluation if appropriate for the helicopter simulated as indicated in the SOQ Configuration List or the level of simulator qualification involved. Items not installed or not functional on the simulator and, therefore, not appearing on the SOQ Configuration List, are not required to be listed as exceptions on the SOQ.				
1. Preparation for Flight				
1.a.	Flight deck check: Switches, indicators, systems, and equipment	X	X	X
2. APU/Engine start and run-up				
2.a.	Normal start procedures	X	X	X
2.b.	Alternate start procedures	X	X	X
2.c.	Abnormal starts and shutdowns (e.g., hot start, hung start)	X	X	X
2.d.	Rotor engagement	X	X	X
2.e.	System checks	X	X	X
3. Taxiing—Ground				
3.a	Power required to taxi	X	X	X
3.b.	Brake effectiveness	X	X	X
3.c.	Ground handling	X	X	X
3.d.	Water handling (if applicable)		X	X
3.e.	Abnormal/emergency procedures:			
3.e.1.	Brake system failure	X	X	X
3.e.2.	Ground resonance		X	X
3.e.3.	Dynamic rollover		X	X
3.e.4.	Deployment of emergency floats/water landing		X	X
3.e.5.	Others listed on the SOQ	A	X	X
4. Taxiing—Hover				
4.a.	Takeoff to a hover	X	X	X
4.b.	Instrument response:			
4.b.1.	Engine instruments	X	X	X
4.b.2.	Flight instruments	X	X	X
4.b.3.	Hovering turns	X	X	X
4.c.	Hover power checks:			
4.c.1.	In ground effect (IGE)	X	X	X
4.c.2.	Out of ground effect (OGE)	X	X	X
4.d.	Crosswind/tailwind hover	X	X	X
4.e.	Translating tendency	X	X	X
4.f.	External load operations:			

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TABLE C3A—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Operations tasks	Simulator level		
		B	C	D
4.f.1.	Hookup		X	X
4.f.2.	Release		X	X
4.f.3.	Winch operations		X	X
4.g.	Abnormal/emergency procedures:			
4.g.1.	Engine failure	X	X	X
4.g.2.	Fuel governing system failure	X	X	X
4.g.3.	Settling with power (OGE)	X	X	X
4.g.4.	Hovering autorotation		X	X
4.g.5.	Stability augmentation system failure	X	X	X
4.g.6.	Directional control malfunction	X	X	X
4.g.7.	Loss of tail rotor effectiveness (LTE)		X	X
4.g.8.	Others listed on the SOQ	A	X	X
4.h.	Pre-takeoff checks	X	X	X
5. Takeoff/Translational Flight				
5.a.	Forward (up to effective translational lift)		X	X
5.b.	Sideward (up to limiting airspeed)		X	X
5.c.	Rearward (up to limiting airspeed)		X	X
6. Takeoff and Departure Phase				
6.a.	Normal	X	X	X
6.a.1.	From ground	X	X	X
6.a.2.	From hover	X	X	X
6.a.2.a.	Cat A	X	X	X
6.a.2.b.	Cat B	X	X	X
6.a.3.	Running	X	X	X
6.a.4.	Crosswind/tailwind	X	X	X
6.a.5.	Maximum performance	X	X	X
6.a.6.	Instrument	X	X	X
6.a.7.	Takeoff from a confined area	X	X	X
6.a.8.	Takeoff from a pinnacle/platform	X	X	X
6.a.9.	Takeoff from a slope	X	X	X
6.a.10.	External load operations		X	X
6.b.	Abnormal/emergency procedures:	X	X	X
6.b.1.	Takeoff with engine failure after critical decision point (CDP)	X	X	X
6.b.1.a.	Cat A		X	X
6.b.1.b.	Cat B		X	X

TABLE C3A—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Operations tasks	Simulator level		
		B	C	D
6.c.	Rejected takeoff			
6.c.1.	Land	X	X	X
6.c.2.	Water (if appropriate)	X	X	X
6.d.	Instrument departure	X	X	X
6.e.	Others as listed on the SOQ	A	X	X
7. Climb				
7.a.	Normal	X	X	X
7.b.	Obstacle clearance	X	X	X
7.c.	Vertical		X	X
7.d.	One engine inoperative	X	X	X
7.e.	Others as listed on the SOQ	A	X	X
8. Cruise				
8.a	Performance	X	X	X
8.b.	Flying qualities	X	X	X
8.c.	Turns	X	X	X
8.c.1.	Timed	X	X	X
8.c.2.	Normal	X	X	X
8.c.3.	Steep	X	X	X
8.d.	Accelerations and decelerations	X	X	X
8.e.	High speed vibrations	X	X	X
8.f.	External Load Operations (see entry 4.f. of this table)		X	X
8.g.	Abnormal/emergency procedures	X	X	X
8.g.1.	Engine fire	X	X	X
8.g.2	Engine failure	X	X	X
8.g.3.	Inflight engine shutdown and restart	X	X	X
8.g.4.	Fuel governing system failures	X	X	X
8.g.5.	Directional control malfunction	X	X	X
8.g.6.	Hydraulic failure	X	X	X
8.g.7.	Stability system failure	X	X	X
8.g.8.	Rotor vibrations	X	X	X
8.g.9.	Recovery from unusual attitudes	X	X	X
9. Descent				
9.a.	Normal	X	X	X
9.b.	Maximum rate	X	X	X
9.c.	Autorotative			

TABLE C3A—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Operations tasks	Simulator level		
		B	C	D
9.c.1.	Straight-in	X	X	X
9.c.2.	With turn	X	X	X
9.d.	External Load		X	X
10. Approach				
10.a.	Non-precision	X	X	X
10.a.1.	All engines operating	X	X	X
10.a.2.	One or more engines inoperative	X	X	X
10.a.3.	Approach procedures:	X	X	X
10.a.3.a.	NDB	X	X	X
10.a.3.b.	VOR, RNAV, TACAN	X	X	X
10.a.3.c.	ASR	X	X	X
10.a.3.d.	Circling	X	X	X
10.a.3.e.	Helicopter only	X	X	X
10.a.4.	Missed approach	X	X	X
10.a.4.a.	All engines operating	X	X	X
10.a.4.b.	One or more engines inoperative	X	X	X
10.b.	Precision	X	X	X
10.b.1.	All engines operating	X	X	X
10.b.2.	Manually controlled—one or more engines inoperative	X	X	X
10.b.3.	Approach procedures:	X	X	X
10.b.3.a.	PAR	X	X	X
10.b.3.b.	MLS	X	X	X
10.b.3.c.	ILS	X	X	X
10.b.3.c.	(1) Manual (raw data)	X	X	X
10.b.3.c.	(2) Flight director only	X	X	X
10.b.3.c.	(3) Autopilot * only	X	X	X
10.b.3.c.	(4) Cat I	X	X	X
10.b.3.c.	(5) Cat II	X	X	X
10.b.4.	Missed approach:			
10.b.4.a.	All engines operating	X	X	X
10.b.4.b.	One or more engines inoperative	X	X	X
10.b.4.c.	Stability system failure	X	X	X
10.c.	Others as listed on the SOQ	A	X	X
11. Landings and Approaches to Landings				
11.a.	Visual Approaches:			

TABLE C3A—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Operations tasks	Simulator level		
		B	C	D
11.a.1.	Normal	X	X	X
11.a.2.	Steep	X	X	X
11.a.3.	Shallow	X	X	X
11.a.4.	Crosswind	X	X	X
11.a.5.	Category A profile		X	X
11.a.6.	Category B profile		X	X
11.a.7.	External Load		X	X
11.b.	Abnormal/emergency procedures:			
11.b.1.	Directional control failure	X	X	X
11.b.2.	Hydraulics failure	X	X	X
11.b.3.	Fuel governing failure	X	X	X
11.b.4.	Autorotation	X	X	X
11.b.5.	Stability system failure	X	X	X
11.b.6.	Others listed on the SOQ	A	X	X
11c.	Landings:			
11.c.1.	Normal:			
11.c.1.a.	Running	X	X	X
11.c.1.b.	From Hover	X	X	X
11.c.2.	Pinnacle/platform	X	X	X
11.c.3.	Confined area	X	X	X
11.c.4.	Slope		X	X
11.c.5.	Crosswind	X	X	X
11.c.6.	Tailwind	X	X	X
11.c.7.	Rejected Landing	X	X	X
11.c.8.	Abnormal/emergency procedures:			
11.c.8.a.	From autorotation		X	X
11.c.8.b.	One or more engines inoperative	X	X	X
11.c.8.c.	Directional control failure	X	X	X
11.c.8.d.	Hydraulics failure	X	X	X
11.c.8.e.	Stability augmentation system failure	X	X	X
11.c.9.	Other (listed on the SOQ)	A	X	X
12. Any Flight Phase				
12.a.1.	Air conditioning	X	X	X
12.a.2.	Anti-icing/deicing	X	X	X
12.a.3.	Auxiliary power-plant	X	X	X

TABLE C3A—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Operations tasks	Simulator level		
		B	C	D
12.a.4.	Communications	X	X	X
12.a.5.	Electrical	X	X	X
12.a.6.	Fire detection and suppression	X	X	X
12.a.7.	Stabilizer	X	X	X
12.a.8.	Flight controls	X	X	X
12.a.9.	Fuel and oil	X	X	X
12.a.10.	Hydraulic	X	X	X
12.a.11.	Landing gear	X	X	X
12.a.12.	Oxygen	X	X	X
12.a.13.	Pneumatic	X	X	X
12.a.14.	Powerplant	X	X	X
12.a.15.	Flight control computers	X	X	X
12.a.16.	Stability and control augmentation	X	X	X
12.b.	Flight management and guidance system:			
12.b.1.	Airborne radar	X	X	X
12.b.2.	Automatic landing aids	X	X	X
12.b.3.	Autopilot	X	X	X
12.b.4.	Collision avoidance system	X	X	X
12.b.5.	Flight data displays	X	X	X
12.b.6.	Flight management computers	X	X	X
12.b.7.	Heads-up displays	X	X	X
12.b.8.	Navigation systems	X	X	X
12.c.	Airborne procedures:			
12.c.1.	Holding	X	X	X
12.c.2.	Air hazard avoidance	X	X	X
12.c.3.	Retreating blade stall recovery	X	X	X
12.c.4.	Mast bumping	X	X	X
12.c.5	Loss of directional control	X	X	X
12.c.6.	Loss of tail rotor effectiveness		X	X
12.c.7.	Other (listed on the SOQ)	A	X	X
13. Engine Shutdown and Parking				
13.a.	Engine and systems operation	X	X	X
13.b.	Parking brake operation	X	X	X
13.c.	Rotor brake operation	X	X	X

TABLE C3A—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Operations tasks	Simulator level		
		B	C	D
13.d.	Abnormal/emergency procedures	X	X	X

* ''Autopilot'' means attitude retention mode of operation.
Note: An ''A'' in the table indicates that the system, task, or procedure may be examined if the appropriate aircraft system or control is simulated in the FFS and is working properly.

TABLE C3B—FUNCTIONS AND SUBJECTIVE TESTS

QPS requirements				
Entry No.	Visual requirements for qualification at the stated level class I airport or landing area models	Simulator level		
		B	C	D
This table specifies the minimum airport visual model content and functionality to qualify a simulator at the indicated level. This table applies only to the airport scenes required for simulator qualification; i.e., two helicopter landing area models for Level B simulators; four helicopter landing area models for Level C and Level D simulators.				
1.	**Functional test content requirements** The following is the minimum airport/landing area model content requirement to satisfy visual capability tests, and provides suitable visual cues to allow completion of all functions and subjective tests described in this attachment for simulators at Level B.			
1.a.	A minimum of one (1) representative airport and one (1) representative helicopter landing area model. The airport and the helicopter landing area may be contained within the same model. If but if this option is selected, the approach path to the airport runway(s) and the approach path to the helicopter landing area must be different. The model(s) used to meet the following requirements may be demonstrated at either a fictional or a real-world airport or helicopter landing area, but each must be acceptable to the sponsor's TPAA, selectable from the IOS, and listed on the SOQ.	X		
1.b.	The fidelity of the visual scene must be sufficient for the aircrew to visually identify the airport and/or helicopter landing area; determine the position of the simulated helicopter within the visual scene; successfully accomplish take-offs, approaches, and landings; and maneuver around the airport on the ground, or hover taxi, as necessary.	X		
1.c.	Runways:			
1.c.1.	Visible runway number	X		
1.c.2.	Runway threshold elevations and locations must be modeled to provide sufficient correlation with helicopter systems (e.g., altimeter).	X		
1.c.3.	Runway surface and markings	X		
1.c.4.	Lighting for the runway in use including runway edge and centerline	X		
1.c.5.	Lighting, visual approach aid (VASI or PAPI) and approach lighting of appropriate colors	X		
1.c.6.	Representative taxiway lights	X		
1.d.	Other helicopter landing area:			
1.d.1.	Standard heliport designation (''H'') marking, properly sized and oriented	X		
1.d.2.	Perimeter markings for the Touchdown and Lift-Off Area (TLOF) or the Final Approach and Takeoff Area (FATO), as appropriate.	X		
1.d.3.	Perimeter lighting for the TLOF or the FATO areas, as appropriate	X		
1.d.4.	Appropriate markings and lighting to allow movement from the runway or helicopter landing area to another part of the landing facility.	X		
2.	**Functional test content requirements for Level C and Level D simulators**			

TABLE C3B—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Visual requirements for qualification at the stated level class I airport or landing area models	Simulator level		
		B	C	D
	The following is the minimum airport/landing area model content requirement to satisfy visual capability tests, and provide suitable visual cues to allow completion of all functions and subjective tests described in this attachment for simulators at Level C and Level D. Not all of the elements described in this section must be found in a single airport/landing area scene. However, all of the elements described in this section must be found throughout a combination of the four (4) airport/landing area models described in entry 2.a. The representations of the hazards (as described in 2.d.) must be "hard objects" that interact as such if contacted by the simulated helicopter. Additionally, surfaces on which the helicopter lands must be "hard surfaces." The model(s) used to meet the following requirements must be demonstrated at either a fictional or a real-world airport or helicopter landing area, and each must be acceptable to the sponsor's TPAA, selectable from the IOS, and listed on the SOQ.			
2.a.	There must be at least the following airport/helicopter landing areas.			
2.a.1.	At least one (1) representative airport		X	X
2.a.2.	At least three representative non-airport landing areas, as follows:			
2.a.2.a	At least one (1) representative helicopter landing area situated on a substantially elevated surface with respect to the surrounding structures or terrain (e.g., building top, offshore oil rig).		X	X
2.a.2.b.	At least one (1) helicopter landing area that meets the definition of a "confined landing area"		X	X
2.a.2.c.	At least one (1) helicopter landing area on a sloped surface where the slope is at least 2½°		X	X
2.b.	For each of the airport/helicopter landing areas described in 2.a., the simulator must be able to provide at least the following:		X	X
2.b.1.	A night and twilight (dusk) environment.		X	X
2.b.2.	A daylight environment			X
2.c.	Non-airport helicopter landing areas must have the following:			
2.c.1.	Representative buildings, structures, and lighting within appropriate distances		X	X
2.c.2.	Representative moving and static clutter (e.g., other aircraft, power carts, tugs, fuel trucks)		X	X
2.c.3.	Representative depiction of terrain and obstacles as well as significant and identifiable natural and cultural features, within 25 NM of the reference landing area.		X	X
2.c.4.	Standard heliport designation ("H") marking, properly sized and oriented		X	X
2.c.5.	Perimeter markings for the Touchdown and Lift-Off Area (TLOF) or the Final Approach and Takeoff Area (FATO), as appropriate.		X	X
2.c.6.	Perimeter lighting for the TLOF or the FATO areas, as appropriate		X	X
2.c.7.	Appropriate markings and lighting to allow movement from the area to another part of the landing facility, if appropriate.		X	X
2.c.8.	Representative markings, lighting, and signage, including a windsock that gives appropriate wind cues.		X	X
2.c.9.	Appropriate markings, lighting, and signage necessary for position identification, and to allow movement from the landing area to another part of the landing facility.		X	X
2.c.10.	Representative moving and static ground traffic (e.g., vehicular and aircraft), including the ability to present surface hazards (e.g., conflicting traffic, vehicular or aircraft, on or approaching the landing area).		X	X
2.c.11.	Portrayal of landing surface contaminants, including lighting reflections when wet and partially obscured lights when snow is present, or suitable alternative effects.		X	X
2.d.	All of the following three (3) hazards must be presented in a combination of the three (3) non-airport landing areas (described in entry 2.a.2. of this table) and each of these non-airport landing areas must have at least one of the following hazards:			
2.d.1.	Other airborne traffic		X	X

TABLE C3B—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Visual requirements for qualification at the stated level class I airport or landing area models	Simulator level		
		B	C	D
2.d.2.	Buildings, trees, or other vertical obstructions in the immediate landing area		X	X
2.d.3.	Suspended wires in the immediate landing area		X	X
2.e.	Airport applications. Each airport must have the following:			
2.e.1.	At least one runway designated as "in-use", appropriately marked and capable of being lighted fully		X	X
2.e.2.	Runway threshold elevations and locations must be modeled to provide sufficient correlation with helicopter systems (e.g., HGS, GPS, altimeter). Slopes in runways, taxiways, and ramp areas, if depicted in the visual scene, may not cause distracting or unrealistic effects, including pilot eye-point height variation.	X	X	X
2.e.3.	Appropriate approach lighting systems and airfield lighting for a VFR circuit and landing, non-precision approaches and landings, and precision approaches and landings, as appropriate..		X	X
2.e.4.	Representative taxiway lights			X
3.	**Airport or landing area model management** The following is the minimum visual scene management requirements			
3.a.	Runway and helicopter landing area approach lighting must fade into view in accordance with the environmental conditions set in the simulator.	X	X	X
3.b.	The direction of strobe lights, approach lights, runway edge lights, visual landing aids, runway centerline lights, threshold lights, touchdown zone lights, and TLOF or FATO lights must be replicated.	X	X	X
4.	**Visual feature recognition.** The following are the minimum distances at which runway features must be visible. Distances are measured from runway threshold or a helicopter landing area to a helicopter aligned with the runway or helicopter landing area on an extended 3° glide-slope in simulated meteorological conditions. For circling approaches, all tests apply to the runway used for the initial approach and to the runway of intended landing			
4.a.	For runways: Runway definition, strobe lights, approach lights, and runway edge lights from 5 sm (8 km) of the runway threshold.	X	X	X
4.b.	For runways: Centerline lights and taxiway definition from 3 sm (5 km)	X	X	X
4.c.	For runways: Visual Approach Aid lights (VASI or PAPI) from 3 sm (5 km) of the threshold	X		
4.d.	For runways: Visual Approach Aid lights (VASI or PAPI) from 5 sm (8 km) of the threshold		X	X
4.e.	For runways: Runway threshold lights and touchdown zone lights from 2 sm (3 km)	X	X	X
4.f.	For runways and helicopter landing areas: Markings within range of landing lights for night/twilight scenes and the surface resolution test on daylight scenes, as required.	X	X	X
4.g.	For circling approaches, the runway of intended landing and associated lighting must fade into view in a non-distracting manner.	X	X	X
4.h.	For helicopter landing areas: Landing direction lights and raised FATO lights from 1 sm (1.5 km)	X	X	X
4.i.	For helicopter landing areas: Flush mounted FATO lights, TOFL lights, and the lighted windsock from 0.5 sm (750 m).			X
4.j.	Hover taxiway lighting (yellow/blue/yellow cylinders) from TOFL area			X
5.	**Airport or helicopter landing area model content**			

TABLE C3B—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Visual requirements for qualification at the stated level class I airport or landing area models	Simulator level		
		B	C	D
	The following prescribes the minimum requirements for an airport/helicopter landing area model and identifies other aspects of the environment that must correspond with that model for simulators at Level B, Level C, and Level D. For circling approaches, all tests apply to the runway used for the initial approach and to the runway of intended landing. If all runways or landing areas in a visual model used to meet the requirements of this attachment are not designated as ''in use,'' then the ''in use'' runways/landing areas must be listed on the SOQ (e.g., KORD, Rwys 9R, 14L, 22R). Models of airports or helicopter landing areas with more than one runway or landing area must have all significant runways or landing areas not ''in-use'' visually depicted for airport runway/landing area recognition purposes. The use of white or off-white light strings that identify the runway or landing area for twilight and night scenes are acceptable for this requirement; and rectangular surface depictions are acceptable for daylight scenes. A visual system's capabilities must be balanced between providing visual models with an accurate representation of the airport and a realistic representation of the surrounding environment. Each runway or helicopter landing area designated as an ''in-use'' runway or area must include the following detail that is developed using airport pictures, construction drawings and maps, or other similar data, or developed in accordance with published regulatory material; however, this does not require that such models contain details that are beyond the design capability of the currently qualified visual system. Only one ''primary'' taxi route from parking to the runway end or helicopter takeoff/landing area will be required for each ''in-use'' runway or helicopter takeoff/landing area.			
5.a.	The surface and markings for each ''in-use'' runway or helicopter landing area must include the following:			
5.a.1.	For airports: Runway threshold markings, runway numbers, touchdown zone markings, fixed distance markings, runway edge markings, and runway centerline stripes.	X	X	X
5.a.2.	For helicopter landing areas: Markings for standard heliport identification (''H'') and TOFL, FATO, and safety areas.	X	X	X
5.b.	The lighting for each ''in-use'' runway or helicopter landing area must include the following:			
5.b.1.	For airports: Runway approach, threshold, edge, end, centerline (if applicable), touchdown zone (if applicable), leadoff, and visual landing aid lights or light systems for that runway.	X	X	X
5.b.2.	For helicopter landing areas: landing direction, raised and flush FATO, TOFL, windsock lighting	X	X	X
5.c.	The taxiway surface and markings associated with each ''in-use'' runway or helicopter landing area must include the following:			
5.c.1.	For airports: Taxiway edge, centerline (if appropriate), runway hold lines, and ILS critical area(s)	X	X	X
5.c.2.	For helicopter landing areas: taxiways, taxi routes, and aprons	X	X	X
5.d.	The taxiway lighting associated with each ''in-use'' runway or helicopter landing area must include the following:			
5.d.1.	For airports: Runway edge, centerline (if appropriate), runway hold lines, ILS critical areas	X	X	X
5.d.2.	For helicopter landing areas: taxiways, taxi routes, and aprons	X	X	X
5.d.3.	For airports: taxiway lighting of correct color			X
5.e.	Airport signage associated with each ''in-use'' runway or helicopter landing area must include the following:			
5.e.1.	For airports: Signs for runway distance remaining, intersecting runway with taxiway, and intersecting taxiway with taxiway.	X	X	X
5.e.2.	For helicopter landing areas: as appropriate for the model used	X	X	X
5.f.	Required visual model correlation with other aspects of the airport or helicopter landing environment simulation:			
5.f.1.	The airport or helicopter landing area model must be properly aligned with the navigational aids that are associated with operations at the ''in-use'' runway or helicopter landing area.	X	X	X
5.f.2.	The simulation of runway or helicopter landing area contaminants must be correlated with the displayed runway surface and lighting where applicable.		X	X
6.	**Correlation with helicopter and associated equipment** The following are the minimum correlation comparisons that must be made for simulators at Level B, Level C, and Level D			
6.a.	Visual system compatibility with aerodynamic programming	X	X	X

TABLE C3B—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Visual requirements for qualification at the stated level class I airport or landing area models	Simulator level		
		B	C	D
6.b.	Visual cues to assess sink rate and depth perception during landings	X	X	X
6.c.	Accurate portrayal of environment relating to flight simulator attitudes	X	X	X
6.d.	The visual scene must correlate with integrated helicopter systems (e.g., terrain, traffic and weather avoidance systems and Head-up Guidance System (HGS)).		X	X
6.e.	Representative visual effects for each visible, own-ship, helicopter external light(s)—taxi and landing light lobes (including independent operation, if appropriate).	X	X	X
6.f.	The effect of rain removal devices		X	X
7.	**Scene quality** The following are the minimum scene quality tests that must be conducted for simulators at Level B, Level C, and Level D.			
7.a.	Surfaces and textural cues must be free from apparent and distracting quantization (aliasing)		X	X
7.b.	System capable of portraying full color realistic textural cues		X	X
7.c.	The system light points must be free from distracting jitter, smearing or streaking	X	X	X
7.d.	Demonstration of occulting through each channel of the system in an operational scene	X	X	X
7.e.	Demonstration of a minimum of ten levels of occulting through each channel of the system in an operational scene.		X	X
7.f.	System capable of providing focus effects that simulate rain.		X	X
7.g.	System capable of providing focus effects that simulate light point perspective growth		X	X
7.h.	Runway light controls capable of six discrete light steps (0–5)	X	X	X
8.	**Environmental effects.** The following are the minimum environmental effects that must be available in simulators at Level B, Level C, and Level D.			
8.a.	The displayed scene corresponding to the appropriate surface contaminants and include appropriate lighting reflections for wet, partially obscured lights for snow, or alternative effects.			X
8.b.	Special weather representations which include:			
8.b.1.	The sound, motion and visual effects of light, medium and heavy precipitation near a thunderstorm on take-off, approach, and landings at and below an altitude of 2,000 ft (600 m) above the surface and within a radius of 10 sm (16 km) from the airport or helicopter landing area.			X
8.b.2.	One airport or helicopter landing area with a snow scene to include terrain snow and snow-covered surfaces.			X
8.c.	In-cloud effects such as variable cloud density, speed cues and ambient changes		X	X
8.d.	The effect of multiple cloud layers representing few, scattered, broken and overcast conditions giving partial or complete obstruction of the ground scene.		X	X
8.e.	Visibility and RVR measured in terms of distance. Visibility/RVR checked at 2,000 ft (600 m) above the airport or helicopter landing area and at two heights below 2,000 ft with at least 500 ft of separation between the measurements. The measurements must be taken within a radius of 10 sm (16 km) from the airport or helicopter landing area.	X	X	X
8.f.	Patchy fog giving the effect of variable RVR			X
8.g.	Effects of fog on airport lighting such as halos and defocus		X	X
8.h.	Effect of own-ship lighting in reduced visibility, such as reflected glare, including landing lights, strobes, and beacons.		X	X
8.i.	Wind cues to provide the effect of blowing snow or sand across a dry runway or taxiway selectable from the instructor station.			X

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TABLE C3B—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Visual requirements for qualification at the stated level class I airport or landing area models	Simulator level		
		B	C	D
8.j.	''White-out'' or ''Brown-out'' effects due to rotor downwash beginning at a distance above the ground equal to the rotor diameter.			X
9.	**Instructor control of the following:** The following are the minimum instructor controls that must be available in Level B, Level C, and Level D simulators, as indicated.			
9.a.	Environmental effects, e.g. cloud base, cloud effects, cloud density, visibility in statute miles/ kilometers and RVR in feet/meters.	X	X	X
9.b.	Airport or helicopter landing area selection	X	X	X
9.c.	Airport or helicopter landing area lighting, including variable intensity	X	X	X
9.d.	Dynamic effects including ground and flight traffic		X	X
End QPS Requirement				
Begin Information				
10.	An example of being able to ''combine two airport models to achieve two ''in-use'' runways: One runway designated as the ''in-use'' runway in the first model of the airport, and the second runway designated as the ''in-use'' runway in the second model of the same airport. For example, the clearance is for the ILS approach to Runway 27, Circle to Land on Runway 18 right. Two airport visual models might be used: the first with Runway 27 designated as the ''in use'' runway for the approach to runway 27, and the second with Runway 18 Right designated as the ''in use'' runway. When the pilot breaks off the ILS approach to runway 27, the instructor may change to the second airport visual model in which runway 18 Right is designated as the ''in use'' runway, and the pilot would make a visual approach and landing. This process is acceptable to the FAA as long as the temporary interruption due to the visual model change is not distracting to the pilot.			
11.	Sponsors are not required to provide every detail of a runway, but the detail that is provided should be correct within reasonable limits.			
End Information				

TABLE C3C—FUNCTIONS AND SUBJECTIVE TESTS

QPS requirements				
Entry No.	Visual scene content additional airport or landing area models beyond minimum required for qualification Class II airport or landing area models	Simulator level		
		B	C	D
This table specifies the minimum airport or helicopter landing area visual model content and functionality necessary to add visual models to a simulator's visual model library (i.e., beyond those necessary for qualification at the stated level) without the necessity of further involvement of the responsible Flight Standards office or TPAA.				
1.	**Airport or landing area model management** The following is the minimum visual scene management requirements for simulators at Levels B, C, and D.			
1.a.	The installation and direction of the following lights must be replicated for the ''in-use'' surface:			
1.a.1.	For ''in-use'' runways: Strobe lights, approach lights, runway edge lights, visual landing aids, runway centerline lights, threshold lights, and touchdown zone lights.	X	X	X
1.a.2.	For ''in-use'' helicopter landing areas: ground level TLOF perimeter lights, elevated TLOF perimeter lights (if applicable), Optional TLOF lights (if applicable), ground FATO perimeter lights, elevated TLOF lights (if applicable), landing direction lights.	X	X	X
2.	**Visual feature recognition** The following are the minimum distances at which runway or landing area features must be visible for simulators at Levels B, C, and D. Distances are measured from runway threshold or a helicopter landing area to an aircraft aligned with the runway or helicopter landing area on a 3° glide-slope from the aircraft to the touchdown point, in simulated meteorological conditions. For circling approaches, all tests apply to the runway used for the initial approach and to the runway of intended landing.			

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TABLE C3C—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Visual scene content additional airport or landing area models beyond minimum required for qualification Class II airport or landing area models	Simulator level		
		B	C	D
2.a.	For Runways:			
2.a.1.	Strobe lights, approach lights, and edge lights from 5 sm (8 km) of the threshold	X	X	X
2.a.2.	Centerline lights and taxiway definition from 3 sm (5 km)	X	X	X
2.a.3.	Visual Approach Aid lights (VASI or PAPI) from 3 sm (5 km) of the threshold	X		
2.a.4.	Visual Approach Aid lights (VASI or PAPI) from 5 sm (8 km) of the threshold		X	X
2.a.5.	Threshold lights and touchdown zone lights from 2 sm (3 km)	X	X	X
2.a.6.	Markings within range of landing lights for night/twilight (dusk) scenes and as required by the surface resolution test on daylight scenes.	X	X	X
2.a.7.	For circling approaches, the runway of intended landing and associated lighting must fade into view in a non-distracting manner.	X	X	X
2.b.	For Helicopter landing areas:			
2.b.1.	Landing direction lights and raised FATO lights from 1 sm (1.5 km)	X	X	X
2.b.2.	Flush mounted FATO lights, TOFL lights, and the lighted windsock from 0.5 sm (750 m)		X	X
2.b.3.	Hover taxiway lighting (yellow/blue/yellow cylinders) from TOFL area		X	X
2.b.4.	Markings within range of landing lights for night/twilight (dusk) scenes and as required by the surface resolution test on daylight scenes.	X	X	X
3.	**Airport or Helicopter landing area model content** The following prescribes the minimum requirements for what must be provided in an airport visual model and identifies other aspects of the airport environment that must correspond with that model for simulators at Level B, C, and D. The detail must be developed using airport pictures, construction drawings and maps, or other similar data, or developed in accordance with published regulatory material; however, this does not require that airport or helicopter landing area models contain details that are beyond the designed capability of the currently qualified visual system. For circling approaches, all requirements of this section apply to the runway used for the initial approach and to the runway of intended landing. Only one "primary" taxi route from parking to the runway end or helicopter takeoff/landing area will be required for each "in-use" runway or helicopter takeoff/landing area.			
3.a.	The surface and markings for each "in-use" runway or helicopter landing area must include the following:			
3.a.1.	For airports: Runway threshold markings, runway numbers, touchdown zone markings, fixed distance markings, runway edge markings, and runway centerline stripes.	X	X	X
3.a.2.	For helicopter landing areas: Standard heliport marking ("H"), TOFL, FATO, and safety areas	X	X	X
3.b.	The lighting for each "in-use" runway or helicopter landing area must include the following:			
3.b.1.	For airports: Runway approach, threshold, edge, end, centerline (if applicable), touchdown zone (if applicable), leadoff, and visual landing aid lights or light systems for that runway.	X	X	X
3.b.2.	For helicopter landing areas: Landing direction, raised and flush FATO, TOFL, windsock lighting	X	X	X
3.c.	The taxiway surface and markings associated with each "in-use" runway or helicopter landing area must include the following:			
3.c.1.	For airports: Taxiway edge, centerline (if appropriate), runway hold lines, and ILS critical area(s)	X	X	X
3.c.2.	For helicopter landing areas: Taxiways, taxi routes, and aprons	X	X	X
3.d.	The taxiway lighting associated with each "in-use" runway or helicopter landing area must include the following:			
3.d.1.	For airports: Runway edge, centerline (if appropriate), runway hold lines, ILS critical areas	X	X	X
3.d.2.	For helicopter landing areas: Taxiways, taxi routes, and aprons	X	X	X
3.d.3.	For airports: Taxiway lighting of correct color			X
4.	**Required visual model correlation with other aspects of the airport environment simulation**			

TABLE C3C—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements				
Entry No.	Visual scene content additional airport or landing area models beyond minimum required for qualification Class II airport or landing area models	Simulator level		
		B	C	D
	The following are the minimum visual model correlation tests that must be conducted for Level B, Level C, and Level D simulators, as indicated.			
4.a.	The airport model must be properly aligned with the navigational aids that are associated with operations at the "in-use" runway.	X	X	X
4.b.	Slopes in runways, taxiways, and ramp areas, if depicted in the visual scene, must not cause distracting or unrealistic effects.	X	X	X
5.	**Correlation with helicopter and associated equipment** The following are the minimum correlation comparisons that must be made for simulators at Level B, C, and D.			
5.a.	Visual system compatibility with aerodynamic programming	X	X	X
5.b.	Accurate portrayal of environment relating to flight simulator attitudes	X	X	X
5.c.	Visual cues to assess sink rate and depth perception during landings	X	X	X
6.	**Scene quality** The following are the minimum scene quality tests that must be conducted for simulators at Level B, C, and D.			
6.a.	Light points free from distracting jitter, smearing or streaking	X	X	X
6.b.	Surfaces and textural cues free from apparent and distracting quantization (aliasing)		X	X
6.c.	Correct color and realistic textural cues			X
7.	**Instructor controls of the following:** The following are the minimum instructor controls that must be available in Level B, Level C, and Level D simulators, as indicated.			
7.a.	Environmental effects, e.g., cloud base (if used), cloud effects, cloud density, visibility in statute miles/kilometers and RVR in feet/meters.	X	X	X
7.b.	Airport/Heliport selection	X	X	X
7.c.	Airport lighting including variable intensity	X	X	X
7.d.	Dynamic effects including ground and flight traffic		X	X
	End QPS Requirements			
	Begin Information			
8.	Sponsors are not required to provide every detail of a runway or helicopter landing area, but the detail that is provided must be correct within the capabilities of the system.	X	X	X
	End Information			

TABLE C3D—FUNCTIONS AND SUBJECTIVE TESTS

QPS requirements					Information
Entry No.	Motion system (and special aerodynamic model) effects	Simulator level			Notes
		B	C	D	

This table specifies motion effects that are required to indicate the threshold at which a flight crewmember must be able to recognize an event or situation. Where applicable, flight simulator pitch, side loading and directional control characteristics must be representative of the helicopter.

TABLE C3D—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements					Information
Entry No.	Motion system (and special aerodynamic model) effects	Simulator level			Notes
		B	C	D	
1	**Runway rumble, oleo deflection, ground speed, uneven runway, runway and taxiway centerline light characteristics:** Procedure: After the helicopter has been preset to the takeoff position and then released, taxi at various speeds with a smooth runway and note the general characteristics of the simulated runway rumble effects of oleo deflections. Repeat the maneuver with a runway roughness of 50%, then with maximum roughness. Note the associated motion vibrations affected by ground speed and runway roughness	X	X	X	If time permits, different gross weights can also be selected as this may also affect the associated vibrations depending on helicopter type. The associated motion effects for the above tests should also include an assessment of the effects of rolling over centerline lights, surface discontinuities of uneven runways, and various taxiway characteristics.
2	**Friction Drag from Skid-type Landing Gear:** Procedure: Perform a running takeoff or a running landing and note an increase in a fuselage vibration (as opposed to rotor vibration) due to the friction of dragging the skid along the surface. This vibration will lessen as the ground speed decreases		X	X	
3.	**Rotor Out-of-Track and/or Out-of-Balance condition:** Procedure: Select the malfunction or condition from the IOS. Start the engine(s) normally and check for an abnormal vibration for an Out-of-Track condition and check for an abnormal vibration for an Out-of-Balance condition	X	X	X	Does not require becoming airborne. The abnormal vibration for Out-of-Track and Out-of-Balance conditions should be recognized in the frequency range of the inverse of the period for each; i.e., 1/P for vertical vibration, and 1/P for lateral vibration.
4.	**Bumps associated with the landing gear:** Procedure: Perform a normal take-off paying special attention to the bumps that could be perceptible due to maximum oleo extension after lift-off	X	X	X	When the landing gear is extended or retracted, motion bumps can be felt when the gear locks into position.
5.	**Buffet during extension and retraction of landing gear:** Procedure: Operate the landing gear. Check that the motion cues of the buffet experienced represent the actual helicopter	X	X	X	
6.	**Failure of Dynamic Vibration Absorber or similar system as appropriate for the helicopter (e.g., droop stop or static stop):** Procedure: May be accomplished any time the rotor is engaged. Select the appropriate failure at the IOS, note an appropriate increase in vibration and check that the vibration intensity and frequency increases with an increase in RPM and an increase in collective application	X	X	X	
7.	**Tail Rotor Drive Failure:** Procedure: With the engine(s) running and the rotor engaged—select the malfunction and note the immediate increase of medium frequency vibration	X	X	X	The tail rotor operates in the medium frequency range, normally estimated by multiplying the tail rotor gear box ratio by the main rotor RPM. The failure can be recognized by an increase in the vibrations in this frequency range.
8.	**Touchdown cues for main and nose gear:** Procedure: Conduct several normal approaches with various rates of descent. Check that the motion cues for the touchdown bumps for each descent rate are representative of the actual helicopter	X	X	X	

TABLE C3D—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements					Information
Entry No.	Motion system (and special aerodynamic model) effects	Simulator level			Notes
		B	C	D	
9.	**Tire failure dynamics:** Procedure: Simulate a single tire failure and a multiple tire failure		X	X	The pilot may notice some yawing with a multiple tire failure selected on the same side. This should require the use of the pedal to maintain control of the helicopter. Dependent on helicopter type, a single tire failure may not be noticed by the pilot and may not cause any special motion effect. Sound or vibration may be associated with the actual tire losing pressure.
10.	**Engine malfunction and engine damage:** Procedure: The characteristics of an engine malfunction as prescribed in the malfunction definition document for the particular flight simulator must describe the special motion effects felt by the pilot. Note the associated engine instruments varying according to the nature of the malfunction and note the replication of the effects of the airframe vibration	X	X	X	
11.	**Tail boom strikes:** Procedure: Tail-strikes can be checked by over-rotation of the helicopter at a quick stop or autorotation to the ground	X	X	X	The motion effect should be felt as a noticeable nose down pitching moment.
12.	**Vortex Ring State (Settling with Power):** Procedure: Specific procedures may differ between helicopters and may be prescribed by the Helicopter Manufacturer or other subject matter expert. However, the following information is provided for illustrative purposes * * * To enter the maneuver, reduce power below hover power. Hold altitude with aft cyclic until the airspeed approaches 20 knots. Then allow the sink rate to increase to 300 feet per minute or more as the attitude is adjusted to obtain an airspeed of less than 10 knots		X	X	When the aircraft begins to shudder, the application of additional up collective increases the vibration and sink rate. One recovery method is to decrease collective to enter vertical autorotation and/or use cyclic inputs to gain horizontal airspeed and exit from vortex ring state.
13.	**Retreating Blade Stall:** Procedure: Specific procedures may differ between helicopters and may be prescribed by the Helicopter Manufacturer or other subject matter expert. However, the following information is provided for illustrative purposes: To enter the maneuver, increase forward airspeed; the effect will be recognized through the development of a low frequency vibration, pitching up of the nose, and a roll in the direction of the retreating blade. High weight, low rotor RPM, high density altitude, turbulence or steep, abrupt turns are all conducive to retreating blade stall at high forward airspeeds		X	X	Correct recovery from retreating blade stall requires the collective to be lowered first, which reduces blade angles and the angle of attack. Aft cyclic can then be used to slow the helicopter.

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TABLE C3D—FUNCTIONS AND SUBJECTIVE TESTS—Continued

QPS requirements					Information
Entry No.	Motion system (and special aerodynamic model) effects	Simulator level			Notes
		B	C	D	
14.	**Translational Lift Effects:** Procedure: From a stabilized in-ground-effect (IGE) Hover begin a forward acceleration. When passing through the effective translational lift range, the noticeable effect will be a possible nose pitch-up in some helicopters, an increase in the rate of climb, and a temporary increase in vibration level (in some cases this vibration may be pronounced). This effect is experienced again upon deceleration through the appropriate speed range. During deceleration, the pitch and rate of climb will have the reverse effect, but there will be a similar, temporary increase in vibration level	X	X	X	

TABLE C3E—FUNCTIONS AND SUBJECTIVE TESTS

QPS Requirements				
Entry number	Sound system	Simulator level		
		B	C	D
The following checks are performed during a normal flight profile, motion system ON.				
1.	Precipitation.		X	X
2.	Rain removal equipment.		X	X
3.	Helicopter noises used by the pilot for normal helicopter operation.		X	X
4.	Abnormal operations for which there are associated sound cues, including engine malfunctions, landing gear or tire malfunctions, tail boom.		X	X
5.	Sound of a crash when the flight simulator is landed in excess of limitations		X	X

TABLE C3F—FUNCTIONS AND SUBJECTIVE TESTS

QPS Requirements				
Entry number	Special effects	Simulator level		
		B	C	D
This table specifies the minimum special effects necessary for the specified simulator level.				
1.	**Braking Dynamics:** .... Representations of the dynamics of brake failure (flight simulator pitch, side-loading, and directional control characteristics representative of the helicopter), including antiskid and decreased brake efficiency due to high brake temperatures (based on helicopter related data), sufficient to enable pilot identification of the problem and implementation of appropriate procedures.		X	X
2.	**Effects of Airframe and Engine Icing: Required only for those helicopters authorized for operations in known icing conditions**. Procedure: With the simulator airborne, in a clean configuration, nominal altitude and cruise airspeed, autopilot on and auto-throttles off, engine and airfoil anti-ice/de-ice systems deactivated; activate icing conditions at a rate that allows monitoring of simulator and systems response. Icing recognition will include an increase in gross weight, airspeed decay, change in simulator pitch attitude, change in engine performance indications (other than due to airspeed changes), and change in data from pitot/static system, or rotor out-of-track/balance. Activate heating, anti-ice, or de-ice systems independently. Recognition will include proper effects of these systems, eventually returning the simulated helicopter to normal flight.		X	X

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TABLE C3G—FUNCTIONS AND SUBJECTIVE TESTS

QPS Requirements				
Entry number	Instructor Operating Station (IOS)	Simulator level		
		B	C	D
Functions in this table are subject to evaluation only if appropriate for the helicopter or the system is installed on the specific simulator.				
1.	**Simulator Power Switch(es)**	X	X	X
2.	**Helicopter conditions.**			
2.a.	Gross weight, center of gravity, fuel loading and allocation	X	X	X
2.b.	Helicopter systems status	X	X	X
2.c.	Ground crew functions	X	X	X
3.	**Airports/Heliports.**			
3.a.	Number and selection	X	X	X
3.b.	Runway or landing area selection	X	X	X
3.c.	Landing surface conditions (rough, smooth, icy, wet, dry, snow)	X	X	X
3.d.	Preset positions	X	X	X
3.e.	Lighting controls	X	X	X
4.	**Environmental controls.**			
4.a	Visibility (statute miles/kilometers)	X	X	X
4.b.	Runway visual range (in feet/meters)	X	X	X
4.c.	Temperature	X	X	X
4.d.	Climate conditions	X	X	X
4.e.	Wind speed and direction	X	X	X
5.	**Helicopter system malfunctions** (Insertion/deletion).	X	X	X
6.	**Locks, Freezes, and Repositioning.**			
6.a.	Problem (all) freeze/release	X	X	X
6.b.	Position (geographic) freeze/release	X	X	X
6.c.	Repositioning (locations, freezes, and releases)	X	X	X
6.d.	Ground speed control	X	X	X
7.	**Remote IOS.**	X	X	X
8.	**Sound Controls.** On/off/adjustment	X	X	X
9.	**Motion/Control Loading System.**			
9.a.	On/off/emergency stop	X	X	X
10.	**Observer Seats/Stations.** Position/Adjustment/Positive restraint system	X	X	X

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ATTACHMENT 4 TO APPENDIX C TO PART 60—SAMPLE DOCUMENTS

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ATTACHMENT 4 TO APPENDIX C TO PART 60—FIGURE C4A—SAMPLE LETTER, REQUEST FOR INITIAL, UPGRADE, OR REINSTATEMENT EVALUATION

INFORMATION

Date _______

RE: Request for Initial/Upgrade Evaluation Date

This is to advise you of our intent to request an (initial or upgrade) evaluation of our (FFS Manufacturer), (Aircraft Type/Level) Full Flight Simulator (FFS), (FAA ID Number, if previously qualified), located in (City, State) at the (Facility) on (Proposed Evaluation Date). (The proposed evaluation date shall not be more than 180 days following the date of this letter.) The FFS will be sponsored by (Name of Training Center/Air Carrier), FAA Designator (4 Letter Code). The FFS will be sponsored as follows; (Select One)

☐ The FFS will be used within the sponsor's FAA approved training program and placed on the sponsor's Training/Operations Specifications.

☐ The FFS will be used for dry lease only.

We agree to provide the formal request for the evaluation to your staff as follows: (check one)

☐ For QTG tests run at the factory, not later, than 45 days prior to the proposed evaluation date with the additional "l/3 on-site" tests provided not later than 14 days prior to the proposed evaluation date.

☐ For QTG tests run on-site, not later than 30 days prior to the proposed evaluation date.

We understand that the formal request will contain the following documents:

1. Sponsor's Letter of Request (*Company Compliance Letter*).
2. Principal Operations Inspector (POI) or Training Center Program Manager's (TCPM) endorsement.
3. Complete QTG.

If we are unable to meet the above requirements, we understand this may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation.

(The sponsor should add additional comments as necessary).

Please contact (Name Telephone and Fax Number of Sponsor's Contact) to confirm the date for this initial evaluation. We understand a member of your National Simulator Program staff will respond to this request within 14 days

A copy of this letter of intent has been provided to (Name), the Principal Operations Inspector (POI) and/or Training Center Program Manager (TCPM).

Sincerely,

Attachment: FFS Information Form

cc: POI/TCPM

aworley on LAPBH6H6L3 with DISTILLER

VerDate Sep<11>2014 14:00 Mar 14, 2024 Jkt 262047 PO 00000 Frm 00378 Fmt 8010 Sfmt 8006 Q:\14\14V2.TXT PC31

ER09DE22.113</GPH>

Attachment 4 to Appendix C to Part 60—
Figure C4B – Sample Letter, Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FFS Information Form

INFORMATION

Date: _____			
Section 1. FSTD Information and Characteristics			
Sponsor Name:	_____	**FSTD Location:**	
Address:	_____ _____	**Physical Address:**	_____ _____
City:	_____	**City:**	_____
State:	_____	**State:**	_____
Country:	_____	**Country:**	_____
ZIP:	_____	**ZIP:**	_____
Manager	_____		
Sponsor ID No: (Four Letter FAA Designator)	_____	**Nearest Airport:** (Airport Designator)	_____

Type of Evaluation Requested:	☐ **Initial** ☐ **Upgrade** ☐ **Continuing Qualification** ☐ **Special** ☐ **Reinstatement**				
Aircraft Make/model/series:	_____				
Initial Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY	**Manufacturer's Identification or Serial Number**	_______________		
Upgrade Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY	☐ **eMQTG**			
Qualification Basis:_______________	☐ **A**	☐ **B**	☐ **Interim C**	☐ **C**	☐ **D**
	☐ **6**	☐ **7**	☐ **Provisional Status**		

Other Technical Information:			
FAA FSTD ID No: (If Applicable)	_____	**FSTD Manufacturer:**	_____
Convertible FSTD:	☐Yes:	**Date of Manufacture:**	_____ MM/DD/YYYY
Related FAA ID No. (If Applicable)	_____ _____ _____	**Sponsor FSTD ID No:** __________	
Engine model(s) and data revision: __________		**Source of aerodynamic model:** __________	
FMS identification and revision level: __________		**Source of aerodynamic coefficient data:** __________	
Visual system manufacturer/model: __________		**Aerodynamic data revision number:** __________	
Flight control data revision: __________		**Visual system display:** __________	
Mot ion system manufacturer/type: __________		**FSTD computer(s) identification:** __________	

National Aviation Authority (NAA): (If Applicable)	__________		
NAA FSTD ID No:	__________	**Last NAA Evaluation Date:**	__________
NAA Qualification Level:	__________		
NAA Qualification Basis:	_____		

Visual System Manufacturer and Type:	__________	**FSTD Seats Available:** __________	**Motion System Manufacturer and Type:**	__________:

Attachment 4 to Appendix C to Part 60—
Figure C4B – Sample Letter, Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FFS Information Form

INFORMATION

Aircraft Equipment:	Engine Type(s):	Flight Instrumentation:	Engine Instrumentation:
	____ ____	☐ EFIS ☐ HUD ☐ HGS ☐ EFVS ☐ TCAS ☐ GPWS ☐ Plain View ☐ GPS ☐ FMS Type: __ ☐ WX Radar ☐ Other: __	☐ EICAS ☐ FADEC ☐ Other: __

Airport Models:	3.6.1 ____ Airport Designator	3.6.2____ Airport Designator	3.6.3 ____ Airport Designator
Circle to Land:	3. 7.1 ____ Airport Designator	3. 7.2____ Approach	3. 7.3 ____ Landing Runway
Visual Ground Segment	3.8.1 ____ Airport Designator	3.8 .2____ Approach	3. 8.3 ____ Landing Runway

Section 2. Supplementary Information

FAA Training Program Approval Authority:		☐ POI ☐ TCPM ☐ Other: _____	
Name:	________	**Office:**	________
Tel:	________	**Fax:**	________
Email:	________		

FSTD Scheduling Person:			
Name:	________		
Address 1:	________	**Address 2**	________
City:	________	**State:**	________
ZIP:	________	**Email:**	________
Tel:	________	**Fax:**	________

FSTD Technical Contact:			
Name:	________		
Address 1:	________	**Address 2**	________
City:	________	**State:**	________
ZIP:	________	**Email:**	________
Tel:	________	**Fax:**	________

Section 3. Training, Testing and Checking Considerations

Area/Function/Maneuver	Requested	Remarks
Private Pilot - Training / Checks: (142)	☐	________
Commercial Pilot - Training /Checks:(142)	☐	________
Multi-Engine Rating - Training / Checks (142)	☐	________
Instrument Rating -Training / Checks (142)	☐	________
Type Rating - Training / Checks (135/121/142)	☐	________
Proficiency Checks (135/121/142)	☐	________
CAT I: (RVR 2400/1800 ft. DH200 ft)	☐	________

Attachment 4 to Appendix C to Part 60—
Figure C4B – Sample Letter, Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FFS Information Form

INFORMATION

CAT II: (RVR 1200 ft. DH 100 ft)	☐	_________
CAT III * (lowest minimum) _________ RVR _________ ft. * State CAT III (≤ 700 ft.), CAT IIIb (≤ 150 ft.), or CAT IIIc (0 ft.)	☐	_________
Circling Approach	☐	_________
Windshear Training:	☐	_________
Windshear Training IAW 121.409(d) (121 Turbojets Only)	☐	_________
Generic Unusual Attitudes and Recoveries within the Normal Flight Envelope	☐	_________
Specific Unusual Attitudes Recoveries	☐	_________
Auto-coupled Approach/Auto Go Around	☐	_________
Auto-land / Roll Out Guidance	☐	_________
TCAS/ACAS I / II	☐	_________
WX-Radar	☐	_________
HUD	☐	_________
HGS	☐	_________
EFVS	☐	_________
Future Air Navigation Systems	☐	_________
GPWS / EGPWS	☐	_________
ETOPS Capability	☐	_________
GPS	☐	_________
SMGCS	☐	_________
Helicopter Slope Landings	☐	_________
Helicopter External Load Operations	☐	_________
Helicopter Pinnacle Approach to Landings	☐	_________
Helicopter Night Vision Maneuvers	☐	_________
Helicopter Category A Takeoffs	☐	_________

ATTACHMENT 4 TO APPENDIX C TO PART 60—
FIGURE C4C—SAMPLE LETTER OF COMPLIANCE

INFORMATION

(Date)

Mr. (Name of Training Program Approval Authority):
(Name of responsible Flight Standards office)
(Address)
(City/State/Zip)

Dear Mr. (Name of TPAA):

RE: Letter of Compliance

(Operator Sponsor Name) requests evaluation of our (Aircraft Type) FFS for Level (__) qualification. The (FFS Manufacturer Name) FFS with (Visual System Manufacturer Name/Model) system is fully defined on the FFS Information page of the accompanying Qualification Test Guide (QTG). We have completed the tests of the FFS and certify that it meets all applicable requirements of FAR parts 121, 125, or 135), and the guidance of (AC 120-40B or 14 CFR Part 60). Appropriate hardware and software configuration control procedures have been established. Our Pilot(s), (Name(s)), who are qualified on (Aircraft Type) aircraft have assessed the FFS and have found that it conforms to the (Operator/Sponsor) (Aircraft Type) flight deck configuration and that the simulated systems and subsystems function equivalently to those in the aircraft. The above named pilot(s) have also assessed the performance and the flying qualities of the FFS and find that it represents the respective aircraft.
(Added Comments may be placed here)

Sincerely,
(Sponsor Representative)

ATTACHMENT 4 TO APPENDIX C TO PART 60—FIGURE C4D—SAMPLE QUALIFICATION TEST GUIDE COVER PAGE

INFORMATION

SPONSOR NAME

SPONSOR ADDRESS

FAA QUALIFICATION TEST GUIDE

(SPECIFIC Helicopter MODEL)
for example
Farnsworth Z-100

(Type of Simulator)

(Simulator Identification Including Manufacturer, Serial Number, Visual System Used)

(Simulator Level)

(Qualification Performance Standard Used)

(Simulator Location)

FAA Initial Evaluation

Date: _____________

__________________________ Date: ___________
(Sponsor)

__________________________ Date: ___________
FAA

ATTACHMENT 4 TO APPENDIX C TO PART 60—FIGURE C4E—SAMPLE STATEMENT OF QUALIFICATION—CERTIFICATE

INFORMATION

Federal Aviation Administration

Certificate of Qualification

This is to certify that representatives of the FAA
Completed an evaluation of the

Go-Fast Airlines
Farnsworth Z-100 Full Flight Simulator

FAA Identification Number 0999

And pursuant to 14 CFR Part 60 found it to meet its original qualification basis, AC 120-63 (MM/DD/YY)

The Master Qualification Test Guide and the attached
Configuration List and List of Qualified Tasks
Provide the Qualification Basis for this device to operate at

Level D

Until April 30, 2010

Unless sooner rescinded or extended by the FAA

March 15, 2009	C. *Nordlie*
(date)	(for the FAA)

Attachment 4 to Appendix C to Part 60—
Figure C4F – Sample Statement of Qualification; Configuration List
INFORMATION

STATEMENT of QUALIFICATION
CONFIGURATION LIST

Date: _____			
Section 1. FSTD Information and Characteristics			
Sponsor Name:	_____	**FSTD Location:**	
Address:	_____ _____	**Physical Address:**	_____ _____
City:	_____	**City:**	_____
State:	_____	**State:**	_____
Country:	_____	**Country:**	_____
ZIP:	_____	**ZIP:**	_____
Manager	_____		
Sponsor ID No: (Four Letter FAA Designator)	_____	**Nearest Airport:** (Airport Designator)	_____

Type of Evaluation Requested:	☐ **Initial** ☐ **Upgrade** ☐ **Continuing Qualification** ☐ **Special** ☐ **Reinstatement**					
Aircraft Make/model/series:	_____					
Initial Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY		**Manufacturer's Identification or Serial Number**	_____________		
Upgrade Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY		☐ **eMQTG**			
Qualification Basis:______________	☐ **A**	☐ **B**	☐ **Interim C**	☐ **C**	☐ **D**	
	☐ **6**	☐ **7**	☐ **Provisional Status**			

Other Technical Information:			
FAA FSTD ID No: (If Applicable)	_____	**FSTD Manufacturer:**	_____
Convertible FSTD:	☐**Yes:**	**Date of Manufacture:**	_____ MM/DD/YYYY
Related FAA ID No. (If Applicable)	_____ _____ _____	**Sponsor FSTD ID No:** _________	
Engine model(s) and data revision: _________		**Source of aerodynamic model:** _________	
FMS identification and revision level: _________		**Source of aerodynamic coefficient data:** _________	
Visual system manufacturer/model: _________		**Aerodynamic data revision number:** _________	
Flight control data revision: _________		**Visual system display:** _________	
Mot ion system manufacturer/type: _________		**FSTD computer(s) identification:** _________	

National Aviation Authority (NAA): (If Applicable)	_________		
NAA FSTD ID No:	_________	**Last NAA Evaluation Date:**	_________
NAA Qualification Level:	_________		
NAA Qualification Basis:	_____		

Attachment 4 to Appendix C to Part 60—
Figure C4F – Sample Statement of Qualification; Configuration List
INFORMATION

Visual System Manufacturer and Type:	______	**FSTD Seats Available:** ______	**Motion System Manufacturer and Type:**	______:

Aircraft Equipment:	**Engine Type(s):** ____ ____	**Flight Instrumentation:** ☐ EFIS ☐ HUD ☐ HGS ☐ EFVS ☐ TCAS ☐ GPWS ☐ Plain View ☐ GPS ☐ FMS Type: __ ☐ WX Radar ☐ Other: __	**Engine Instrumentation:** ☐ EICAS ☐ FADEC ☐ Other: __

Airport Models:	3.6.1 ____ Airport Designator	3.6.2____ Airport Designator	3.6.3 ____ Airport Designator
Circle to Land:	3. 7.1 ____ Airport Designator	3. 7.2____ Approach	3. 7.3 ____ Landing Runway
Visual Ground Segment	3.8.1 ____ Airport Designator	3.8 .2____ Approach	3. 8.3 ____ Landing Runway

Section 2. Supplementary Information

FAA Training Program Approval Authority:		☐ POI ☐ TCPM ☐ Other: _____	
Name:	______	**Office:**	______
Tel:	______	**Fax:**	______
Email:	______		
FSTD Scheduling Person:			
Name:	______		
Address 1:	______	**Address 2**	______
City:	______	**State:**	______
ZIP:	______	**Email:**	______
Tel:	______	**Fax:**	______
FSTD Technical Contact:			
Name:	______		
Address 1:	______	**Address 2**	______
City:	______	**State:**	______
ZIP:	______	**Email:**	______
Tel:	______	**Fax:**	______

Section 3. Training, Testing and Checking Considerations

Area/Function/Maneuver	**Requested**	**Remarks**
Private Pilot - Training / Checks: (142)	☐	______
Commercial Pilot - Training /Checks:(142)	☐	______
Multi-Engine Rating - Training / Checks (142)	☐	______
Instrument Rating -Training / Checks (142)	☐	______
Type Rating - Training / Checks (135/121/142)	☐	______

Attachment 4 to Appendix C to Part 60—
Figure C4F – Sample Statement of Qualification; Configuration List
INFORMATION

Proficiency Checks (135/121/142)	☐	________
CAT I: (RVR 2400/1800 ft. DH200 ft)	☐	________
CAT II: (RVR 1200 ft. DH 100 ft)	☐	________
CAT III * (lowest minimum) _________ RVR _________ ft. * State CAT III (≤ 700 ft.), CAT IIIb (≤ 150 ft.), or CAT IIIc (0 ft.)	☐	________
Circling Approach	☐	________
Windshear Training:	☐	________
Windshear Training IAW 121.409(d) (121 Turbojets Only)	☐	________
Generic Unusual Attitudes and Recoveries within the Normal Flight Envelope	☐	________
Specific Unusual Attitudes Recoveries	☐	________
Auto-coupled Approach/Auto Go Around	☐	________
Auto-land / Roll Out Guidance	☐	________
TCAS/ACAS I / II	☐	________
WX-Radar	☐	________
HUD	☐	________
HGS	☐	________
EFVS	☐	________
Future Air Navigation Systems	☐	________
GPWS / EGPWS	☐	________
ETOPS Capability	☐	________
GPS	☐	________
SMGCS	☐	________
Helicopter Slope Landings	☐	________
Helicopter External Load Operations	☐	________
Helicopter Pinnacle Approach to Landings	☐	________
Helicopter Night Vision Maneuvers	☐	________
Helicopter Category A Takeoffs	☐	________

Attachment 4 to Appendix C to Part 60—
Figure C4G – Sample Statement of Qualification – List of Qualified Tasks
INFORMATION

STATEMENT of QUALIFICATION
List of Qualified Tasks

Go Fast Airline Training -- Farnsworth Z-100 -- Level D -- FAA ID# 0999

The FFS is qualified to perform all of the Maneuvers, Procedures, Tasks, and Functions Listed in Appendix A, Attachment 1, Table A1B, Minimum FFS Requirements In Effect on [mm/dd/yyyy] except for the following listed Tasks or Functions.

Qualified for all tasks in Table C1B for which the sponsor has requested qualification, except for the following: 6.e. Environmental system. 6.f. Fire detection and extinguisher system. 7.b. In-flight fire and smoke removal. 7.d. Ditching.
Additional tasks for which this FFS is qualified (i.e., in addition to the list in Table C1B) Enhanced Visual System

ATTACHMENT 4 TO APPENDIX C TO PART 60—FIGURE C4H [RESERVED]

Attachment 4 to Appendix C to Part 60—
Figure C4I – Sample MQTG Index of Effective FFS Directives
INFORMATION

Index of Effective FSTD Directives Filed in this Section			
Number	**Effective Date**	**Date of Notification**	**Details**

Continue as Necessary....

ATTACHMENT 5 TO APPENDIX C TO PART 60—FSTD DIRECTIVES APPLICABLE TO HELICOPTER FFSS

FLIGHT SIMULATION TRAINING DEVICE (FSTD) DIRECTIVE

FSTD Directive 1. Applicable to all FFSs, regardless of the original qualification basis and qualification date (original or upgrade), having Class II or Class III airport models available.

Agency: Federal Aviation Administration (FAA), DOT

Action: This is a retroactive requirement to have all Class II or Class III airport models meet current requirements.

Summary: Notwithstanding the authorization listed in paragraph 13b in Appendices A and C of this part, this FSTD Directive requires each certificate holder to ensure that by May 30, 2009, except for the airport model(s) used to qualify the simulator at the designated level, each airport model used by the certificate holder's instructors or evaluators for training, checking, or testing under this chapter in an FFS, meets the definition of a Class II or Class III airport model as defined in 14CFR part 60. The completion of this requirement will not require a report, and the method used for keeping instructors and evaluators apprised of the airport models that meet Class II or Class III requirements on any given simulator is at the option of the certificate holder whose employees are using the FFS, but the method used must be available for review by the TPAA for that certificate holder.

Dates: FSTD Directive 1 becomes effective on May 30, 2008.

SPECIFIC REQUIREMENTS:

1. Part 60 requires that each FSTD be:

a. Sponsored by a person holding or applying for an FAA operating certificate under Part 119, Part 141, or Part 142, or holding or applying for an FAA-approved training program under Part 63, Appendix C, for flight engineers, and

b. Evaluated and issued an SOQ for a specific FSTD level.

2. FFSs also require the installation of a visual system that is capable of providing an out-of-the-flight-deck view of airport models. However, historically these airport models were not routinely evaluated or required to meet any standardized criteria. This has led to qualified simulators containing airport models being used to meet FAA-approved training, testing, or checking requirements with potentially incorrect or inappropriate visual references.

3. To prevent this from occurring in the future, by May 30, 2009, except for the airport model(s) used to qualify the simulator at the designated level, each certificate holder must assure that each airport model used for training, testing, or checking under this

chapter in a qualified FFS meets the definition of a Class II or Class III airport model as defined in Appendix F of this part.

4. These references describe the requirements for visual scene management and the minimum distances from which runway or landing area features must be visible for all levels of simulator. The visual scene or airport model must provide, for each ''in-use runway'' or ''in-use landing area,'' runway or landing area surface and markings, runway or landing area lighting, taxiway surface and markings, and taxiway lighting. Additional requirements include correlation of the visual scenes or airport models with other aspects of the airport environment, correlation of the aircraft and associated equipment, scene quality assessment features, and the extent to which the instructor is able to exercise control of these scenes or models.

5. For circling approaches, all requirements of this section apply to the runway used for the initial approach and to the runway of intended landing.

6. The details in these scenes or models must be developed using airport pictures, construction drawings and maps, or other similar data, or be developed in accordance with published regulatory material. However, FSTD Directive 1 does not require that airport models contain details that are beyond the initially designed capability of the visual system, as currently qualified. The recognized limitations to visual systems are as follows:

a. Visual systems not required to have runway numbers as a part of the specific runway marking requirements are:

(1) Link NVS and DNVS.

(2) Novoview 2500 and 6000.

(3) FlightSafety VITAL series up to, and including, VITAL III, but not beyond.

(4) Redifusion SP1, SP1T, and SP2.

b. Visual systems required to display runway numbers only for LOFT scenes are:

(1) FlightSafety VITAL IV.

(2) Redifusion SP3 and SP3T.

(3) Link-Miles Image II.

c. Visual systems not required to have accurate taxiway edge lighting are:

(1) Redifusion SP1.

(2) FlightSafety Vital IV.

(3) Link-Miles Image II and Image IIT

(4) XKD displays (even though the XKD image generator is capable of generating blue colored lights, the display cannot accommodate that color).

7. A copy of this Directive must be filed in the MQTG in the designated FSTD Directive Section, and its inclusion must be annotated on the Index of Effective FSTD Directives chart. See Attachment 4, Appendices A through D of this part for a sample MQTG Index of Effective FSTD Directives chart.

[Doc. No. FAA–2002–12461, 73 FR 26490, May 9, 2008, as amended by Docket FAA–2018–0119, Amdt. 60–5, 83 FR 9170, Mar. 5, 2018; Amdt. 60–6, 83 FR 30275, June 27, 2018; Docket No. FAA–2022–1355; Amdt. No. 60–7; 87 FR 75822, Dec. 9, 2022]

EDITORIAL NOTE: At 87 FR 75822, Dec. 9, 2022, appendix C to part 60 was amended in the introductory ''Begin Information'' text, by removing the word ''NSPM'' and adding in its place the words ''Flight Standards Service'' in the first sentence; however this amendment could not be incorporated due to inaccurate amendatory instruction.

APPENDIX D TO PART 60—QUALIFICATION PERFORMANCE STANDARDS FOR HELICOPTER FLIGHT TRAINING DEVICES

BEGIN INFORMATION

This appendix establishes the standards for Helicopter Flight Training Device (FTD) evaluation and qualification at Level 4, Level 5, Level 6, or Level 7. The Flight Standards Service is responsible for the development, application, and implementation of the standards contained within this appendix. The procedures and criteria specified in this appendix will be used by the responsible Flight Standards office when conducting helicopter FTD evaluations.

TABLE OF CONTENTS

END INFORMATION

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1. INTRODUCTION

BEGIN INFORMATION

a. This appendix contains background information as well as regulatory and informative material as described later in this section. To assist the reader in determining what areas are required and what areas are permissive, the text in this appendix is divided into two sections: ''QPS Requirements'' and ''Information.'' The QPS Requirements sections contain details regarding compliance with the part 60 rule language. These details are regulatory, but are found only in this appendix. The Information sections contain material that is advisory in nature, and designed to give the user general information about the regulation.

b. [Reserved]

c. The responsible Flight Standards office encourages the use of electronic media for all communication, including any record, report, request, test, or statement required by this appendix. The electronic media used must have adequate security provisions and be acceptable to the responsible Flight Standards office.

d. Related Reading References.

(1) 14 CFR part 60.
(2) 14 CFR part 61.
(3) 14 CFR part 63.
(4) 14 CFR part 119.
(5) 14 CFR part 121.
(6) 14 CFR part 125.
(7) 14 CFR part 135.
(8) 14 CFR part 141.
(9) 14 CFR part 142.
(10) AC 120–28, as amended, Criteria for Approval of Category III Landing Weather Minima.
(11) AC 120–29, as amended, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.
(12) AC 120–35, as amended, Flightcrew Member Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.
(13) AC 120–41, as amended, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.
(14) AC 120–57, as amended, Surface Movement Guidance and Control System (SMGCS).
(15) AC 120–63, as amended, Helicopter Simulator Qualification.
(16) AC 150/5300–13, as amended, Airport Design.
(17) AC 150/5340–1, as amended, Standards for Airport Markings.
(18) AC 150/5340–4, as amended, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.
(19) AC 150/5390–2, as amended, Heliport Design.
(20) AC 150/5340–19, as amended, Taxiway Centerline Lighting System.
(21) AC 150/5340–24, as amended, Runway and Taxiway Edge Lighting System.
(22) AC 150/5345–28, as amended, Precision Approach Path Indicator (PAPI) Systems.
(23) International Air Transport Association document, ''Flight Simulator Design and Performance Data Requirements,'' as amended.
(24) AC 29–2, as amended, Flight Test Guide for Certification of Transport Category Rotorcraft.
(25) AC 27–1, as amended, Flight Test Guide for Certification of Normal Category Rotorcraft.
(26) International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, as amended.
(27) Airplane Flight Simulator Evaluation Handbook, Volume I, as amended and Volume II, as amended, The Royal Aeronautical Society, London, UK.
(28) FAA Airman Certification Standards and Practical Test Standards for Airline Transport Pilot, Type Ratings, Commercial Pilot, and Instrument Ratings.
(29) The FAA Aeronautical Information Manual (AIM). An electronic version of the AIM is on the Internet at *http://www.faa.gov/atpubs*.
(30) Aeronautical Radio, Inc. (ARINC) document number 436, *Guidelines For Electronic Qualification Test Guide* (as amended).

(31) Aeronautical Radio, Inc. (ARINC) document 610, *Guidance for Design and Integration of Aircraft Avionics Equipment in Simulators* (as amended).

END INFORMATION

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2. APPLICABILITY (§ 60.1 AND 60.2)

BEGIN INFORMATION

No additional regulatory or informational material applies to § 60.1, Applicability, or to § 60.2, Applicability of sponsor rules to person who are not sponsors and who are engaged in certain unauthorized activities.

END INFORMATION

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3. DEFINITIONS (§ 60.3)

BEGIN INFORMATION

See Appendix F of this part for a list of definitions and abbreviations from part 1, part 60, and the QPS appendices of part 60.

END INFORMATION

---

4. QUALIFICATION PERFORMANCE STANDARDS (§ 60.4)

BEGIN INFORMATION

No additional regulatory or informational material applies to § 60.4, Qualification Performance Standards.

END INFORMATION

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5. QUALITY MANAGEMENT SYSTEM (§ 60.5)

BEGIN INFORMATION

Additional regulatory material and informational material regarding Quality Management Systems for FTDs may be found in Appendix E of this part.

END INFORMATION

---

6. SPONSOR QUALIFICATION REQUIREMENTS (§ 60.7)

BEGIN INFORMATION

a. The intent of the language in § 60.7(b) is to have a specific FTD, identified by the sponsor, used at least once in an FAA-approved flight training program for the helicopter simulated during the 12-month period described. The identification of the specific FTD may change from one 12-month period to the next 12-month period as long as that sponsor sponsors and uses at least one FTD at least once during the prescribed period. There is no minimum number of hours or minimum FTD periods required.

b. The following examples describe acceptable operational practices:

(1) Example One.

(a) A sponsor is sponsoring a single, specific FTD for its own use, in its own facility or elsewhere—this single FTD forms the basis for the sponsorship. The sponsor uses that FTD at least once in each 12-month period in that sponsor's FAA-approved flight training program for the helicopter simulated. This 12-month period is established according to the following schedule:

(i) If the FTD was qualified prior to May 30, 2008, the 12-month period begins on the date of the first continuing qualification evaluation conducted in accordance with § 60.19 after May 30, 2008, and continues for each subsequent 12-month period;

(ii) A device qualified on or after May 30, 2008, will be required to undergo an initial or upgrade evaluation in accordance with § 60.15. Once the initial or upgrade evaluation is complete, the first continuing qualification evaluation will be conducted within 6 months. The 12 month continuing qualification evaluation cycle begins on that date and continues for each subsequent 12-month period.

(b) There is no minimum number of hours of FTD use required.

(c) The identification of the specific FTD may change from one 12-month period to the next 12-month period as long as that sponsor sponsors and uses at least one FTD at least once during the prescribed period.

(2) Example Two.

(a) A sponsor sponsors an additional number of FTDs, in its facility or elsewhere. Each additionally sponsored FTD must be—

(i) Used by the sponsor in the sponsor's FAA-approved flight training program for the helicopter simulated (as described in § 60.7(d)(1)); or

(ii) Used by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the helicopter simulated (as described in § 60.7(d)(1)). This 12-month period is established in the same manner as in example one; or

(iii) Provided a statement each year from a qualified pilot, (after having flown the helicopter not the subject FTD or another FTD, during the preceding 12-month period) stating that the subject FTD's performance and handling qualities represent the helicopter (as described in § 60.7(d)(2)). This statement is provided at least once in each 12-month period established in the same manner as in example one.

(b) There is no minimum number of hours of FTD use required.

(3) Example Three.

(a) A sponsor in New York (in this example, a Part 142 certificate holder) establishes ''satellite'' training centers in Chicago and Moscow.

(b) The satellite function means that the Chicago and Moscow centers must operate under the New York center's certificate (in accordance with all of the New York center's practices, procedures, and policies; e.g., instructor and/or technician training/checking requirements, record keeping, QMS program).

(c) All of the FTDs in the Chicago and Moscow centers could be dry-leased (i.e., the certificate holder does not have and use FAA-approved flight training programs for the FTDs in the Chicago and Moscow centers) because—

(i) Each FTD in the Chicago center and each FTD in the Moscow center is used at least once each 12-month period by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the helicopter (as described in §60.7(d)(1)); or

(ii) A statement is obtained from a qualified pilot (having flown the helicopter, not the subject FTD or another FTD during the preceding 12-month period) stating that the performance and handling qualities of each FTD in the Chicago and Moscow centers represents the helicopter (as described in §60.7(d)(2)).

END INFORMATION

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7. ADDITIONAL RESPONSIBILITIES OF THE SPONSOR (§60.9)

BEGIN INFORMATION

The phrase ''as soon as practicable'' in §60.9(a) means without unnecessarily disrupting or delaying beyond a reasonable time the training, evaluation, or experience being conducted in the FTD.

END INFORMATION

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8. FTD USE (§60.11).

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.11, FTD Use.

END INFORMATION

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9. FTD OBJECTIVE DATA REQUIREMENTS (§60.13)

BEGIN QPS REQUIREMENTS

a. Flight test data used to validate FTD performance and handling qualities must have been gathered in accordance with a flight test program containing the following:

(1) A flight test plan consisting of:

(a) The maneuvers and procedures required for aircraft certification and simulation programming and validation.

(b) For each maneuver or procedure—

(i) The procedures and control input the flight test pilot and/or engineer used.

(ii) The atmospheric and environmental conditions.

(iii) The initial flight conditions.

(iv) The helicopter configuration, including weight and center of gravity.

(v) The data to be gathered.

(vi) All other information necessary to recreate the flight test conditions in the FTD.

(2) Appropriately qualified flight test personnel.

(3) Appropriate and sufficient data acquisition equipment or system(s), including appropriate data reduction and analysis methods and techniques, acceptable to the FAA's Aircraft Certification Service.

b. The data, regardless of source, must be presented:

(1) In a format that supports the FTD validation process;

(2) In a manner that is clearly readable and annotated correctly and completely;

(3) With resolution sufficient to determine compliance with the tolerances set forth in Attachment 2, Table D2A Appendix D;

(4) With any necessary guidance information provided; and

(5) Without alteration, adjustments, or bias. Data may be corrected to address known data calibration errors provided that an explanation of the methods used to correct the errors appears in the QTG. The corrected data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation

c. After completion of any additional flight test, a flight test report must be submitted in support of the validation data. The report must contain sufficient data and rationale to support qualification of the FTD at the level requested.

d. As required by §60.13(f), the sponsor must notify the responsible Flight Standards office when it becomes aware that an addition to or a revision of the flight related data or helicopter systems related data is available if this data is used to program and operate a qualified FTD. The data referred to in this sub-section is data used to validate the performance, handling qualities, or other characteristics of the aircraft, including data related to any relevant changes occurring after the type certification is issued. The sponsor must—

(1) Within 10 calendar days, notify the responsible Flight Standards office of the existence of this data; and

(a) Within 45 calendar days, notify the responsible Flight Standards office of—

(b) The schedule to incorporate this data into the FTD; or

(c) The reason for not incorporating this data into the FTD.

e. In those cases where the objective test results authorize a ''snapshot test'' or a ''series of snapshot tests'' results in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the ''snapshot.'' The steady state condition must exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snap shot.

END QPS REQUIREMENTS

BEGIN INFORMATION

f. The FTD sponsor is encouraged to maintain a liaison with the manufacturer of the aircraft being simulated (or with the holder of the aircraft type certificate for the aircraft being simulated if the manufacturer is no longer in business), and if appropriate, with the person having supplied the aircraft data package for the FTD in order to facilitate the notification described in this paragraph.

g. It is the intent of the responsible Flight Standards office that for new aircraft entering service, at a point well in advance of preparation of the QTG, the sponsor should submit to the responsible Flight Standards office for approval, a descriptive document (see Appendix C of this part, Table C2D, Sample Validation Data Roadmap for Helicopters) containing the plan for acquiring the validation data, including data sources. This document should clearly identify sources of data for all required tests, a description of the validity of these data for a specific engine type and thrust rating configuration, and the revision levels of all avionics affecting the performance or flying qualities of the aircraft. Additionally, this document should provide other information such as the rationale or explanation for cases where data or data parameters are missing, instances where engineering simulation data are used, or where flight test methods require further explanations. It should also provide a brief narrative describing the cause and effect of any deviation from data requirements. The aircraft manufacturer may provide this document.

h. There is no requirement for any flight test data supplier to submit a flight test plan or program prior to gathering flight test data. However, the responsible Flight Standards office notes that inexperienced data gatherers often provide data that is irrelevant, improperly marked, or lacking adequate justification for selection. Other problems include inadequate information regarding initial conditions or test maneuvers. The responsible Flight Standards office has been forced to refuse these data submissions as validation data for an FTD evaluation. For this reason the responsible Flight Standards office recommends that any data supplier not previously experienced in this area review the data necessary for programming and for validating the performance of the FTD and discuss the flight test plan anticipated for acquiring such data with the responsible Flight Standards office well in advance of commencing the flight tests.

i. The responsible Flight Standards office will consider, on a case-by-case basis, whether to approve supplemental validation data derived from flight data recording systems such as a Quick Access Recorder or Flight Data Recorder.

END INFORMATION

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10. SPECIAL EQUIPMENT AND PERSONNEL REQUIREMENTS FOR QUALIFICATION OF THE FTD (§60.14).

BEGIN INFORMATION

a. In the event that the responsible Flight Standards office determines that special equipment or specifically qualified persons will be required to conduct an evaluation, the responsible Flight Standards office will make every attempt to notify the sponsor at least one (1) week, but in no case less than 72 hours, in advance of the evaluation. Examples of special equipment include flight control measurement devices, accelerometers, or oscilloscopes. Examples of specially qualified personnel include individuals specifically qualified to install or use any special equipment when its use is required.

b. Examples of a special evaluation include an evaluation conducted after an FTD is moved; at the request of the TPAA; or as a result of comments received from users of the FTD that raise questions about the continued qualification or use of the FTD.

END INFORMATION

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11. INITIAL (AND UPGRADE) QUALIFICATION REQUIREMENTS (§60.15).

BEGIN QPS REQUIREMENT

a. In order to be qualified at a particular qualification level, the FTD must:

(1) Meet the general requirements listed in Attachment 1 of this appendix.

(2) Meet the objective testing requirements listed in Attachment 2 of this appendix (Level 4 FTDs do not require objective tests).

(3) Satisfactorily accomplish the subjective tests listed in Attachment 3 of this appendix.

b. The request described in § 60.15(a) must include all of the following:

(1) A statement that the FTD meets all of the applicable provisions of this part and all applicable provisions of the QPS.

(2) A confirmation that the sponsor will forward to the responsible Flight Standards office the statement described in § 60.15(b) in such time as to be received no later than 5 business days prior to the scheduled evaluation and may be forwarded to the responsible Flight Standards office via traditional or electronic means.

(3) Except for a Level 4 FTD, a QTG, acceptable to the responsible Flight Standards office, that includes all of the following:

(a) Objective data obtained from aircraft testing or another approved source.

(b) Correlating objective test results obtained from the performance of the FTD as prescribed in the appropriate QPS.

(c) The result of FTD subjective tests prescribed in the appropriate QPS.

(d) A description of the equipment necessary to perform the evaluation for initial qualification and the continuing qualification evaluations.

c. The QTG described in paragraph a(3) of this section must provide the documented proof of compliance with the FTD objective tests in Attachment 2, Table D2A of this appendix.

d. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, to the responsible Flight Standards office for review and approval, and must include, for each objective test:

(1) Parameters, tolerances, and flight conditions.

(2) Pertinent and complete instructions for conducting automatic and manual tests.

(3) A means of comparing the FTD test results to the objective data.

(4) Any other information as necessary to assist in the evaluation of the test results.

(5) Other information appropriate to the qualification level of the FTD.

e. The QTG described in paragraphs (a)(3) and (b) of this section, must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see Attachment 4, Figure D4C, of this appendix, for a sample QTG cover page).

(2) A continuing qualification evaluation requirements page. This page will be used by the responsible Flight Standards office to establish and record the frequency with which continuing qualification evaluations must be conducted and any subsequent changes that may be determined by the responsible Flight Standards office in accordance with § 60.19. See Attachment 4, Figure D4G, of this appendix for a sample Continuing Qualification Evaluation Requirements page.

(3) An FTD information page that provides the information listed in this paragraph, if applicable (see Attachment 4, Figure D4B, of this appendix, for a sample FTD information page). For convertible FTDs, the sponsor must submit a separate page for each configuration of the FTD.

(a) The sponsor's FTD identification number or code.

(b) The helicopter model and series being simulated.

(c) The aerodynamic data revision number or reference.

(d) The source of the basic aerodynamic model and the aerodynamic coefficient data used to modify the basic model.

(e) The engine model(s) and its data revision number or reference.

(f) The flight control data revision number or reference.

(g) The flight management system identification and revision level.

(h) The FTD model and manufacturer.

(i) The date of FTD manufacture.

(j) The FTD computer identification.

(k) The visual system model and manufacturer, including display type.

(l) The motion system type and manufacturer, including degrees of freedom.

(4) A Table of Contents.

(5) A log of revisions and a list of effective pages.

(6) List of all relevant data references.

(7) A glossary of terms and symbols used (including sign conventions and units).

(8) Statements of Compliance and Capability (SOC) with certain requirements.

(9) Recording procedures or equipment required to accomplish the objective tests.

(10) The following information for each objective test designated in Attachment 2 of this appendix, as applicable to the qualification level sought:

(a) Name of the test.

(b) Objective of the test.

(c) Initial conditions.

(d) Manual test procedures.

(e) Automatic test procedures (if applicable).

(f) Method for evaluating FTD objective test results.

(g) List of all relevant parameters driven or constrained during the automatic test(s).

(h) List of all relevant parameters driven or constrained during the manual test(s).

(i) Tolerances for relevant parameters.

(j) Source of Validation Data (document and page number).

(k) Copy of the Validation Data (if located in a separate binder, a cross reference for the identification and page number for pertinent data location must be provided).

(l) FTD Objective Test Results as obtained by the sponsor. Each test result must reflect the date completed and must be clearly labeled as a product of the device being tested.

f. A convertible FTD is addressed as a separate FTD for each model and series helicopter to which it will be converted and for the FAA qualification level sought. The responsible Flight Standards office will conduct an evaluation for each configuration. If a sponsor seeks qualification for two or more models of a helicopter type using a convertible FTD, the sponsor must provide a QTG for each helicopter model, or a QTG for the first helicopter model and a supplement to that QTG for each additional helicopter model. The responsible Flight Standards office will conduct evaluations for each helicopter model.

g. The form and manner of presentation of objective test results in the QTG must include the following:

(1) The sponsor's FTD test results must be recorded in a manner acceptable to the responsible Flight Standards office, that allows easy comparison of the FTD test results to the validation data (e.g., use of a multichannel recorder, line printer, cross plotting, overlays, transparencies).

(2) FTD results must be labeled using terminology common to helicopter parameters as opposed to computer software identifications.

(3) Validation data documents included in a QTG may be photographically reduced only if such reduction will not alter the graphic scaling or cause difficulties in scale interpretation or resolution.

(4) Scaling on graphical presentations must provide the resolution necessary to evaluate the parameters shown in Attachment 2, Table D2A of this appendix.

(5) Tests involving time histories, data sheets (or transparencies thereof) and FTD test results must be clearly marked with appropriate reference points to ensure an accurate comparison between FTD and helicopter with respect to time. Time histories recorded via a line printer are to be clearly identified for cross-plotting on the helicopter data. Over-plots may not obscure the reference data.

h. The sponsor may elect to complete the QTG objective and subjective tests at the manufacturer's facility or at the sponsor's training facility. If the tests are conducted at the manufacturer's facility, the sponsor must repeat at least one-third of the tests at the sponsor's training facility in order to substantiate FTD performance. The QTG must be clearly annotated to indicate when and where each test was accomplished. Tests conducted at the manufacturer's facility and at the sponsor's training facility must be conducted after the FTD is assembled with systems and sub-systems functional and operating in an interactive manner. The test results must be submitted to the responsible Flight Standards office.

i. The sponsor must maintain a copy of the MQTG at the FTD location.

j. All FTDs for which the initial qualification is conducted after May 30, 2014, must have an electronic MQTG (eMQTG) including all objective data obtained from helicopter testing, or another approved source (reformatted or digitized), together with correlating objective test results obtained from the performance of the FTD (reformatted or digitized) as prescribed in this appendix. The eMQTG must also contain the general FTD performance or demonstration results (reformatted or digitized) prescribed in this appendix, and a description of the equipment necessary to perform the initial qualification evaluation and the continuing qualification evaluations. The eMQTG must include the original validation data used to validate FTD performance and handling qualities in either the original digitized format from the data supplier or an electronic scan of the original time-history plots that were provided by the data supplier. A copy of the eMQTG must be provided to the responsible Flight Standards office.

k. All other FTDs (not covered in subparagraph ''j'') must have an electronic copy of the MQTG by and after May 30, 2014. An electronic copy of the MQTG must be provided to the responsible Flight Standards office. This may be provided by an electronic scan presented in a Portable Document File (PDF), or similar format acceptable to the responsible Flight Standards office.

l. During the initial (or upgrade) qualification evaluation conducted by the responsible Flight Standards office, the sponsor must also provide a person knowledgeable about the operation of the aircraft and the operation of the FTD.

END QPS REQUIREMENTS

BEGIN INFORMATION

m. Only those FTDs that are sponsored by a certificate holder as defined in Appendix F of this part will be evaluated by the responsible Flight Standards office. However, other FTD evaluations may be conducted on a case-by-case basis as the Administrator deems appropriate, but only in accordance with applicable agreements.

n. The responsible Flight Standards office will conduct an evaluation for each configuration, and each FTD must be evaluated as completely as possible. To ensure a thorough

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and uniform evaluation, each FTD is subjected to the general FTD requirements in Attachment 1 of this appendix, the objective tests listed in Attachment 2 of this appendix, and the subjective tests listed in Attachment 3 of this appendix. The evaluations described herein will include, but not necessarily be limited to the following:

(1) Helicopter responses, including longitudinal and lateral-directional control responses (see Attachment 2 of this appendix).

(2) Performance in authorized portions of the simulated helicopter's operating envelope, to include tasks evaluated by the responsible Flight Standards office in the areas of surface operations, takeoff, climb, cruise, descent, approach and landing, as well as abnormal and emergency operations (see Attachment 2 of this appendix).

(3) Control checks (see Attachment 1 and Attachment 2 of this appendix).

(4) Flight deck configuration (see Attachment 1 of this appendix).

(5) Pilot, flight engineer, and instructor station functions checks (see Attachment 1 and Attachment 3 of this appendix).

(6) Helicopter systems and sub-systems (as appropriate) as compared to the helicopter simulated (see attachment 1 and attachment 3 of this appendix).

(7) FTD systems and sub-systems, including force cueing (motion), visual, and aural (sound) systems, as appropriate (see Attachment 1 and Attachment 2 of this appendix).

(8) Certain additional requirements, depending upon the qualification level sought, including equipment or circumstances that may become hazardous to the occupants. The sponsor may be subject to Occupational Safety and Health Administration requirements.

o. The responsible Flight Standards office administers the objective and subjective tests, which include an examination of functions. The tests include a qualitative assessment of the FTD by a pilot from the responsible Flight Standards office. The evaluation team leader may assign other qualified personnel to assist in accomplishing the functions examination and/or the objective and subjective tests performed during an evaluation when required.

(1) Objective tests provide a basis for measuring and evaluating FTD performance and determining compliance with the requirements of this part.

(2) Subjective tests provide a basis for:

(a) Evaluating the capability of the FTD to perform over a typical utilization period;

(b) Determining that the FTD satisfactorily simulates each required task;

(c) Verifying correct operation of the FTD controls, instruments, and systems; and

(d) Demonstrating compliance with the requirements of this part.

p. The tolerances for the test parameters listed in Attachment 2 of this appendix reflect the range of tolerances acceptable to the responsible Flight Standards office for FTD validation and are not to be confused with design tolerances specified for FTD manufacture. In making decisions regarding tests and test results, the responsible Flight Standards office relies on the use of operational and engineering judgment in the application of data (including consideration of the way in which the flight test was flown and way the data was gathered and applied), data presentations, and the applicable tolerances for each test.

q. In addition to the scheduled continuing qualification evaluation, each FTD is subject to evaluations conducted by the responsible Flight Standards office at any time without prior notification to the sponsor. Such evaluations would be accomplished in a normal manner (i.e., requiring exclusive use of the FTD for the conduct of objective and subjective tests and an examination of functions) if the FTD is not being used for flight crewmember training, testing, or checking. However, if the FTD were being used, the evaluation would be conducted in a non-exclusive manner. This non-exclusive evaluation will be conducted by the FTD evaluator accompanying the check airman, instructor, Aircrew Program Designee (APD), or FAA inspector aboard the FTD along with the student(s) and observing the operation of the FTD during the training, testing, or checking activities.

r. Problems with objective test results are handled as follows:

(1) If a problem with an objective test result is detected by the evaluation team during an evaluation, the test may be repeated or the QTG may be amended.

(2) If it is determined that the results of an objective test do not support the qualification level requested but do support a lower level, the responsible Flight Standards office may qualify the FTD at a lower level.

s. After an FTD is successfully evaluated, the responsible Flight Standards office issues an SOQ to the sponsor. The responsible Flight Standards office recommends the FTD to the TPAA, who will approve the FTD for use in a flight training program. The SOQ will be issued at the satisfactory conclusion of the initial or continuing qualification evaluation and will list the tasks for which the FTD is qualified, referencing the tasks described in Table D1B in Attachment 1 of this appendix. However, it is the sponsor's responsibility to obtain TPAA approval prior to using the FTD in an FAA-approved flight training program.

t. Under normal circumstances, the responsible Flight Standards office establishes a date for the initial or upgrade evaluation within ten (10) working days after determining that a complete QTG is acceptable.

Unusual circumstances may warrant establishing an evaluation date before this determination is made. A sponsor may schedule an evaluation date as early as 6 months in advance. However, there may be a delay of 45 days or more in rescheduling and completing the evaluation if the sponsor is unable to meet the scheduled date. See Attachment 4, of this appendix, Figure D4A, Sample Request for Initial, Upgrade, or Reinstatement Evaluation.

u. The numbering system used for objective test results in the QTG should closely follow the numbering system set out in Attachment 2, FTD Objective Tests, Table D2A of this appendix.

v. Contact the responsible Flight Standards office for additional information regarding the preferred qualifications of pilots used to meet the requirements of §60.15(d).

w. Examples of the exclusions for which the FTD might not have been subjectively tested by the sponsor or the responsible Flight Standards office and for which qualification might not be sought or granted, as described in §60.15(g)(6), include approaches to and departures from slopes and pinnacles.

END INFORMATION

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12. ADDITIONAL QUALIFICATIONS FOR CURRENTLY QUALIFIED FTDS (§60.16)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.16, Additional Qualifications for a Currently Qualified FTD.

END INFORMATION

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13. PREVIOUSLY QUALIFIED FTDS (§60.17)

BEGIN QPS REQUIREMENTS

a. In instances where a sponsor plans to remove an FTD from active status for a period of less than two years, the following procedures apply:

(1) The responsible Flight Standards office must be notified in writing and the notification must include an estimate of the period that the FTD will be inactive.

(2) Continuing Qualification evaluations will not be scheduled during the inactive period.

(3) The responsible Flight Standards office will remove the FTD from the list of qualified FTDs on a mutually established date not later than the date on which the first missed continuing qualification evaluation would have been scheduled.

(4) Before the FTD is restored to qualified status, it must be evaluated by the responsible Flight Standards office. The evaluation content and the time required to accomplish the evaluation is based on the number of continuing qualification evaluations and sponsor-conducted quarterly inspections missed during the period of inactivity.

(5) The sponsor must notify the responsible Flight Standards office of any changes to the original scheduled time out of service.

b. FTDs and replacement FTD systems qualified prior to May 30, 2008, are not required to meet the general FTD requirements, the objective test requirements, and the subjective test requirements of Attachments 1, 2, and 3, respectively, of this appendix as long as the FTD continues to meet the test requirements contained in the MQTG developed under the original qualification basis.

c. After (1 year after date of publication of the final rule in the FEDERAL REGISTER) each visual scene and airport model installed in and available for use in a qualified FTD must meet the requirements described in Attachment 3 of this appendix.

d. Simulators qualified prior to May 30, 2008, may be updated. If an evaluation is deemed appropriate or necessary by the responsible Flight Standards office after such an update, the evaluation will not require an evaluation to standards beyond those against which the simulator was originally qualified.

END QPS REQUIREMENTS

BEGIN INFORMATION

e. Other certificate holders or persons desiring to use an FTD may contract with FTD sponsors to use FTDs previously qualified at a particular level for a helicopter type and approved for use within an FAA-approved flight training program. Such FTDs are not required to undergo an additional qualification process, except as described in §60.16.

f. Each FTD user must obtain approval from the appropriate TPAA to use any FTD in an FAA-approved flight training program.

g. The intent of the requirement listed in §60.17(b), for each FTD to have an SOQ within 6 years, is to have the availability of that statement (including the configuration list and the limitations to authorizations) to provide a complete picture of the FTD inventory regulated by the FAA. The issuance of the statement will not require any additional evaluation or require any adjustment to the evaluation basis for the FTD.

h. Downgrading of an FTD is a permanent change in qualification level and will necessitate the issuance of a revised SOQ to reflect the revised qualification level, as appropriate. If a temporary restriction is placed on an FTD because of a missing, malfunctioning, or inoperative component or on-going repairs, the restriction is not a permanent change in qualification level. Instead, the restriction is temporary and is removed when the reason for the restriction has been resolved.

i. It is not the intent of the responsible Flight Standards office to discourage the improvement of existing simulation (e.g., the "updating" of a control loading system, or the replacement of the IOS with a more capable unit) by requiring the "updated" device to meet the qualification standards current at the time of the update. Depending on the extent of the update, the responsible Flight Standards officemay require that the updated device be evaluated and may require that an evaluation include all or a portion of the elements of an initial evaluation. However, the standards against which the device would be evaluated are those that are found in the MQTG for that device.

j. The responsible Flight Standards officewill determine the evaluation criteria for an FTD that has been removed from active status for a prolonged period. The criteria will be based on the number of continuing qualification evaluations and quarterly inspections missed during the period of inactivity. For example, if the FTD were out of service for a 1 year period, it would be necessary to complete the entire QTG, since all of the quarterly evaluations would have been missed. The responsible Flight Standards officewill also consider how the FTD was stored, whether parts were removed from the FTD and whether the FTD was disassembled.

k. The FTD will normally be requalified using the FAA-approved MQTG and the criteria that was in effect prior to its removal from qualification. However, inactive periods of 2 years or more will require re-qualification under the standards in effect and current at the time of requalification.

END INFORMATION

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14. INSPECTION, CONTINUING QUALIFICATION, EVALUATION, AND MAINTENANCE REQUIREMENTS (§ 60.19)

BEGIN QPS REQUIREMENT

a. The sponsor must conduct a minimum of four evenly spaced inspections throughout the year. The objective test sequence and content of each inspection in this sequence must be developed by the sponsor and must be acceptable to the responsible Flight Standards office.

b. The description of the functional preflight check must be contained in the sponsor's QMS.

c. Record "functional preflight" in the FTD discrepancy log book or other acceptable location, including any item found to be missing, malfunctioning, or inoperative.

d. During the continuing qualification evaluation conducted by the responsible Flight Standards office, the sponsor must also provide a person knowledgeable about the operation of the aircraft and the operation of the FTD.

END QPS REQUIREMENTS

BEGIN INFORMATION

e. The sponsor's test sequence and the content of each quarterly inspection required in § 60.19(a)(1) should include a balance and a mix from the objective test requirement areas listed as follows:

(1) Performance.

(2) Handling qualities.

(3) Motion system (where appropriate).

(4) Visual system (where appropriate).

(5) Sound system (where appropriate).

(6) Other FTD systems.

f. If the evaluator plans to accomplish specific tests during a normal continuing qualification evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; but not less than 72 hours. Examples of such tests include latencies and control sweeps.

g. The continuing qualification evaluations described in § 60.19(b) will normally require 4 hours of FTD time. However, flexibility is necessary to address abnormal situations or situations involving aircraft with additional levels of complexity (e.g., computer controlled aircraft). The sponsor should anticipate that some tests may require additional time. The continuing qualification evaluations will consist of the following:

(1) Review of the results of the quarterly inspections conducted by the sponsor since the last scheduled continuing qualification evaluation.

(2) A selection of approximately 8 to 15 objective tests from the MQTG that provide an adequate opportunity to evaluate the performance of the FTD. The tests chosen will be performed either automatically or manually and should be able to be conducted within approximately one-third (1/3) of the allotted FTD time.

(3) A subjective evaluation of the FTD to perform a representative sampling of the tasks set out in attachment 3 of this appendix. This portion of the evaluation should take approximately two-thirds (2/3) of the allotted FTD time.

(4) An examination of the functions of the FTD may include the motion system, visual

system, sound system as applicable, instructor operating station, and the normal functions and simulated malfunctions of the simulated helicopter systems. This examination is normally accomplished simultaneously with the subjective evaluation requirements.

h. The requirement established in §60.19(b)(4) regarding the frequency of responsible Flight Standards office-conducted continuing qualification evaluations for each FTD is typically 12 months. However, the establishment and satisfactory implementation of an approved QMS for a sponsor will provide a basis for adjusting the frequency of evaluations to exceed 12-month intervals.

END INFORMATION

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15. LOGGING FTD DISCREPANCIES (§60.20)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.20. Logging FTD Discrepancies.

END INFORMATION

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16. INTERIM QUALIFICATION OF FTDS FOR NEW HELICOPTER TYPES OR MODELS (§60.21)

BEGIN INFORMATION

No additional regulatory or informational material applies to §60.21, Interim Qualification of FTDs for New Helicopter Types or Models.

END INFORMATION

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17. MODIFICATIONS TO FTDS (§60.23)

BEGIN QPS REQUIREMENTS

a. The notification described in §60.23(c)(2) must include a complete description of the planned modification, with a description of the operational and engineering effect the proposed modification will have on the operation of the FTD and the results that are expected with the modification incorporated.

b. Prior to using the modified FTD:

(1) All the applicable objective tests completed with the modification incorporated, including any necessary updates to the MQTG (e.g., accomplishment of FSTD Directives) must be acceptable to the responsible Flight Standards office; and

(2) The sponsor must provide the responsible Flight Standards office with a statement signed by the MR that the factors listed in §60.15(b) are addressed by the appropriate personnel as described in that section.

END QPS REQUIREMENTS

BEGIN INFORMATION

c. FSTD Directives are considered modification of an FTD. See Attachment 4 of this appendix, Figure D4I for a sample index of effective FSTD Directives. See Attachment 6 of this appendix for a list of all effective FSTD Directives applicable to Helicopter FTDs.

END INFORMATION

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18. OPERATION WITH MISSING, MALFUNCTIONING, OR INOPERATIVE COMPONENTS (§60.25)

BEGIN INFORMATION

a. The sponsor's responsibility with respect to §60.25(a) is satisfied when the sponsor fairly and accurately advises the user of the current status of an FTD, including any missing, malfunctioning, or inoperative (MMI) component(s).

b. It is the responsibility of the instructor, check airman, or representative of the administrator conducting training, testing, or checking to exercise reasonable and prudent judgment to determine if any MMI component is necessary for the satisfactory completion of a specific maneuver, procedure, or task.

c. If the 29th or 30th day of the 30-day period described in §60.25(b) is on a Saturday, a Sunday, or a holiday, the FAA will extend the deadline until the next business day.

d. In accordance with the authorization described in §60.25(b), the sponsor may develop a discrepancy prioritizing system to accomplish repairs based on the level of impact on the capability of the FTD. Repairs having a larger impact on the FTD's ability to provide the required training, evaluation, or flight experience will have a higher priority for repair or replacement.

END INFORMATION

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19. AUTOMATIC LOSS OF QUALIFICATION AND PROCEDURES FOR RESTORATION OF QUALIFICATION (§60.27)

BEGIN INFORMATION

If the sponsor provides a plan for how the FTD will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems;

routine replacement of hydraulic fluid; control of the environmental factors in which the FTD is to be maintained) there is a greater likelihood that the responsible Flight Standards office will be able to determine the amount of testing that is required for requalification.

END INFORMATION

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20. OTHER LOSSES OF QUALIFICATION AND PROCEDURES FOR RESTORATION OF QUALIFICATION (§ 60.29)

BEGIN INFORMATION

If the sponsor provides a plan for how the FTD will be maintained during its out-of-service period (e.g., periodic exercise of mechanical, hydraulic, and electrical systems; routine replacement of hydraulic fluid; control of the environmental factors in which the FTD is to be maintained) there is a greater likelihood that the responsible Flight Standards office will be able to determine the amount of testing that is required for requalification.

END INFORMATION

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21. RECORD KEEPING AND REPORTING (§ 60.31)

BEGIN QPS REQUIREMENTS

a. FTD modifications can include hardware or software changes. For FTD modifications involving software programming changes, the record required by § 60.31(a)(2) must consist of the name of the aircraft system software, aerodynamic model, or engine model change, the date of the change, a summary of the change, and the reason for the change.

b. If a coded form for record keeping is used, it must provide for the preservation and retrieval of information with appropriate security or controls to prevent the inappropriate alteration of such records after the fact.

END INFORMATION

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22. APPLICATIONS, LOGBOOKS, REPORTS, AND RECORDS: FRAUD, FALSIFICATION, OR INCORRECT STATEMENTS (§ 60.33)

BEGIN INFORMATION

No additional regulatory or informational material applies to § 60.33, Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements

23. [RESERVED]

END INFORMATION

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24. LEVELS OF FTD

BEGIN INFORMATION

a. The following is a general description of each level of FTD. Detailed standards and tests for the various levels of FTDs are fully defined in Attachments 1 through 3 of this appendix.

(1) Level 4. A Level 4 device is one that may have an open helicopter-specific flight deck area, or an enclosed helicopter-specific flight deck and at least one operating system. Air/ground logic is required (no aerodynamic programming required). All displays may be flat/LCD panel representations or actual representations of displays in the aircraft. All controls, switches, and knobs may be touch sensitive activation (not capable of manual manipulation of the flight controls) or may physically replicate the aircraft in control operation.

(2) Level 5. A Level 5 device is one that may have an open helicopter-specific flight deck area, or an enclosed helicopter-specific flight deck and a generic aerodynamic program with at least one operating system and control loading representative of the simulated helicopter. The control loading need only represent the helicopter at an approach speed and configuration. All displays may be flat/LCD panel representations or actual representations of displays in the aircraft. Primary and secondary flight controls (e.g., rudder, aileron, elevator, flaps, spoilers/speed brakes, engine controls, landing gear, nosewheel steering, trim, brakes) must be physical controls. All other controls, switches, and knobs may be touch sensitive activation.

(3) Level 6. A Level 6 device is one that has an enclosed helicopter-specific flight deck and aerodynamic program with all applicable helicopter systems operating and control loading that is representative of the simulated helicopter throughout its ground and flight envelope and significant sound representation. All displays may be flat/LCD panel representations or actual representations of displays in the aircraft, but all controls, switches, and knobs must physically replicate the aircraft in control operation.

(4) Level 7. A Level 7 device is one that has an enclosed helicopter-specific flight deck and aerodynamic program with all applicable helicopter systems operating and control loading that is representative of the simulated helicopter throughout its ground and flight envelope and significant sound representation. All displays may be flat/LCD

panel representations or actual representations of displays in the aircraft, but all controls, switches, and knobs must physically replicate the aircraft in control operation. It also has a visual system that provides an out-of-the-flight deck view, providing cross-flight deck viewing (for both pilots simultaneously) of a field-of-view of at least 146° horizontally and 36° vertically as well as a vibration cueing system for characteristic helicopter vibrations noted at the pilot station(s).

END INFORMATION

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25. FTD QUALIFICATION ON THE BASIS OF A BILATERAL AVIATION SAFETY AGREEMENT (BASA) (§ 60.37)

BEGIN INFORMATION

No additional regulatory or informational material applies to § 60.37, FTD Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA).

END INFORMATION

ATTACHMENT 1 TO APPENDIX D TO PART 60—GENERAL FTD REQUIREMENTS

BEGIN QPS REQUIREMENTS

1. REQUIREMENTS

a. Certain requirements included in this appendix must be supported with an SOC as defined in Appendix F, which may include objective and subjective tests. The requirements for SOCs are indicated in the ''General FTD Requirements'' column in Table D1A of this appendix.

b. Table D1A describes the requirements for the indicated level of FTD. Many devices include operational systems or functions that exceed the requirements outlined in this section. In any event, all systems will be tested and evaluated in accordance with this appendix to ensure proper operation.

END QPS REQUIREMENTS

BEGIN INFORMATION

2. DISCUSSION

a. This attachment describes the general requirements for qualifying Level 4 through Level 7 FTDs. The sponsor should also consult the objectives tests in Attachment 2 of this appendix and the examination of functions and subjective tests listed in Attachment 3 of this appendix to determine the complete requirements for a specific level FTD.

b. The material contained in this attachment is divided into the following categories:

(1) General Flight Deck Configuration.
(2) Programming.
(3) Equipment Operation.
(4) Equipment and Facilities for Instructor/Evaluator Functions.
(5) Motion System.
(6) Visual System.
(7) Sound System.

c. Table D1A provides the standards for the General FTD Requirements.

d. Table D1B provides the tasks that the sponsor will examine to determine whether the FTD satisfactorily meets the requirements for flight crew training, testing, and experience.

e. Table D1C provides the functions that an instructor/check airman must be able to control in the simulator.

f. It is not required that all of the tasks that appear on the List of Qualified Tasks (part of the SOQ) be accomplished during the initial or continuing qualification evaluation.

END INFORMATION

TABLE D1A—MINIMUM FTD REQUIREMENTS

QPS requirements						Information
Entry No.	General FTD requirements	FTD level				Notes
		4	5	6	7	
1. General Flight Deck Configuration.						

TABLE D1A—MINIMUM FTD REQUIREMENTS—Continued

QPS requirements						Information
Entry No.	General FTD requirements	FTD level				Notes
		4	5	6	7	
1.a.	The FTD must have a flight deck that is a replica of the helicopter, or set of helicopters simulated with controls, equipment, observable flight deck indicators, circuit breakers, and bulkheads properly located, functionally accurate and replicating the helicopter or set of helicopters. The direction of movement of controls and switches must be identical to that in the helicopter or set of helicopters. Crewmember seats must afford the capability for the occupant to be able to achieve the design ''eye position.'' Equipment for the operation of the flight deck windows must be included, but the actual windows need not be operable. Those circuit breakers that affect procedures or result in observable flight deck indications must be properly located and functionally accurate. Fire axes, extinguishers, landing gear pins, and spare light bulbs must be available, and may be represented in silhouette, in the flight simulator. This equipment must be present as near as practical to the original position			X	X	For FTD purposes, the flight deck consists of all that space forward of a cross section of the flight deck at the most extreme aft setting of the pilots' seats including additional, required crewmember duty stations and those required bulkheads aft of the pilot seats. Bulkheads containing only items such as landing gear pin storage compartments, fire axes and extinguishers, spare light bulbs, and aircraft documents pouches are not considered essential and may be omitted. If omitted, these items, or the silhouettes of these items, may be placed on the wall of the simulator, or in any other location as near as practical to the original position of these items.
1.b.	The FTD must have equipment (i.e., instruments, panels, systems, circuit breakers, and controls) simulated sufficiently for the authorized training/checking events to be accomplished. The installed equipment, must be located in a spatially correct configuration, and may be in a flight deck or an open flight deck area. Those circuit breakers that affect procedures or result in observable flight deck indications must be properly located and functionally accurate. Additional equipment required for the authorized training and checking events must be available in the FTD but may be located in a suitable location as near as practical to the spatially correct position. Actuation of this equipment must replicate the appropriate function in the helicopter. Fire axes, landing gear pins, and any similar purpose instruments need only be represented in silhouette	X	X			
2. Programming.						
2.a.	The FTD must provide the proper effect of aerodynamic changes for the combinations of drag and thrust normally encountered in flight. This must include the effect of change in helicopter attitude, thrust, drag, altitude, temperature, and configuration. Levels 6 and 7 additionally require the effects of changes in gross weight and center of gravity.Level 5 requires only generic aerodynamic programming. An SOC is required		X	X	X	
2.b.	The FTD must have the computer (analog or digital) capability (i.e., capacity, accuracy, resolution, and dynamic response) needed to meet the qualification level sought. An SOC is required	X	X	X	X	

TABLE D1A—MINIMUM FTD REQUIREMENTS—Continued

QPS requirements						Information
Entry No.	General FTD requirements	FTD level				Notes
		4	5	6	7	
2.c.	Relative responses of the flight deck instruments must be measured by latency tests or transport delay tests, and may not exceed 150 milliseconds. The instruments must respond to abrupt input at the pilot's position within the allotted time, but not before the time that the helicopter or set of helicopters respond under the same conditions • Latency: The FTD instrument and, if applicable, the motion system and the visual system response must not be prior to that time when the helicopter responds and may respond up to 150 milliseconds after that time under the same conditions. • Transport Delay: As an alternative to the Latency requirement, a transport delay objective test may be used to demonstrate that the FTD system does not exceed the specified limit. The sponsor must measure all the delay encountered by a step signal migrating from the pilot's control through all the simulation software modules in the correct order, using a handshaking protocol, finally through the normal output interfaces to the instrument display and, if applicable, the motion system, and the visual system.		X	X	X	The intent is to verify that the FTD provides instrument cues that are, within the stated time delays, like the helicopter responses. For helicopter response, acceleration in the appropriate, corresponding rotational axis is preferred.
3. Equipment Operation.						
3.a.	All relevant instrument indications involved in the simulation of the helicopter must automatically respond to control movement or external disturbances to the simulated helicopter or set of helicopters; e.g., turbulence or winds	A	X	X	X	
3.b.	Navigation equipment must be installed and operate within the tolerances applicable for the helicopter or set of helicopters. Levels 6 and 7 must also include communication equipment (inter-phone and air/ground) like that in the helicopter. Level 5 only needs that navigation equipment necessary to fly an instrument approach	A	X	X	X	
3.c.	Installed systems must simulate the applicable helicopter system operation both on the ground and in flight. At least one helicopter system must be represented. Systems must be operative to the extent that applicable normal, abnormal, and emergency operating procedures included in the sponsor's training programs can be accomplished. Levels 6 and 7 must simulate all applicable helicopter flight, navigation, and systems operation. Level 5 must have functional flight and navigational controls, displays, and instrumentation	A	X	X	X	
3.d.	The lighting environment for panels and instruments must be sufficient for the operation being conducted	X	X	X	X	Back-lighted panels and instruments may be installed but are not required.

TABLE D1A—MINIMUM FTD REQUIREMENTS—Continued

QPS requirements						Information
Entry No.	General FTD requirements	FTD level				Notes
		4	5	6	7	
3.e.	The FTD must provide control forces and control travel that correspond to the replicated helicopter or set of helicopters. Control forces must react in the same manner as in the helicopter or set of helicopters under the same flight conditions			X	X	
3.f.	The FTD must provide control forces and control travel of sufficient precision to manually fly an instrument approach. The control forces must react in the same manner as in the helicopter or set of helicopters under the same flight conditions		X			
4. Instructor or Evaluator Facilities.						
4.a.	In addition to the flight crewmember stations, suitable seating arrangements for an instructor/check airman and FAA Inspector must be available. These seats must provide adequate view of crewmember's panel(s)	X	X	X	X	These seats need not be a replica of an aircraft seat and may be as simple as an office chair placed in an appropriate position.
4.b.	The FTD must have instructor controls that permit activation of normal, abnormal, and emergency conditions, as appropriate. Once activated, proper system operation must result from system management by the crew and not require input from the instructor controls.	X	X	X	X	
5. Motion System						
5.a.	A motion system may be installed in an FTD. If installed, the motion system operation must not be distracting. If a motion system is installed and additional training, testing, or checking credits are being sought, sensory cues must also be integrated. The motion system must respond to abrupt input at the pilot's position within the allotted time, but not before the time when the helicopter responds under the same conditions. The motion system must be measured by latency tests or transport delay tests and may not exceed 150 milliseconds. Instrument response must not occur prior to motion onset	X	X	X	X	
5.b.	The FTD must have at least a vibration cueing system for characteristic helicopter vibrations noted at the pilot station(s)				X	May be accomplished by a "seat shaker" or a bass speaker sufficient to provide the necessary cueing.
6. Visual System						
6.a.	The FTD may have a visual system, if desired, although it is not required. If a visual system is installed, it must meet the following criteria:					
6.a.1.	The visual system must respond to abrupt input at the pilot's position. An SOC is required	X	X	X		
6.a.2.	The visual system must be at least a single channel, non-collimated display. An SOC is required	X	X	X		

TABLE D1A—MINIMUM FTD REQUIREMENTS—Continued

QPS requirements						Information
Entry No.	General FTD requirements	FTD level				Notes
		4	5	6	7	
6.a.3.	The visual system must provide at least a field-of-view of 18° vertical/24° horizontal for the pilot flying. An SOC is required	X	X	X		
6.a.4.	The visual system must provide for a maximum parallax of 10° per pilot. An SOC is required	X	X	X		
6.a.5.	The visual scene content may not be distracting. An SOC is required	X	X	X		
6.a.6.	The minimum distance from the pilot's eye position to the surface of a direct view display may not be less than the distance to any front panel instrument. An SOC is required	X	X	X		
6.a.7.	The visual system must provide for a minimum resolution of 5 arc-minutes for both computed and displayed pixel size. An SOC is required	X	X	X		
6.b.	If a visual system is installed and additional training, testing, or checking credits are being sought on the basis of having a visual system, a visual system meeting the standards set out for at least a Level A FFS (see Appendix A of this part) will be required. A "direct-view," non-collimated visual system (with the other requirements for a Level A visual system met) may be considered satisfactory for those installations where the visual system design "eye point" is appropriately adjusted for each pilot's position such that the parallax error is at or less than 10° simultaneously for each pilot. An SOC is required	X	X	X		
6.c.	The FTD must provide a continuous visual field-of-view of at least 146° horizontally and 36° vertically for both pilot seats, simultaneously. The minimum horizontal field-of-view coverage must be plus and minus one-half (½) of the minimum continuous field-of-view requirement, centered on the zero degree azimuth line relative to the aircraft fuselage. Additional horizontal field-of-view capability may be added at the sponsor's discretion provided the minimum field-of-view is retained. Capability for a field-of-view in excess of these minima is not required for qualification at Level 7. However, where specific tasks require extended fields of view beyond the 146° by 36° (e.g., to accommodate the use of "chin windows" where the accommodation is either integral with or separate from the primary visual system display), then such extended fields of view must be provided.. An SOC is required and must explain the geometry of the installation..				X	Optimization of the vertical field-of-view may be considered with respect to the specific helicopter flight deck cut-off angle. When considering the installation/use of augmented fields of view, as described here, it will be the responsibility of the sponsor to meet with the responsible Flight Standards office to determine the training, testing, checking, or experience tasks for which the augmented field-of-view capability may be critical to that approval.
7. Sound System						

TABLE D1A—MINIMUM FTD REQUIREMENTS—Continued

QPS requirements						Information
Entry No.	General FTD requirements	FTD level				Notes
		4	5	6	7	
7.a.	The FTD must simulate significant flight deck sounds resulting from pilot actions that correspond to those heard in the helicopter			X	X	

Note: An "A" in the table indicates that the system, task, or procedure may be examined if the appropriate helicopter system or control is simulated in the FTD and is working properly.

TABLE D1B—MINIMUM FTD REQUIREMENTS

QPS requirements						Information
Entry No.	Subjective requirements The FTD must be able to perform the tasks associated with the level of qualification sought.	FTD level				Notes
		4	5	6	7	
1. Preflight Procedures						
1.a.	Preflight Inspection (Flight Deck Only) switches, indicators, systems, and equipment.	A	A	X	X	
1.b.	APU/Engine start and run-up.					
1.b.1.	Normal start procedures	A	A	X	X	
1.b.2.	Alternate start procedures	A	A	X	X	
1.b.3.	Abnormal starts and shutdowns (hot start, hung start).	A	A	X	X	
1.c.	Taxiing—Ground				X	
1.d.	Taxiing—Hover				X	
1.e.	Pre-takeoff Checks	A	A	X	X	
2. Takeoff and Departure Phase						
2.a.	Normal takeoff.					
2.a.1.	From ground				X	
2.a.2.	From hover				X	
2.a.3	Running				X	
2.b.	Instrument			X	X	
2.c.	Powerplant Failure During Takeoff			X	X	
2.d.	Rejected Takeoff				X	
2.e.	Instrument Departure			X	X	
3. Climb						
3.a.	Normal			X	X	
3.b.	Obstacle clearance				X	
3.c.	Vertical			X	X	
3.d.	One engine inoperative			X	X	
4. In-flight Maneuvers						
4.a.	Turns (timed, normal, steep)		X	X	X	
4.b.	Powerplant Failure—Multiengine Helicopters			X	X	

TABLE D1B—MINIMUM FTD REQUIREMENTS—Continued

QPS requirements						Information
Entry No.	Subjective requirements The FTD must be able to perform the tasks associated with the level of qualification sought.	FTD level				Notes
		4	5	6	7	
4.c.	Powerplant Failure—Single-Engine Helicopters.			X	X	
4.d.	Recovery From Unusual Attitudes				X	
4.e.	Settling with Power				X	
5. Instrument Procedures						
5.a.	Instrument Arrival			X	X	
5.b.	Holding			X	X	
5.c.	Precision Instrument Approach					
5.c.1.	Normal—All engines operating		X	X	X	
5.c.2.	Manually controlled—One or more engines inoperative.			X	X	
5.d.	Non-precision Instrument Approach		X	X	X	
5.e.	Missed Approach.					
5.e.1.	All engines operating			X	X	
5.e.2.	One or more engines inoperative			X	X	
5.e.3.	Stability augmentation system failure			X	X	
6. Landings and Approaches to Landings						
6.a.	Visual Approaches (normal, steep, shallow)		X	X	X	
6.b.	Landings.					
6.b.1.	Normal/crosswind.					
6.b.1.a.	Running				X	
6.b.1.b.	From Hover				X	
6.b.2.	One or more engines inoperative				X	
6.b.3.	Rejected Landing				X	
7. Normal and Abnormal Procedures						
7.a.	Powerplant	A	A	X	X	
7.b.	Fuel System	A	A	X	X	
7.c.	Electrical System	A	A	X	X	
7.d.	Hydraulic System	A	A	X	X	
7.e.	Environmental System(s)	A	A	X	X	
7.f.	Fire Detection and Extinguisher Systems	A	A	X	X	
7.g.	Navigation and Aviation Systems	A	A	X	X	
7.h.	Automatic Flight Control System, Electronic Flight Instrument System, and Related Subsystems.	A	A	X	X	
7.i.	Flight Control Systems	A	A	X	X	
7.j.	Anti-ice and Deice Systems	A	A	X	X	

TABLE D1B—MINIMUM FTD REQUIREMENTS—Continued

QPS requirements						Information
Entry No.	Subjective requirements The FTD must be able to perform the tasks associated with the level of qualification sought.	FTD level				Notes
		4	5	6	7	
7.k.	Aircraft and Personal Emergency Equipment	A	A	X	X	
7.l.	Special Missions tasks (e.g., Night Vision goggles, Forward Looking Infrared System, External Loads and as listed on the SOQ.).				X	
8. Emergency procedures (as applicable)						
8.a.	Emergency Descent			X	X	
8.b.	Inflight Fire and Smoke Removal			X	X	
8.c.	Emergency Evacuation			X	X	
8.d.	Ditching				X	
8.e.	Autorotative Landing				X	
8.f.	Retreating blade stall recovery				X	
8.g.	Mast bumping				X	
8.h.	Loss of tail rotor effectiveness			X	X	
9. Postflight Procedures						
9.a.	After-Landing Procedures	A	A	X	X	
9.b.	Parking and Securing					
9.b.1.	Rotor brake operation	A	A	X	X	
9.b.2.	Abnormal/emergency procedures	A	A	X	X	

Note: An "A" in the table indicates that the system, task, or procedure may be examined if the appropriate aircraft system or control is simulated in the FTD and is working properly.

TABLE D1C—TABLE OF FTD SYSTEM TASKS

QPS requirements						Information
Entry No.	Subjective requirements In order to be qualified at the FTD qualification level indicated, the FTD must be able to perform at least the tasks associate with that level of qualification.	FTD level				Notes
		4	5	6	7	
1. Instructor Operating Station (IOS)						
1.a.	Power switch(es)	A	X	X	X	
1.b.	Helicopter conditions	A	A	X	X	e.g., GW, CG, Fuel loading, Systems, Ground. Crew.
1.c.	Airports/Heliports/Helicopter Landing Areas	A	X	X	X	e.g., Selection, Surface, Presets, Lighting controls.
1.d.	Environmental controls	A	X	X	X	e.g., Temp and Wind.
1.e.	Helicopter system malfunctions (Insertion/deletion)	A	A	X	X	
1.f.	Locks, Freezes, and Repositioning (as appropriate)	A	X	X	X	
1.g.	Sound Controls. (On/off/adjustment)		X	X	X	
1.h.	Motion/Control Loading System, as appropriate. On/off/emergency stop.		A	X	X	
2. Observer Seats/Stations						

TABLE D1C—TABLE OF FTD SYSTEM TASKS—Continued

QPS requirements						Information
Entry No.	Subjective requirements In order to be qualified at the FTD qualification level indicated, the FTD must be able to perform at least the tasks associate with that level of qualification.	FTD level				Notes
		4	5	6	7	
2.a.	Position/Adjustment/Positive restraint system	A	X	X	X	

Note: An "A" in the table indicates that the system, task, or procedure may be examined if the appropriate simulator system or control is in the FTD and is working properly.

ATTACHMENT 2 TO APPENDIX D TO PART 60—FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS

BEGIN INFORMATION

1. DISCUSSION

a. If relevant winds are present in the objective data, the wind vector (magnitude and direction) should be noted as part of the data presentation, expressed in conventional terminology, and related to the runway being used for the test.

b. The format for numbering the objective tests in Appendix C of this part, Attachment 2, Table C2A, and the objective tests in Appendix D of this part, Attachment 2, Table D2A, is identical. However, each test required for FFSs is not necessarily required for FTDs, and each test required for FTDs is not necessarily required for FFSs. When a test number (or series of numbers) is not required, the term "Reserved" is used in the table at that location. Following this numbering format provides a degree of commonality between the two tables and substantially reduces the potential for confusion when referring to objective test numbers for either FFSs or FTDs.

c. A Level 4 FTD does not require objective tests and is not addressed in the following table.

END INFORMATION

BEGIN QPS REQUIREMENTS

2. TEST REQUIREMENTS

a. The ground and flight tests required for qualification are listed in Table D2A Objective Evaluation Tests. Computer generated FTD test results must be provided for each test except where an alternate test is specifically authorized by the responsible Flight Standards office. If a flight condition or operating condition is required for the test but does not apply to the helicopter being simulated or to the qualification level sought, it may be disregarded (e.g., engine out climb capability for a single-engine helicopter). Each test result is compared against the validation data described in §60.13, and in Appendix B of this part. The results must be produced on an appropriate recording device acceptable to the responsible Flight Standards office and must include FTD number, date, time, conditions, tolerances, and appropriate dependent variables portrayed in comparison to the validation data. Time histories are required unless otherwise indicated in Table D2A. All results must be labeled using the tolerances and units given.

b. Table D2A in this attachment sets out the test results required, including the parameters, tolerances, and flight conditions for FTD validation. Tolerances are provided for the listed tests because mathematical modeling and acquisition and development of reference data are often inexact. All tolerances listed in the following tables are applied to FTD performance. When two tolerance values are given for a parameter, the less restrictive may be used unless otherwise indicated. In those cases where a tolerance is expressed only as a percentage, the tolerance percentage applies to the maximum value of that parameter within its normal operating range as measured from the neutral or zero position unless otherwise indicated.

c. Certain tests included in this attachment must be supported with an SOC. In Table D2A, requirements for SOCs are indicated in the "Test Details" column.

d. When operational or engineering judgment is used in making assessments for flight test data applications for FTD validity, such judgment must not be limited to a single parameter. For example, data that exhibit rapid variations of the measured parameters may require interpolations or a "best fit" data section. All relevant parameters related to a given maneuver or flight condition must be provided to allow overall interpretation. When it is difficult or impossible to match FTD to helicopter data throughout a time history, differences must be justified by providing a comparison of other related variables for the condition being assessed.

e. The FTD may not be programmed so that the mathematical modeling is correct only at the validation test points. Unless noted otherwise, tests must represent helicopter performance and handling qualities at operating weights and centers of gravity

(CG) typical of normal operation. If a test is supported by aircraft data at one extreme weight or CG, another test supported by aircraft data at mid-conditions or as close as possible to the other extreme is necessary. Certain tests that are relevant only at one extreme CG or weight condition need not be repeated at the other extreme. The results of the tests for Level 6 are expected to be indicative of the device's performance and handling qualities throughout all of the following:

(1) The helicopter weight and CG envelope.

(2) The operational envelope.

(3) Varying atmospheric ambient and environmental conditions—including the extremes authorized for the respective helicopter or set of helicopters.

f. When comparing the parameters listed to those of the helicopter, sufficient data must also be provided to verify the correct flight condition and helicopter configuration changes. For example, to show that control force is within the parameters for a static stability test, data to show the correct airspeed, power, thrust or torque, helicopter configuration, altitude, and other appropriate datum identification parameters must also be given. If comparing short period dynamics, normal acceleration may be used to establish a match to the helicopter, but airspeed, altitude, control input, helicopter configuration, and other appropriate data must also be given. If comparing landing gear change dynamics, pitch, airspeed, and altitude may be used to establish a match to the helicopter, but landing gear position must also be provided. All airspeed values must be properly annotated (e.g., indicated versus calibrated). In addition, the same variables must be used for comparison (e.g., compare inches to inches rather than inches to centimeters).

g. The QTG provided by the sponsor must clearly describe how the FTD will be set up and operated for each test. Each FTD subsystem may be tested independently, but overall integrated testing of the FTD must be accomplished to assure that the total FTD system meets the prescribed standards. A manual test procedure with explicit and detailed steps for completing each test must also be provided.

h. For previously qualified FTDs, the tests and tolerances of this attachment may be used in subsequent continuing qualification evaluations for any given test if the sponsor has submitted a proposed MQTG revision to the responsible Flight Standard office and has received responsible Flight Standards office approval.

i. Tests of handling qualities must include validation of augmentation devices. FTDs for highly augmented helicopters will be validated both in the unaugmented configuration (or failure state with the maximum permitted degradation in handling qualities) and the augmented configuration. Where various levels of handling qualities result from failure states, validation of the effect of the failure is necessary. For those performance and static handling qualities tests where the primary concern is control position in the unaugmented configuration, unaugmented data are not required if the design of the system precludes any affect on control position. In those instances where the unaugmented helicopter response is divergent and non-repeatable, it may not be feasible to meet the specified tolerances. Alternative requirements for testing will be mutually agreed upon by the sponsor and the responsible Flight Standards office on a case-by-case basis.

j. Some tests will not be required for helicopters using helicopter hardware in the FTD flight deck (e.g., ''helicopter modular controller''). These exceptions are noted in Section 2 ''Handling Qualities'' in Table D2A of this attachment. However, in these cases, the sponsor must provide a statement that the helicopter hardware meets the appropriate manufacturer's specifications and the sponsor must have supporting information to that fact available for responsible Flight Standards office review.

k. In cases where light-class helicopters are being simulated, prior coordination with the responsible Flight Standards office on acceptable weight ranges is required. The terms ''light,'' ''medium,'' and ''near maximum,'' may not be appropriate for the simulation of light-class helicopters.

END QPS REQUIREMENTS

BEGIN INFORMATION

l. In those cases where the objective test results authorize a ''snapshot test'' or a ''series of snapshot test'' results in lieu of a time-history result, the sponsor or other data provider must ensure that a steady state condition exists at the instant of time captured by the ''snapshot.'' The steady state condition must exist from 4 seconds prior to, through 1 second following, the instant of time captured by the snap shot.

m. Refer to AC 120–27, Aircraft Weight and Balance; and FAA–H–8083–1, Aircraft Weight and Balance Handbook, for more information.

END INFORMATION

TABLE D2A—FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS

QPS requirements								Information
Test		Tolerances	Flight conditions	Test details	FTD level			Notes
Entry No.	Title				5	6	7	
1.	**Performance**							
1.a.	Engine Assessment.							
1.a.1.	Start Operations.							
1.a.1.a.	Engine start and acceleration (transient).	Light Off Time—±10% or ±1 sec. Torque—±5% Rotor Speed—±3% Fuel Flow—±10% Gas Generator Speed—±5% Power Turbine Speed—±5% Gas Turbine Temp—±30 °C.	Ground with the Rotor Brake Used and Not Used.	Record each engine start from the initiation of the start sequence to steady state idle and from steady state idle to operating RPM.		X	X	
1.a.1.b.	Steady State Idle and Operating RPM conditions.	Torque—±3% Rotor Speed—±1.5% Fuel Flow—±5% Gas Generator Speed—±2% Power Turbine Speed—±2% Turbine Gas Temp—±20 °C.	Ground	Record both steady state idle and operating RPM conditions. May be a series of snapshot tests.	X	X	X	
1.a.2.	Power Turbine Speed Trim.	±10% of total change of power turbine speed; or ±0.5% change of rotor speed.	Ground	Record engine response to trim system actuation in both directions.		X	X	
1.a.3.	Engine and Rotor Speed Governing.	Torque—±5% Rotor Speed—±1.5%.	Climb Descent	Record results using a step input to the collective. May be conducted concurrently with climb and descent performance tests.		X	X	
1.b.	Reserved.							
1.c.	Takeoff.							

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1.c.1.	All Engines	Airspeed—±3 kt, Altitude—±20 ft (6.1 m) Torque—±3%, Rotor Speed—±1.5%, Vertical Velocity—±100 fpm (0.50 m/sec) or 10%, Pitch Attitude—±1.5°, Bank Attitude—±2°, Heading—±2°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Ground/Takeoff and Initial Segment of Climb.	Record results of takeoff flight path (running takeoff and takeoff from a hover). The criteria apply only to those segments at airspeeds above effective translational lift. Results must be recorded from the initiation of the takeoff to at least 200 ft (61 m) AGL.			X	
1.c.2. through 1.c.3	Reserved.							
1.d.	Hover.							
	Performance	Torque—±3%, Pitch Attitude—±1.5°, Bank Attitude—±1.5°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	In Ground Effect (IGE); and Out of Ground Effect (OGE).	Record results for light and heavy gross weights. May be a series of snapshot tests.			X	
1.e.	Vertical Climb.							
	Performance	Vertical Velocity—±100 fpm (0.50 m/sec) or ±10%, Directional Control Position—±5%, Collective Control Position—±5%.	From OGE Hover	Record results for light and heavy gross weights. May be a series of snapshot tests.			X	
1.f.	Level Flight.							
	Performance and Trimmed Flight Control Positions.	Torque—±3% Pitch Attitude—±1.5° Sideslip Angle—±2° Longitudinal Control Position—±5% Lateral Control position—±5% Directional Control Position—±5% Collective Control Position—±5%.	Cruise (Augmentation On and Off).	Record results for two gross weight and CG combinations with varying trim speeds throughout the airspeed envelope. May be a series of snapshot tests.	X	X	X	This test validates performance at speeds above maximum endurance airspeed.
1.g.	Climb.							

TABLE D2A—FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerances	Flight conditions	Test details	FTD level			Notes
Entry No.	Title				5	6	7	
	Performance and Trimmed Flight Control Positions.	Vertical Velocity—±100 fpm (61 m/sec) or ±10% Pitch Attitude—±1.5° Sideslip Angle—±2° Longitudinal Control Position—±5% Lateral Control Position—±5% Directional Control Position—±5% Collective Control Position—±5%.	All engines operating One engine inoperative. Augmentation System(s) On and Off.	Record results for two gross weight and CG combinations. The data presented must be for normal climb power conditions. May be a series of snapshot tests.	X	X	X	
1.h.	Descent.							
1.h.1.	Descent Performance and Trimmed Flight Control Positions.	Torque—±3% Pitch Attitude—±1.5° Sideslip Angle—±2° Longitudinal Control Position—±5% Lateral Control Position—±5% Directional Control Position—±5% Collective Control Position—±5%.	At or near 1,000 fpm (5 m/sec) rate of descent (RoD) at normal approach speed. Augmentation System(s) On and Off.	Record results for two gross weight and CG combinations. May be a series of snapshot tests.	X	X	X	
1.h.2.	Autorotation Performance and Trimmed Flight Control Positions.	Pitch Attitude—±1.5° Sideslip Angle—±2° Longitudinal Control Position—±5% Lateral Control Position—±5% Directional Control Position—±5% Collective Control Position—±5%.	Steady descents. Augmentation System(s) On and Off.	Record results for two gross weight conditions. Data must be recorded for normal operating RPM. (Rotor speed tolerance applies only if collective control position is full down.) Data must be recorded for speeds from 50 kts, ±5 kts through at least maximum glide distance airspeed. May be a series of snapshot tests.	X	X	X	
1.i.	Autorotation.							

	Entry	Rotor Speed—±3% Pitch Attitude ±2° Roll Attitude—±3° Yaw Attitude—±5° Airspeed—±5 kts. Vertical Velocity—±200 fpm (1.00 m/sec) or 10%.	Cruise; or Climb	Record results of a rapid throttle reduction to idle. If accomplished in cruise, results must be for the maximum range airspeed. If accomplished in climb, results must be for the maximum rate of climb airspeed at or near maximum continuous power.		X	X	
1.j.	Landing.							
1.j.1.	All Engines	Airspeed—±3 kts, Altitude—±20 ft (6.1 m) Torque—±3%, Rotor Speed—±1.5%, Pitch Attitude—±1.5°, Bank Attitude—±1.5°, Heading—±2°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Approach	Record results of the approach and landing profile (running landing or approach to a hover). The criteria apply only to those segments at airspeeds above effective translational lift. Record the results from 200 ft AGL (61 m) to the landing or to where the hover is established prior to landing.			X	
1.j.2. through 1.j.3	Reserved.							

TABLE D2A—FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS—Continued

QPS requirements									Information
Test		Tolerances	Flight conditions	Test details	FTD level			Notes
Entry No.	Title				5	6	7	
1.j.4.	Autorotational Landing.	Torque—±3%, Rotor Speed—±3%, Vertical Velocity—±100 fpm (0.50 m/sec) or 10%, Pitch Attitude—±2°, Bank Attitude—±2°, Heading—±5°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Landing.	Record the results of an autorotational deceleration and landing from a stabilized autorotational descent, to touch down..	....	....	X	If flight test data containing all required parameters for a complete power-off landing is not available from the aircraft manufacturer for this test, and other qualified flight test personnel are not available to acquire this data, the sponsor must coordinate with the responsible Flight Standards office to determine if it would be appropriate to accept alternative testing means. Alternative approaches to this data acquisition that may be acceptable are: (1) a simulated autorotational flare and reduction of rate of descent (ROD) at altitude; or (2) a power-on termination following an autorotational approach and flare.
2.	**Handling Qualities**							
2.a.	Control System Mechanical Characteristics..	Contact the responsible Flight Standards office for clarification of any issue regarding helicopters with reversible controls..						
2.a.1.	Cyclic	Breakout—±0.25 lbs (0.112 daN) or 25%. Force—±1.0 lb (0.224 daN) or 10%.	Ground; Static conditions. Trim On and Off. Friction Off. Augmentation On and Off.	Record results for an uninterrupted control sweep to the stops. (This test does not apply if aircraft hardware modular controllers are used.).	X	X	X	

2.a.2.	Collective and Pedals	Breakout—±0.5 lb (0.224 daN) or 25%. Force—±1.0 lb (0.224 daN) or 10%.	Ground; Static conditions. Trim On and Off. Friction Off. Augmentation On and Off.	Record results for an uninterrupted control sweep to the stops.	X	X	X	
2.a.3.	Brake Pedal Force vs. Position.	±5 lbs (2.224 daN) or 10%	Ground; Static conditions.		X	X	X	
2.a.4.	Trim System Rate (all applicable systems).	Rate—±10%	Ground; Static conditions. Trim On. Friction Off.	The tolerance applies to the recorded value of the trim rate.	X	X	X	
2.a.5.	Control Dynamics (all axes).	±10% of time for first zero crossing and ±10 (N + 1)% of period thereafter. ±10% of amplitude of first overshoot. ±20% of amplitude of 2nd and subsequent overshoots greater than 5% of initial displacement. ±1 overshoot.	Hover/Cruise Trim On Friction Off.	Results must be recorded for a normal control displacement in both directions in each axis, using 25% to 50% of full throw.		X	X	Control Dynamics for irreversible control systems may be evaluated in a ground/static condition. Refer to paragraph 3 of this attachment for additional information. "N" is the sequential period of a full cycle of oscillation.
2.a.6.	Freeplay	±0.10 in. (±2.5 mm)	Ground; Static conditions.	Record and compare results for all controls.	X	X	X	
2.b.	Low Airspeed Handling Qualities.							
2.b.1.	Trimmed Flight Control Positions.	Torque ±3% Pitch Attitude ±1.5° Bank Attitude ±2° Longitudinal Control Position ±5% Lateral Control Position ±5% Directional Control Position ±5% Collective Control Position ±5%.	Translational Flight IGE—Sideward, rearward, and forward flight. Augmentation On and Off.	Record results for several airspeed increments to the translational airspeed limits and for 45 kts. forward airspeed. May be a series of snapshot tests.			X	
2.b.2.	Critical Azimuth	Torque ±3% Pitch Attitude ±1.5°, Bank Attitude ±2°, Longitudinal Control Position ±5%, Lateral Control Position ±5%, Directional Control Position ±5%, Collective Control Position ±5%.	Stationary Hover. Augmentation On and Off.	Record results for three relative wind directions (including the most critical case) in the critical quadrant. May be a series of snapshot tests.			X	
2.b.3.	Control Response.							

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TABLE D2A—FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerances	Flight conditions	Test details	FTD level			Notes
Entry No.	Title				5	6	7	
2.b.3.a.	Longitudinal	Pitch Rate—±10% or ±2°/sec. Pitch Attitude Change—±10% or 1.5°.	Hover. Augmentation On and Off.	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases. This test must be conducted in a hover, in ground effect, without entering translational flight.			X	This is a "short time" test.
2.b.3.b.	Lateral	Roll Rate—±10% or ±3°/sec. Roll Attitude Change—±10% or ±3°.	Hover Augmentation On and Off.	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.			X	This is a "short time" test conducted in a hover, in ground effect, without entering translational flight, to provide better visual reference.
2.b.3.c.	Directional	Yaw Rate—±10% or ±2°/sec. Heading Change—±10% or ±2°.	Hover Augmentation On and Off.	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases. This test must be conducted in a hover, in ground effect, without entering translational flight.			X	This is a "short time" test.
2.b.3.d.	Vertical	Normal Acceleration ±0.1g	Hover Augmentation On and Off.	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.			X	
2.c.	Longitudinal Handling Qualities.							
2.c.1.	Control Response	Pitch Rate—±10% or ±2°/sec. Pitch Attitude Change—±10% or ±1.5°.	Cruise Augmentation On and Off.	Results must be recorded for two cruise airspeeds to include minimum power required speed. Record data for a step control input. The Off-axis response must show correct trend for unaugmented cases.	X	X	X	

2.c.2.	Static Stability	Longitudinal Control Position: ±10% of change from trim or ±0.25 in. (6.3 mm) or Longitudinal Control Force: ±0.5 lb. (0.223 daN) or ±10%.	Cruise or Climb. Autorotation. Augmentation On and Off.	Record results for a minimum of two speeds on each side of the trim speed. May be a series of snapshot tests.	X	X	X	
2.c.3.	Dynamic Stability.							
2.c.3.a.	Long Term Response	±10% of calculated period. ±10% of time to ½ or double amplitude, or ±0.02 of damping ratio. For non-periodic responses, the time history must be matched within ±3° pitch; and ±5 kts airspeed over a 20 sec period following release of the controls.	Cruise Augmentation On and Off.	Record results for three full cycles (6 overshoots after input completed) or that sufficient to determine time to ½ or double amplitude, whichever is less. For non-periodic responses, the test may be terminated prior to 20 sec if the test pilot determines that the results are becoming uncontrollably divergent. Displace the cyclic for one second or less to excite the test. The result will be either convergent or divergent and must be recorded. If this method fails to excite the test, displace the cyclic to the predetermined maximum desired pitch attitude and return to the original position. If this method is used, record the results.	X	X	X	The response for certain helicopters may be unrepeatable throughout the stated time. In these cases, the test should show at least that a divergence is identifiable. For example: Displacing the cyclic for a given time normally excites this test or until a given pitch attitude is achieved and then return the cyclic to the original position. For non-periodic responses, results should show the same convergent or divergent character as the flight test data.
2.c.3.b.	Short Term Response	±1.5° Pitch or ±2°/sec. Pitch Rate. ±0.1 g Normal Acceleration.	Cruise or Climb. Augmentation On and Off.	Record results for at least two airspeeds.		X	X	A control doublet inserted at the natural frequency of the aircraft normally excites this test. However, while input doublets are preferred over pulse inputs for Augmentation-Off tests, for Augmentation-On cases, when the short term response exhibits 1st-order or deadbeat characteristics, longitudinal pulse inputs may produce a more coherent response.

TABLE D2A—FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerances	Flight conditions	Test details	FTD level			Notes
Entry No.	Title				5	6	7	
2.c.4.	Maneuvering Stability	Longitudinal Control Position—±10% of change from trim or ±0.25 in. (6.3 mm) or Longitudinal Control Forces—±0.5 lb. (0.223 daN) or ±10%.	Cruise or Climb. Augmentation On and Off.	Record results for at least two airspeeds at 30°–45° bank angle. The force may be shown as a cross plot for irreversible systems. May be a series of snapshot tests.		X	X	
2.d.	Lateral and Directional Handling Qualities.							
2.d.1.	Control Response.							
2.d.1.a.	Lateral	Roll Rate—±10% or ±3°/sec. Roll Attitude Change—±10% or ±3°.	Cruise Augmentation On and Offd.	Record results for at least two airspeeds, including the speed at or near the minimum power required airspeed. Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.	X	X	X	
2.d.1.b.	Directional	Yaw Rate—±10% or ±2°/sec. Yaw Attitude Change—±10% or ±2°.	Cruise Augmentation On and Off.	Record data for at least two Airspeeds, including the speed at or near the minimum power required airspeed. Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.	X	X	X	

2.d.2.	Directional Static Stability.	Lateral Control Position—±10% of change from trim or ±0.25 in. (6.3 mm) or Lateral Control Force—±0.5 lb. (0.223 daN) or 10%. Roll Attitude—±1.5 Directional Control Position—±10% of change from trim or ±0.25 in. (6.3 mm) or Directional Control Force—±1 lb. (0.448 daN) or 10%. Longitudinal Control Position—±10% of change from trim or ±0.25 in. (6.3 mm). Vertical Velocity—±100 fpm (0.50m/sec) or 10%.	Cruise; or Climb (may use Descent instead of Climb if desired) Augmentation On and Off.	Record results for at least two sideslip angles on either side of the trim point. The force may be shown as a cross plot for irreversible systems. May be a series of snapshot tests.	X	X	X	This is a steady heading sideslip test at a fixed collective position.
2.d.3.	Dynamic Lateral and Directional Stability.							
2.d.3.a.	Lateral-Directional Oscillations.	±0.5 sec. or ±10% of period. ±10% of time to ½ or double amplitude or ±0.02 of damping ratio. ±20% or ±1 sec of time difference between peaks of bank and sideslip. For non-periodic responses, the time history must be matched within ±10 knots Airspeed; ±5°/s Roll Rate or ±5° Roll Attitude; ±4°/s Yaw Rate or ±4° Yaw Angle over a 20 sec period roll angle following release of the controls.	Cruise or Climb Augmentation On and Off.	Record results for at least two airspeeds. The test must be initiated with a cyclic or a pedal doublet input. Record results for six full cycles (12 overshoots after input completed) or that sufficient to determine time to ½ or double amplitude, whichever is less. The test may be terminated prior to 20 sec if the test pilot determines that the results are becoming uncontrollably divergent.	X	X	X	
2.d.3.b.	Spiral Stability	±2° or ±10% roll angle	Cruise or Climb. Augmentation On and Off.	Record the results of a release from pedal only or cyclic only turns for 20 sec. Results must be recorded from turns in both directions. Terminate check at zero roll angle or when the test pilot determines that the attitude is becoming uncontrollably divergent.	X	X	X	
2.d.3.c.	Adverse/Proverse Yaw ..	Correct Trend, ±2° transient sideslip angle.	Cruise or Climb. Augmentation On and Off.	Record the time history of initial entry into cyclic only turns, using only a moderate rate for cyclic input. Results must be recorded for turns in both directions.	X	X	X	
3.	**Reserved**							

TABLE D2A—FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerances	Flight conditions	Test details	FTD level			Notes
Entry No.	Title				5	6	7	
4.	**Visual System**							
4.a.	Visual System Response Time: (Choose either test 4.a.1. or 4.a.2. to satisfy test 4.a., Visual System Response Time Test. This test is also sufficient for flight deck instrument response timing.)					....	....	
4.a.1.	Latency.							
		150 ms (or less) after helicopter response.	Takeoff, climb, and descent.	One test is required in each axis (pitch, roll and yaw) for each of the three conditions (take-off, cruise, and approach or landing).			X	
4.a.2.	Transport Delay.							
		150 ms (or less) after controller movement.	N/A	A separate test is required in each axis (pitch, roll, and yaw).			X	
4.b.	Field-of-view.							
4.b.1.	Reserved.							
4.b.2.	Continuous visual field-of-view.	Minimum continuous field-of-view providing 146° horizontal and 36° vertical field-of-view for each pilot simultaneously and any geometric error between the Image Generator eye point and the pilot eye point is 8° or less.	N/A	An SOC is required and must explain the geometry of the installation. Horizontal field-of-view must not be less than a total of 146° (including not less than 73° measured either side of the center of the design eye point). Additional horizontal field-of-view capability may be added at the sponsor's discretion provided the minimum field-of-view is retained. Vertical field-of-view: Not less than a total of 36° measured from the pilot's and co-pilot's eye point.			X	Horizontal field-of-view is centered on the zero degree azimuth line relative to the aircraft fuselage.
4.b.3.	Reserved.							

4.c.	Surface contrast ratio	Not less than 5:1	N/A	The ratio is calculated by dividing the brightness level of the center, bright square (providing at least 2 foot-lamberts or 7 cd/m²) by the brightness level of any adjacent dark square.			X	Measurements may be made using a 1° spot photometer and a raster drawn test pattern filling the entire visual scene (all channels) with a test pattern of black and white squares, 5 per square, with a white square in the center of each channel. During contrast ratio testing, simulator aft-cab and flight deck ambient light levels should be zero.
4.d.	Highlight brightness	Not less than three (3) foot-lamberts (10 cd/m²).	N/A	Measure the brightness of the center white square while superimposing a highlight on that white square. The use of calligraphic capabilities to enhance the raster brightness is acceptable, but measuring light points is not acceptable.			X	Measurements may be made using a 1° spot photometer and a raster drawn test pattern filling the entire visual scene (all channels) with a test pattern of black and white squares, 5 per square, with a white square in the center of each channel.
4.e.	Surface resolution	Not greater than two (2) arc minutes.	N/A	An SOC is required and must include the relevant calculations.			X	When the eye is positioned on a 3° glide slope at the slant range distances indicated with white runway markings on a black runway surface, the eye will subtend two (2) arc minutes: (1) A slant range of 6,876 ft with stripes 150 ft long and 16 ft wide, spaced 4 ft apart. (2) For Configuration A; a slant range of 5,157 feet with stripes 150 ft long and 12 ft wide, spaced 3 ft apart. (3) For Configuration B; a slant range of 9,884 feet, with stripes 150 ft long and 5.75 ft wide, spaced 5.75 ft apart.

TABLE D2A—FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS—Continued

QPS requirements								Information
Test		Tolerances	Flight conditions	Test details	FTD level			Notes
Entry No.	Title				5	6	7	
4.f.	Light point size	Not greater than five (5) arc-minutes.	N/A	An SOC is required and must include the relevant calculations.			X	Light point size may be measured using a test pattern consisting of a centrally located single row of light points reduced in length until modulation is just discernible in each visual channel. A row of 48 lights will form a 4° angle or less.
4.g.	Light point contrast ratio							A 1° spot photometer may be used to measure a square of at least 1° filled with light points (where light point modulation is just discernible) and compare the results to the measured adjacent background. During contrast ratio testing, simulator aft-cab and flight deck ambient light levels should be zero.
4.g.1.	Reserved.							
4.g.2.		Not less than 25:1	N/A	An SOC is required and must include the relevant calculations.			X	
4.h.	Visual ground segment.							

		The visible segment in the simulator must be within 20% of the segment computed to be visible from the helicopter flight deck. The tolerance(s) may be applied at either end or at both ends of the displayed segment. However, lights and ground objects computed to be visible from the helicopter flight deck at the near end of the visible segment must be visible in the simulator.	Landing configuration, trimmed for appropriate airspeed, at 100 ft (30m) above the touchdown zone, on glide slope with an RVR value set at 1,200 ft (350m).	The QTG must contain relevant calculations and a drawing showing the data used to establish the helicopter location and the segment of the ground that is visible considering design eyepoint, helicopter attitude, flight deck cut-off angle, and a visibility of 1200 ft (350 m) RVR. Simulator performance must be measured against the QTG calculations. The data submitted must include at least the following: (1) Static helicopter dimensions as follows: (i) Horizontal and vertical distance from main landing gear (MLG) to glideslope reception antenna. (ii) Horizontal and vertical distance from MLG to pilot's eyepoint. (iii) Static flight deck cutoff angle. (2) Approach data as follows: (i) Identification of runway. (ii) Horizontal distance from runway threshold to glideslope intercept with runway. (iii) Glideslope angle. (iv) Helicopter pitch angle on approach. (3) Helicopter data for manual testing: (i) Gross weight. (ii) Helicopter configuration. (iii) Approach airspeed. If non-homogenous fog is used to obscure visibility, the vertical variation in horizontal visibility must be described and be included in the slant range visibility calculation used in the computations.			X	Pre-position for this test is encouraged, but may be achieved via manual or autopilot control to the desired position.
5.	**Reserved**							

EDITORIAL NOTE: At 87 FR 75832, December 9, 2022, appendix D to part 60 was amended in attachment 2, in table D2A, by revising entries for 1.j.4. and 2.a.; however, the amendment could not be incorporated because the revised entry was photographed.

BEGIN INFORMATION

3. CONTROL DYNAMICS

a. The characteristics of a helicopter flight control system have a major effect on the handling qualities. A significant consideration in pilot acceptability of a helicopter is the ''feel'' provided through the flight deck controls. Considerable effort is expended on helicopter feel system design in order to deliver a system with which pilots will be comfortable and consider the helicopter desirable to fly. In order for an FTD to be representative, it too must present the pilot with the proper feel; that of the respective helicopter. Compliance with this requirement is determined by comparing a recording of the control feel dynamics of the FFS to actual helicopter measurements in the hover and cruise configurations.

(1) Recordings such as free response to an impulse or step function are classically used to estimate the dynamic properties of electromechanical systems. It is only possible to estimate the dynamic properties as a result of only being able to estimate true inputs and responses. Therefore, it is imperative that the best possible data be collected since close matching of the FTD control loading system to the helicopter systems is essential. Control feel dynamic tests are described in the Table of Objective Tests in this appendix. Where accomplished, the free response is measured after a step or pulse input is used to excite the system.

(2) For initial and upgrade evaluations, it is required that control dynamic characteristics be measured at and recorded directly from the flight deck controls. This procedure is usually accomplished by measuring the free response of the controls using a step or pulse input to excite the system. The procedure must be accomplished in hover, climb, cruise, and autorotation. For helicopters with irreversible control systems, measurements may be obtained on the ground. The procedure should be accomplished in the hover and cruise flight conditions and configurations. Proper pitot-static inputs (if appropriate) must be provided to represent airspeeds typical of those encountered in flight.

(3) It may be shown that for some helicopters, climb, cruise, and autorotation have like effects. Thus, some tests for one may suffice for some tests for another. If either or both considerations apply, engineering validation or helicopter manufacturer rationale must be submitted as justification for ground tests or for eliminating a configuration. For FTDs requiring static and dynamic tests at the controls, special test fixtures will not be required during initial and upgrade evaluations if the sponsor's QTG shows both test fixture results and the results of an alternative approach, such as computer plots which were produced concurrently and show satisfactory agreement. Repeat of the alternative method during the initial evaluation satisfies this test requirement.

b. Control Dynamics Evaluations. The dynamic properties of control systems are often stated in terms of frequency, damping, and a number of other classical measurements which can be found in texts on control systems. In order to establish a consistent means of validating test results for FTD control loading, criteria are needed that will clearly define the interpretation of the measurements and the tolerances to be applied. Criteria are needed for both the underdamped system and the overdamped system, including the critically damped case. In the case of an underdamped system with very light damping, the system may be quantified in terms of frequency and damping. In critically damped or overdamped systems, the frequency and damping is not readily measured from a response time history. Therefore, some other measurement must be used.

(1) Tests to verify that control feel dynamics represent the helicopter must show that the dynamic damping cycles (free response of the control) match that of the helicopter within specified tolerances. The method of evaluating the response and the tolerance to be applied are described below for the underdamped and critically damped cases.

(a) Underdamped Response. Two measurements are required for the period, the time to first zero crossing (in case a rate limit is present) and the subsequent frequency of oscillation. It is necessary to measure cycles on an individual basis in case there are nonuniform periods in the response. Each period will be independently compared to the respective period of the helicopter control system and, consequently, will enjoy the full tolerance specified for that period.

(b) The damping tolerance will be applied to overshoots on an individual basis. Care must be taken when applying the tolerance to small overshoots since the significance of such overshoots becomes questionable. Only those overshoots larger than 5 percent of the total initial displacement will be considered significant. The residual band, labeled $T(A_d)$ on Figure 1 of this attachment is ±5 percent of the initial displacement amplitude, A_d, from the steady state value of the oscillation. Oscillations within the residual band are considered insignificant. When comparing simulator data to helicopter data, the process would begin by overlaying or aligning the simulator and helicopter steady state values and then comparing amplitudes of oscillation peaks, the time of the first zero crossing, and individual periods of oscillation. To be satisfactory, the simulator must show the same number of significant overshoots to within one when compared against the helicopter data. The procedure for evaluating the response is illustrated in Figure 1 of this attachment.

(c) Critically Damped and Overdamped Response. Due to the nature of critically damped responses (no overshoots), the time to reach 90 percent of the steady state (neutral point) value must be the same as the helicopter within ±10 percent. The simulator response must be critically damped also. Figure 2 of this attachment illustrates the procedure.

(d) Special considerations. Control systems that exhibit characteristics other than classical overdamped or underdamped responses should meet specified tolerances. In addition, special consideration should be given to ensure that significant trends are maintained.

(2) Tolerances.

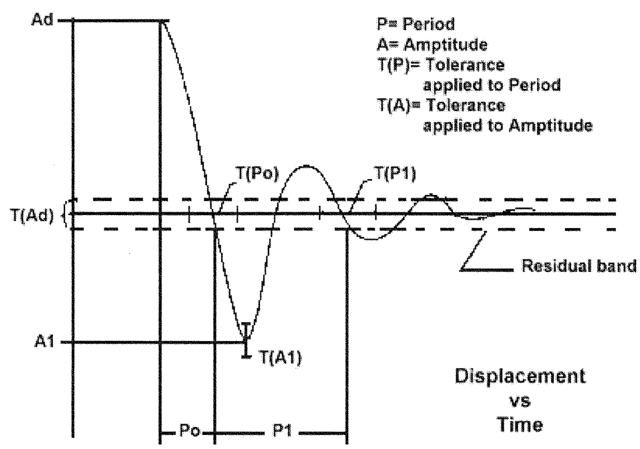
(a) The following summarizes the tolerances, ''T'' for underdamped systems, and ''n'' is the sequential period of a full cycle of oscillation. See Figure D2A of this attachment for an illustration of the referenced measurements.

$T(P_0)$ ±10% of P_0
$T(P_1)$ ±20% of P_1
$T(P_2)$ ±30% of P_2
$T(P_n)$ ±10(n + 1)% of P_n
$T(A_n)$ ±10% of A_1
$T(A_d)$ ±5% of A_d = residual band
Significant overshoots First overshoot and ±1 subsequent overshoots

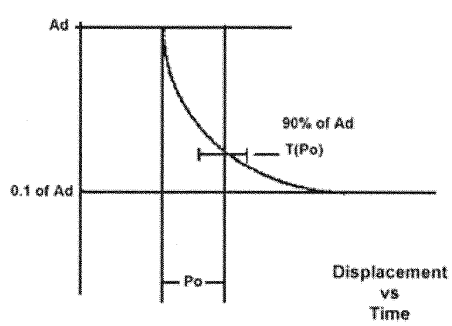
(b) The following tolerance applies to critically damped and overdamped systems only. See Figure D2B for an illustration of the reference measurements:

$T(P_0)$ ±10% of P_0

Attachment 2 to Appendix D to Part 60—
Figure D2A. Under-Damped Step Response



Attachment 2 to Appendix D to Part 60—
Figure D2B. Critically-Damped Step Response



End Information

Begin QPS Requirement

c. Alternative method for control dynamics evaluation.

(1) An alternative means for validating control dynamics for aircraft with hydraulically powered flight controls and artificial feel systems is by the measurement of control force and rate of movement. For each axis of pitch, roll, and yaw, the control must be forced to its maximum extreme position for the following distinct rates. These tests are conducted under normal flight and ground conditions.

(a) Static test—Slowly move the control so that a full sweep is achieved within 95–105 seconds. A full sweep is defined as movement of the controller from neutral to the stop, usually aft or right stop, then to the opposite stop, then to the neutral position.

(b) Slow dynamic test—Achieve a full sweep within 8–12 seconds.

(c) Fast dynamic test—Achieve a full sweep within 3–5 seconds.

NOTE: Dynamic sweeps may be limited to forces not exceeding 100 lbs. (44.5 daN).

(d) Tolerances.

(i) Static test; see Table D2A, Flight Training Device (FTD) Objective Tests, Entries 2.a.1., 2.a.2., and 2.a.3.

(ii) Dynamic test—±2 lbs (0.9 daN) or ±10% on dynamic increment above static test.

END QPS REQUIREMENT

BEGIN INFORMATION

d. The FAA is open to alternative means that are justified and appropriate to the application. For example, the method described here may not apply to all manufacturers' systems and certainly not to aircraft with reversible control systems. Each case is considered on its own merit on an ad hoc basis. If the FAA finds that alternative methods do not result in satisfactory performance, more conventionally accepted methods will have to be used.

4. FOR ADDITIONAL INFORMATION ON THE FOLLOWING TOPICS, PLEASE REFER TO APPENDIX C OF THIS PART, ATTACHMENT 2, AND THE INDICATED PARAGRAPH WITHIN THAT ATTACHMENT

• Additional Information About Flight Simulator Qualification for New or Derivative Helicopters, paragraph 8.

• Engineering Simulator Validation Data, paragraph 9.

• Validation Test Tolerances, paragraph 11.

• Validation Data Road Map, paragraph 12.

• Acceptance Guidelines for Alternative Avionics, paragraph 13.

• Transport Delay Testing, paragraph 15.

• Continuing Qualification Evaluation Validation Data Presentation, paragraph 16.

END INFORMATION

ATTACHMENT 3 TO APPENDIX D TO PART 60—FLIGHT TRAINING DEVICE (FTD) SUBJECTIVE EVALUATION

BEGIN QPS REQUIREMENTS

1. REQUIREMENTS

a. Except for special use airport models, all airport models required by this part must be representations of real-world, operational airports or representations of fictional airports and must meet the requirements set out in Tables D3B or D3C of this attachment, as appropriate.

b. If fictional airports are used, the sponsor must ensure that navigational aids and all appropriate maps, charts, and other navigational reference material for the fictional airports (and surrounding areas as necessary) are compatible, complete, and accurate with respect to the visual presentation and the airport model of this fictional airport. An SOC must be submitted that addresses navigation aid installation and performance and other criteria (including obstruction clearance protection) for all instrument approaches to the fictional airports that are available in the simulator. The SOC must reference and account for information in the terminal instrument procedures manual and the construction and availability of the required maps, charts, and other navigational material. This material must be clearly marked ''for training purposes only.''

c. When the simulator is being used by an instructor or evaluator for purposes of training, checking, or testing under this chapter, only airport models classified as Class I, Class II, or Class III may be used by the instructor or evaluator. Detailed descriptions/definitions of these classifications are found in Appendix F of this part.

d. When a person sponsors an FTD maintained by a person other than a U.S. certificate holder, the sponsor is accountable for that FTD originally meeting, and continuing to meet, the criteria under which it was originally qualified and the appropriate Part 60 criteria, including the visual scenes and airport models that may be used by instructors or evaluators for purposes of training, checking, or testing under this chapter.

e. Neither Class II nor Class III airport visual models are required to appear on the SOQ, and the method used for keeping instructors and evaluators apprised of the airport models that meet Class II or Class III requirements on any given simulator is at the option of the sponsor, but the method used must be available for review by the TPAA.

f. When an airport model represents a real world airport and a permanent change is made to that real world airport (e.g., a new runway, an extended taxiway, a new lighting system, a runway closure) without a written extension grant from the responsible Flight Standards office (described in paragraph 1.g., of this section), an update to that airport model must be made in accordance with the following time limits:

(1) For a new airport runway, a runway extension, a new airport taxiway, a taxiway extension, or a runway/taxiway closure—within 90 days of the opening for use of the new airport runway, runway extension, new airport taxiway, or taxiway extension; or within 90 days of the closure of the runway or taxiway.

(2) For a new or modified approach light system—within 45 days of the activation of the new or modified approach light system.

(3) For other facility or structural changes on the airport (e.g., new terminal, relocation of Air Traffic Control Tower)—within 180 days of the opening of the new or changed facility or structure.

g. If a sponsor desires an extension to the time limit for an update to a visual scene or airport model or has an objection to what must be updated in the specific airport model requirement, the sponsor must provide a written extension request to the responsible Flight Standards office stating the reason for the update delay and a proposed completion date or provide an explanation for the objection, explaining why the identified airport change will not have an impact on flight training, testing, or checking. A copy of this request or objection must also be sent to the POI/TCPM.

h. Examples of situations that may warrant Class_III model designation by the TPAA include the following:

(a) Training, testing, or checking on very low visibility operations, including SMGCS operations.

(b) Instrument operations training (including instrument takeoff, departure, arrival, approach, and missed approach training, testing, or checking) using—

(i) A specific model that has been geographically ‘‘moved’’ to a different location and aligned with an instrument procedure for another airport.

(ii) A model that does not match changes made at the real-world airport (or landing area for helicopters) being modeled.

(iii) A model generated with an ‘‘off-board’’ or an ‘‘on-board’’ model development tool (by providing proper latitude/longitude reference; correct runway or landing area orientation, length, width, marking, and lighting information; and appropriate adjacent taxiway location) to generate a facsimile of a real world airport or landing area.

These airport models may be accepted by the TPAA without individual observation provided the sponsor provides the TPAA with an acceptable description of the process for determining the acceptability of a specific airport model, outlines the conditions under which such an airport model may be used, and adequately describes what restrictions will be applied to each resulting airport or landing area model.

END QPS REQUIREMENTS

BEGIN INFORMATION

2. DISCUSSION

a. The subjective tests and the examination of functions provide a basis for evaluating the capability of the FTD to perform over a typical utilization period; determining that the FTD satisfactorily meets the appropriate training/testing/checking objectives and competently simulates each required maneuver, procedure, or task; and verifying correct operation of the FTD controls, instruments, and systems. The items in the list of operations tasks are for FTD evaluation purposes only. They must not be used to limit or exceed the authorizations for use of a given level of FTD as found in the Practical Test Standards or as approved by the TPAA. All items in the following paragraphs are subject to an examination of function.

b. The List of Operations Tasks in Table D3A addressing pilot functions and maneuvers is divided by flight phases. All simulated helicopter systems functions will be assessed for normal and, where appropriate, alternate operations. Normal, abnormal, and emergency operations associated with a flight phase will be assessed during the evaluation of maneuvers or events within that flight phase.

c. Systems to be evaluated are listed separately under ‘‘Any Flight Phase’’ to ensure appropriate attention to systems checks. Operational navigation systems (including inertial navigation systems, global positioning systems, or other long-range systems) and the associated electronic display systems will be evaluated if installed. The pilot will include in his report to the TPAA, the effect of the system operation and any system limitation.

d. At the request of the TPAA, the Pilot may assess the FTD for a special aspect of a sponsor's training program during the functions and subjective portion of an evaluation. Such an assessment may include a portion of a specific operation (e.g., a Line Oriented Flight Training (LOFT) scenario) or special emphasis items in the sponsor's training program. Unless directly related to a requirement for the qualification level, the results of such an evaluation would not necessarily affect the qualification of the FTD.

e. The FAA intends to allow the use of Class III airport models on a limited basis when the sponsor provides the TPAA (or other regulatory authority) an appropriate analysis of the skills, knowledge, and abilities (SKAs) necessary for competent performance of the tasks in which this particular media element is used. The analysis should describe the ability of the FTD/visual media to provide an adequate environment in which the required SKAs are satisfactorily performed and learned. The analysis should also include the specific media element, such as the visual scene or airport model. Additional sources of information on the conduct of task and capability analysis may be found on the FAA's Advanced Qualification Program (AQP) Web site at: *http://www.faa.gov/education_research/training/aqp*.

END INFORMATION

TABLE D3A—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 7 FTD

QPS requirements	
Entry No.	Operations tasks
Tasks in this table are subject to evaluation if appropriate for the helicopter simulated as indicated in the SOQ Configuration List or a Level 7 FTD. Items not installed, not functional on the FTD, and not appearing on the SOQ Configuration List, are not required to be listed as exceptions on the SOQ.	
1. Preflight Procedures	
1.a.	Preflight Inspection (Flight Deck Only) switches, indicators, systems, and equipment.
1.b.	APU/Engine start and run-up.
1.b.1.	Normal start procedures.
1.b.2.	Alternate start procedures.
1.b.3.	Abnormal starts and shutdowns (hot start, hung start).
1.b.4.	Rotor engagement.
1.b.5.	System checks.
1.c.	Taxiing—Ground.
1.c.1.	Power required to taxi.
1.c.2.	Brake effectiveness.
1.c.3.	Ground handling.
1.c.4.	Abnormal/emergency procedures, for example:
1.c.4.a.	Brake system failure.
1.c.4.b.	Ground resonance.
1.c.4.c.	Other (listed on the SOQ).
1.d.	Taxiing—Hover.
1.d.1.	Takeoff to a hover.
1.d.2.	Instrument response.
1.d.2.a.	Engine instruments.
1.d.2.a.	Flight instruments.
1.d.3.	Hovering turns.
1.d.4.	Hover power checks.
1.d.4.a.	In ground effect (IGE).
1.d.4.b.	Out of ground effect (OGE).
1.d.5.	Crosswind/tailwind hover.
1.d.6.	Abnormal/emergency procedures:
1.d.6.a.	Engine failure.
1.d.6.b.	Fuel governing system failure.

TABLE D3A—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 7 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
1.d.6.c.	Settling with power (OGE).
1.d.6.d.	Stability augmentation system failure.
1.d.6.e.	Directional control malfunction (including Loss of Tail Rotor Effectiveness, LTE).
1.d.6.f.	Other (listed on the SOQ).
1.e.	Pre-takeoff Checks.
2. Takeoff and Departure Phase	
2.a.	Normal and Crosswind Takeoff.
2.a.1.	From ground.
2.a.2.	From hover.
2.a.3.	Running.
2.a.4.	Crosswind/tailwind.
2.a.5.	Maximum performance.
2.b.	Instrument.
2.c.	Powerplant Failure During Takeoff.
2.c.1.	Takeoff with engine failure after critical decision point (CDP).
2.d.	Rejected Takeoff.
2.e.	Instrument Departure.
2.f.	Other (listed on the SOQ).
3. Climb	
3.a.	Normal.
3.b.	Obstacle clearance.
3.c.	Vertical.
3.d.	One engine inoperative.
3.e.	Other (listed on the SOQ).
4. Inflight Maneuvers	
4.a.	Performance.
4.b.	Flying qualities.
4.c.	Turns.
4.c.1.	Timed.
4.c.2.	Normal.
4.c.3.	Steep.
4.d.	Accelerations and decelerations.
4.e.	High-speed vibrations.
4.f.	Abnormal/emergency procedures, for example:
4.f.1.	Engine fire.
4.f.2.	Engine failure.

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TABLE D3A—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 7 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
4.f.2.a.	Powerplant Failure—Multiengine Helicopters.
4.f.2.b.	Powerplant Failure—Single-Engine Helicopters.
4.f.3.	Inflight engine shutdown (and restart, if applicable).
4.f.4.	Fuel governing system failures (e.g., FADEC malfunction).
4.f.5.	Directional control malfunction.
4.f.6.	Hydraulic failure.
4.f.7.	Stability augmentation system failure.
4.f.8.	Rotor vibrations.
4.f.9.	Recovery From Unusual Attitudes.
4.f.10.	Settling with Power.
4.g.	Other (listed on the SOQ).
5. Instrument Procedures	
5.a.	Instrument Arrival.
5.b.	Holding.
5.c.	Precision Instrument Approach.
5.c.1.	Normal—All engines operating.
5.c.2.	Manually controlled—One or more engines inoperative.
5.c.3.	Approach procedures:
5.c.3.a.	PAR.
5.c.3.b.	GPS.
5.c.3.c.	ILS.
5.c.3.c.1.	Manual (raw data).
5.c.3.c.2.	Autopilot * only.
5.c.3.c.3.	Flight director only.
5.c.3.c.4.	Autopilot * and flight director (if appropriate) coupled.
5.c.3.d.	Other (listed on the SOQ).
5.d.	Non-precision Instrument Approach.
5.d.1.	Normal—All engines operating.
5.d.2.	One or more engines inoperative.
5.d.3.	Approach procedures:
5.d.3.a.	NDB.
5.d.3.b.	VOR, RNAV, TACAN, GPS.
5.d.3.c.	ASR.
5.d.3.d.	Circling.
5.d.3.e.	Helicopter only.
5.d.3.f.	Other (listed on the SOQ).

TABLE D3A—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 7 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
5.e.	Missed Approach.
5.e.1.	All engines operating.
5.e.2.	One or more engines inoperative.
5.e.3.	Stability augmentation system failure.
5.e.4.	Other (listed on the SOQ).
6. Landings and Approaches to Landings	
6.a.	Visual Approaches.
6.a.1.	Normal.
6.a.2.	Steep.
6.a.3.	Shallow.
6.a.4.	Crosswind.
6.b.	Landings.
6.b.1.	Normal.
6.b.1.a.	Running.
6.b.1.b.	From Hover.
6.b.2.	Crosswind.
6.b.3.	Tailwind.
6.b.4.	One or more engines inoperative.
6.b.5.	Rejected Landing.
6.b.6.	Other (listed on the SOQ).
7. Normal and Abnormal Procedures (any phase of flight)	
7.a.	Helicopter and powerplant systems operation (as applicable).
7.a.1.	Anti-icing/deicing systems.
7.a.2.	Auxiliary powerplant.
7.a.3.	Communications.
7.a.4.	Electrical system.
7.a.5.	Environmental system.
7.a.6.	Fire detection and suppression.
7.a.7.	Flight control system.
7.a.8.	Fuel system.
7.a.9.	Engine oil system.
7.a.10.	Hydraulic system.
7.a.11.	Landing gear.
7.a.12.	Oxygen.
7.a.13.	Pneumatic.
7.a.14.	Powerplant.

TABLE D3A—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 7 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
7.a.15.	Flight control computers.
7.a.16.	Fly-by-wire controls.
7.a.17.	Stabilizer.
7.a.18.	Stability augmentation and control augmentation system(s).
7.a.19.	Other (listed on the SOQ).
7.b.	Flight management and guidance system (as applicable).
7.b.1.	Airborne radar.
7.b.2.	Automatic landing aids.
7.b.3.	Autopilot.*
7.b.4.	Collision avoidance system.
7.b.5.	Flight data displays.
7.b.6.	Flight management computers.
7.b.7.	Head-up displays.
7.b.8.	Navigation systems.
7.b.9.	Other (listed on the SOQ).
8. Emergency Procedures (as applicable)	
8.a.	Autorotative Landing.
8.b.	Air hazard avoidance.
8.c.	Ditching.
8.d.	Emergency evacuation.
8.e.	Inflight fire and smoke removal.
8.f.	Retreating blade stall recovery.
8.g.	Mast bumping.
8.h.	Loss of tail rotor effectiveness.
8.i.	Other (listed on the SOQ).
9. Postflight Procedures	
9.a.	After-Landing Procedures.
9.b.	Parking and Securing.
9.b.1.	Engine and systems operation.
9.b.2.	Parking brake operation.
9.b.3.	Rotor brake operation.
9.b.4.	Abnormal/emergency procedures.
10. Instructor Operating Station (IOS), as appropriate	
10.a.	Power Switch(es).
10.b.	Helicopter conditions.
10.b.1.	Gross weight, center of gravity, fuel loading and allocation, etc.

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TABLE D3A—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 7 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
10.b.2.	Helicopter systems status.
10.b.3.	Ground crew functions (e.g., ext. power).
10.c.	Airports.
10.c.1.	Selection.
10.c.2.	Runway selection.
10.c.3.	Preset positions (e.g., ramp, over final approach fix).
10.d.	Environmental controls.
10.d.1.	Temperature.
10.d.2.	Climate conditions (e.g., ice, rain).
10.d.3.	Wind speed and direction.
10.e.	Helicopter system malfunctions.
10.e.1.	Insertion/deletion.
10.e.2.	Problem clear.
10.f.	Locks, Freezes, and Repositioning.
10.f.1.	Problem (all) freeze/release.
10.f.2.	Position (geographic) freeze/release.
10.f.3.	Repositioning (locations, freezes, and releases).
10.f.4.	Ground speed control.
10.g.	Sound Controls.
10.g.1.	On/off/adjustment.
10.h.	Control Loading System (as applicable).
10.h.1.	On/off/emergency stop.
10.i.	Observer Stations.
10.i.1.	Position.
10.i.2.	Adjustments.

* "Autopilot" means attitude retention mode of operation.

TABLE D3B—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS AIRPORT OR LANDING AREA CONTENT REQUIREMENTS FOR QUALIFICATION AT LEVEL 7 FTD

QPS requirements	
Entry No.	Operations tasks
This table specifies the minimum airport visual model content and functionality to qualify an FTD at the indicated level. This table applies only to the airport/helicopter landing area scenes required for FTD qualification.	
1.	**Functional test content** requirements for Level 7 FTDs. The following is the minimum airport/landing area model content requirement to satisfy visual capability tests, and provides suitable visual cues to allow completion of all functions and subjective tests described in this attachment for Level 7 FTDs.

TABLE D3B—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS AIRPORT OR LANDING AREA CONTENT REQUIREMENTS FOR QUALIFICATION AT LEVEL 7 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
1.a.	A minimum of one (1) representative airport and one (1) representative helicopter landing area model. The airport and the helicopter landing area may be contained within the same visual model. If this option is selected, the approach path to the airport runway(s) and the approach path to the helicopter landing area must be different. The model(s) used to meet the following requirements may be demonstrated at either a fictional or a real-world airport or helicopter landing area, but each must be acceptable to the sponsor's TPAA, selectable from the IOS, and listed on the SOQ.
1.b.	Fidelity of the Visual Scene. The fidelity of the visual scene must be sufficient for the aircrew to visually identify the airport and/or helicopter landing area; determine the position of the simulated helicopter within the visual scene; successfully accomplish take-offs, approaches, and landings; and maneuver around the airport and/or helicopter landing area on the ground, or hover taxi, as necessary.
1.b.1.	For each of the airport/helicopter landing areas described in 1.a., the FTD visual system must be able to provide at least the following:
1.b.1.a.	A night and twilight (dusk) environment.
1.b.1.b.	A daylight environment.
1.c.	Runways:
1.c.1.	Visible runway number.
1.c.2.	Runway threshold elevations and locations must be modeled to provide sufficient correlation with helicopter systems (e.g., altimeter).
1.c.3.	Runway surface and markings.
1.c.4.	Lighting for the runway in use including runway edge and centerline.
1.c.5.	Lighting, visual approach aid (VASI or PAPI) and approach lighting of appropriate colors.
1.c.6	Taxiway lights.
1.d.	Helicopter landing area.
1.d.1.	Standard heliport designation (''H'') marking, properly sized and oriented.
1.d.2.	Perimeter markings for the Touchdown and Lift-Off Area (TLOF) or the Final Approach and Takeoff Area (FATO), as appropriate.
1.d.3.	Perimeter lighting for the TLOF or the FATO areas, as appropriate.
1.d.4.	Appropriate markings and lighting to allow movement from the runway or helicopter landing area to another part of the landing facility.
2.	**Visual scene management.** The following is the minimum visual scene management requirements for a Level 7 FTD.
2.a.	Runway and helicopter landing area approach lighting must fade into view appropriately in accordance with the environmental conditions set in the FTD.
2.b.	The direction of strobe lights, approach lights, runway edge lights, visual landing aids, runway centerline lights, threshold lights, touchdown zone lights, and TLOF or FATO lights must be replicated.
3.	**Visual feature recognition.** The following are the minimum distances at which runway features must be visible. Distances are measured from runway threshold or a helicopter landing area to a helicopter aligned with the runway or helicopter landing area on an extended 3° glide-slope in simulated meteorological conditions. For circling approaches, all tests apply to the runway used for the initial approach and to the runway of intended landing.
3.a.	For runways: Runway definition, strobe lights, approach lights, and edge lights from 5 sm (8 km) of the threshold.
3.b.	For runways: Centerline lights and taxiway definition from 3 sm (5 km).
3.c.	For runways: Visual Approach Aid lights (VASI or PAPI) from 5 sm (8 km) of the threshold.
3.d.	For runways: Runway threshold lights and touchdown zone from 2 sm (3 km).

TABLE D3B—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS AIRPORT OR LANDING AREA CONTENT REQUIREMENTS FOR QUALIFICATION AT LEVEL 7 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
3.e.	For runways and helicopter landing areas: Markings within range of landing lights for night/twilight scenes and the surface resolution test on daylight scenes, as required.
3.f.	For circling approaches: The runway of intended landing and associated lighting must fade into view in a non-distracting manner.
3.g.	For helicopter landing areas: Landing direction lights and raised FATO lights from 1 sm (1.5 km).
3.h.	For helicopter landing areas: Flush mounted FATO lights, TLOF lights, and the lighted windsock from 0.5 sm (750 m).
4.	**Airport or Helicopter Landing Area Model Content.** The following prescribes the minimum requirements for an airport/helicopter landing area visual model and identifies other aspects of the environment that must correspond with that model for a Level 7 FTD. For circling approaches, all tests apply to the runway used for the initial approach and to the runway of intended landing. If all runways or landing areas in a visual model used to meet the requirements of this attachment are not designated as ''in use,'' then the ''in use'' runways/landing areas must be listed on the SOQ (e.g., KORD, Rwys 9R, 14L, 22R). Models of airports or helicopter landing areas with more than one runway or landing area must have all significant runways or landing areas not ''in-use'' visually depicted for airport/runway/landing area recognition purposes. The use of white or off white light strings that identify the runway or landing area for twilight and night scenes are acceptable for this requirement; and rectangular surface depictions are acceptable for daylight scenes. A visual system's capabilities must be balanced between providing visual models with an accurate representation of the airport and a realistic representation of the surrounding environment. Each runway or helicopter landing area designated as an ''in-use'' runway or area must include the following detail that is developed using airport pictures, construction drawings and maps, or other similar data, or developed in accordance with published regulatory material; however, this does not require that such models contain details that are beyond the design capability of the currently qualified visual system. Only one ''primary'' taxi route from parking to the runway end or helicopter takeoff/landing area will be required for each ''in-use'' runway or helicopter takeoff/landing area.
4.a.	The surface and markings for each ''in-use'' runway or helicopter landing area must include the following:
4.a.1.	For airports: Runway threshold markings, runway numbers, touchdown zone markings, fixed distance markings, runway edge markings, and runway centerline stripes.
4.a.2.	For helicopter landing areas: Markings for standard heliport identification (''H'') and TLOF, FATO, and safety areas.
4.b.	The lighting for each ''in-use'' runway or helicopter landing area must include the following:
4.b.1.	For airports: Runway approach, threshold, edge, end, centerline (if applicable), touchdown zone (if applicable), leadoff, and visual landing aid lights or light systems for that runway.
4.b.2.	For helicopter landing areas: Landing direction, raised and flush FATO, TLOF, windsock lighting.
4.c.	The taxiway surface and markings associated with each ''in-use'' runway or helicopter landing area must include the following:
4.c.1.	For airports: Taxiway edge, centerline (if appropriate), runway hold lines, and ILS critical area(s).
4.c.2.	For helicopter landing areas: Taxiways, taxi routes, and aprons.
4.d.	The taxiway lighting associated with each ''in-use'' runway or helicopter landing area must include the following:
4.d.1.	For airports: Taxiway edge, centerline (if appropriate), runway hold lines, ILS critical areas.
4.d.2.	For helicopter landing areas: Taxiways, taxi routes, and aprons.
4.d.3.	For airports: Taxiway lighting of correct color.
4.e.	Airport signage associated with each ''in-use'' runway or helicopter landing area must include the following:
4.e.1.	For airports: Signs for runway distance remaining, intersecting runway with taxiway, and intersecting taxiway with taxiway.
4.e.2.	For helicopter landing areas: As appropriate for the model used.
4.f.	Required visual model correlation with other aspects of the airport or helicopter landing environment simulation:

TABLE D3B—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS AIRPORT OR LANDING AREA CONTENT REQUIREMENTS FOR QUALIFICATION AT LEVEL 7 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
4.f.1.	The airport or helicopter landing area model must be properly aligned with the navigational aids that are associated with operations at the "in-use" runway or helicopter landing area.
4.f.2.	The simulation of runway or helicopter landing area contaminants must be correlated with the displayed runway surface and lighting, if applicable.
5.	**Correlation with helicopter and associated equipment.** The following are the minimum correlation comparisons that must be made for a Level 7 FTD.
5.a.	Visual system compatibility with aerodynamic programming.
5.b.	Visual cues to assess sink rate and depth perception during landings.
5.c.	Accurate portrayal of environment relating to FTD attitudes.
5.d.	The visual scene must correlate with integrated helicopter systems, where installed (e.g., terrain, traffic and weather avoidance systems and Head-up Guidance System (HGS)).
5.e.	Representative visual effects for each visible, own-ship, helicopter external light(s)—taxi and landing light lobes (including independent operation, if appropriate).
5.f.	The effect of rain removal devices.
6.	**Scene quality.** The following are the minimum scene quality tests that must be conducted for a Level 7 FTD.
6.a.	System light points must be free from distracting jitter, smearing and streaking.
6.b.	Demonstration of occulting through each channel of the system in an operational scene.
6.c.	Six discrete light step controls (0–5).
7.	**Special weather representations, which include visibility and RVR, measured in terms of distance.** Visibility/RVR checked at 2,000 ft (600 m) above the airport or helicopter landing area and at two heights below 2,000 ft with at least 500 ft of separation between the measurements. The measurements must be taken within a radius of 10 sm (16 km) from the airport or helicopter landing area.
7.a.	Effects of fog on airport lighting such as halos and defocus.
7.b.	Effect of own-ship lighting in reduced visibility, such as reflected glare, including landing lights, strobes, and beacons.
8.	**Instructor control of the following:** The following are the minimum instructor controls that must be available in a Level 7 FTD.
8.a.	Environmental effects: E.g., cloud base, cloud effects, cloud density, visibility in statute miles/kilometers and RVR in feet/meters.
8.b.	Airport or helicopter landing area selection.
8.c.	Airport or helicopter landing area lighting, including variable intensity.
8.d.	Dynamic effects including ground and flight traffic.
End QPS Requirement	
Begin Information	
9.	An example of being able to combine two airport models to achieve two "in-use" runways: One runway designated as the "in-use" runway in the first model of the airport, and the second runway designated as the "in-use" runway in the second model of the same airport. For example, the clearance is for the ILS approach to Runway 27, Circle to Land on Runway 18 right. Two airport visual models might be used: The first with Runway 27 designated as the "in use" runway for the approach to runway 27, and the second with Runway 18 Right designated as the "in use" runway. When the pilot breaks off the ILS approach to runway 27, the instructor may change to the second airport visual model in which runway 18 Right is designated as the "in use" runway, and the pilot would make a visual approach and landing. This process is acceptable to the FAA as long as the temporary interruption due to the visual model change is not distracting to the pilot.

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TABLE D3B—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS AIRPORT OR LANDING AREA CONTENT REQUIREMENTS FOR QUALIFICATION AT LEVEL 7 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
10.	Sponsors are not required to provide every detail of a runway, but the detail that is provided should be correct within reasonable limits.
End Information	

TABLE D3C—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 7 FTD VISUAL REQUIREMENTS ADDITIONAL VISUAL MODELS BEYOND MINIMUM REQUIRED FOR QUALIFICATION CLASS II AIRPORT OR HELICOPTER LANDING AREA MODELS

QPS requirements	
Entry No.	Operations tasks
This table specifies the minimum airport or helicopter landing area visual model content and functionality necessary to add visual models to an FTD's visual model library (i.e., beyond those necessary for qualification at the stated level) without the necessity of further involvement of the responsible Flight Standards office or TPAA.	
1.	Visual scene management. **The following is the minimum visual scene management requirements.**
1.a.	The installation and direction of the following lights must be replicated for the ''in-use'' surface:
1.a.1.	For ''in-use'' runways: Strobe lights, approach lights, runway edge lights, visual landing aids, runway centerline lights, threshold lights, and touchdown zone lights.
1.a.2.	For ''in-use'' helicopter landing areas: Ground level TLOF perimeter lights, elevated TLOF perimeter lights (if applicable), Optional TLOF lights (if applicable), ground FATO perimeter lights, elevated TLOF lights (if applicable), landing direction lights.
2.	**Visual feature recognition.** The following are the minimum distances at which runway or landing area features must be visible. Distances are measured from runway threshold or a helicopter landing area to an aircraft aligned with the runway or helicopter landing area on a 3° glide-slope from the aircraft to the touchdown point, in simulated meteorological conditions. For circling approaches, all tests apply to the runway used for the initial approach and to the runway of intended landing.
2.a.	For Runways.
2.a.1.	Strobe lights, approach lights, and edge lights from 5 sm (8 km) of the threshold.
2.a.2.	Centerline lights and taxiway definition from 3 sm (5 km).
2.a.3.	Visual Approach Aid lights (VASI or PAPI) from 5 sm (8 km) of the threshold.
2.a.4.	Threshold lights and touchdown zone lights from 2 sm (3 km).
2.a.5.	Markings within range of landing lights for night/twilight (dusk) scenes and as required by the surface resolution test on daylight scenes.
2.a.6.	For circling approaches, the runway of intended landing and associated lighting must fade into view in a non-distracting manner.
2.b.	For Helicopter landing areas.
2.b.1.	Landing direction lights and raised FATO lights from 2 sm (3 km).
2.b.2.	Flush mounted FATO lights, TOFL lights, and the lighted windsock from 1 sm (1500 m).
2.b.3.	Hover taxiway lighting (yellow/blue/yellow cylinders) from TOFL area.
2.b.4.	Markings within range of landing lights for night/twilight (dusk) scenes and as required by the surface resolution test on daylight scenes.

TABLE D3C—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 7 FTD VISUAL REQUIREMENTS ADDITIONAL VISUAL MODELS BEYOND MINIMUM REQUIRED FOR QUALIFICATION CLASS II AIRPORT OR HELICOPTER LANDING AREA MODELS—Continued

QPS requirements	
Entry No.	Operations tasks
3.	Airport or Helicopter Landing Area Model Content. The following prescribes the minimum requirements for what must be provided in an airport visual model and identifies other aspects of the airport environment that must correspond with that model. The detail must be developed using airport pictures, construction drawings and maps, or other similar data, or developed in accordance with published regulatory material; however, this does not require that airport or helicopter landing area models contain details that are beyond the designed capability of the currently qualified visual system. For circling approaches, all requirements of this section apply to the runway used for the initial approach and to the runway of intended landing. Only one ''primary'' taxi route from parking to the runway end or helicopter takeoff/landing area will be required for each ''in-use'' runway or helicopter takeoff/landing area.
3.a.	The surface and markings for each ''in-use'' runway or helicopter landing area must include the following:
3.a.1.	For airports: Runway threshold markings, runway numbers, touchdown zone markings, fixed distance markings, runway edge markings, and runway centerline stripes.
3.a.2.	For helicopter landing areas: Standard heliport marking (''H''), TOFL, FATO, and safety areas.
3.b.	The lighting for each ''in-use'' runway or helicopter landing area must include the following:
3.b.1.	For airports: Runway approach, threshold, edge, end, centerline (if applicable), touchdown zone (if applicable), leadoff, and visual landing aid lights or light systems for that runway.
3.b.2.	For helicopter landing areas: Landing direction, raised and flush FATO, TOFL, windsock lighting.
3.c.	The taxiway surface and markings associated with each ''in-use'' runway or helicopter landing area must include the following:
3.c.1.	For airports: Taxiway edge, centerline (if appropriate), runway hold lines, and ILS critical area(s).
3.c.2.	For helicopter landing areas: Taxiways, taxi routes, and aprons.
3.d.	The taxiway lighting associated with each ''in-use'' runway or helicopter landing area must include the following:
3.d.1.	For airports: Runway edge, centerline (if appropriate), runway hold lines, ILS critical areas.
3.d.2.	For helicopter landing areas: Taxiways, taxi routes, and aprons.
4.	**Required visual model correlation with other aspects of the airport environment simulation.** The following are the minimum visual model correlation tests that must be conducted for Level 7 FTD.
4.a.	The airport model must be properly aligned with the navigational aids that are associated with operations at the ''in-use'' runway.
4.b.	Slopes in runways, taxiways, and ramp areas, if depicted in the visual scene, must not cause distracting or unrealistic effects.
5.	**Correlation with helicopter and associated equipment.** The following are the minimum correlation comparisons that must be made.
5.a.	Visual system compatibility with aerodynamic programming.
5.b.	Accurate portrayal of environment relating to flight simulator attitudes.
5.c.	Visual cues to assess sink rate and depth perception during landings.
6.	**Scene quality.** The following are the minimum scene quality tests that must be conducted.
6.a.	Light points free from distracting jitter, smearing or streaking.
6.b.	Surfaces and textural cues free from apparent and distracting quantization (aliasing).
7.	**Instructor controls of the following.** The following are the minimum instructor controls that must be available.
7.a.	Environmental effects, e.g., cloud base (if used), cloud effects, cloud density, visibility in statute miles/kilometers and RVR in feet/meters.

TABLE D3C—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 7 FTD VISUAL REQUIREMENTS ADDITIONAL VISUAL MODELS BEYOND MINIMUM REQUIRED FOR QUALIFICATION CLASS II AIRPORT OR HELICOPTER LANDING AREA MODELS—Continued

QPS requirements	
Entry No.	Operations tasks
7.b.	Airport/Heliport selection.
7.c.	Airport/Heliport lighting including variable intensity.
7.d.	Dynamic effects including ground and flight traffic.
End QPS Requirements	
Begin Information	
8.	Sponsors are not required to provide every detail of a runway or helicopter landing area, but the detail that is provided must be correct within the capabilities of the system.
End Information	

TABLE D3D—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 6 FTD

QPS requirements	
Entry No.	Operations tasks
Tasks in this table are subject to evaluation if appropriate for the helicopter simulated as indicated in the SOQ Configuration List or for a Level 6 FTD. Items not installed or not functional on the FTD and not appearing on the SOQ Configuration List, are not required to be listed as exceptions on the SOQ.	
1. Preflight Procedures	
1.a.	Preflight Inspection (Flight Deck Only) switches, indicators, systems, and equipment.
1.b.	APU/Engine start and run-up.
1.b.1.	Normal start procedures.
1.b.2.	Alternate start procedures.
1.b.3.	Abnormal starts and shutdowns.
1.b.4.	Rotor engagement.
1.b.5	System checks.
2. Takeoff and Departure Phase	
2.a.	Instrument.
2.b.	Takeoff with engine failure after critical decision point (CDP).
3. Climb	
3.a.	Normal.
3.b.	One engine inoperative.
4. Inflight Maneuvers	
4.a.	Performance.
4.b.	Flying qualities.
4.c.	Turns.
4.c.1.	Timed.
4.c.2.	Normal.
4.c.3.	Steep.
4.d.	Accelerations and decelerations.

TABLE D3D—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 6 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
4.e.	Abnormal/emergency procedures:
4.e.1.	Engine fire.
4.e.2.	Engine failure.
4.e.3.	In-flight engine shutdown (and restart, if applicable).
4.e.4.	Fuel governing system failures (e.g., FADEC malfunction).
4.e.5.	Directional control malfunction (restricted to the extent that the maneuver may not terminate in a landing).
4.e.6.	Hydraulic failure.
4.e.7.	Stability augmentation system failure.
5. Instrument Procedures	
5.a.	Holding.
5.b.	Precision Instrument Approach.
5.b.1.	All engines operating.
5.b.2.	One or more engines inoperative.
5.b.3.	Approach procedures:
5.b.4.	PAR.
5.b.5.	ILS.
5.b.6.	Manual (raw data).
5.b.7.	Flight director only.
5.b.8.	Autopilot* and flight director (if appropriate) coupled.
5.c.	Non-precision Instrument Approach.
5.c.	Normal—All engines operating.
5.c.	One or more engines inoperative.
5.c.	Approach procedures:
5.c.1.	NDB.
5.c.2.	VOR, RNAV, TACAN, GPS.
5.c.3.	ASR.
5.c.4.	Helicopter only.
5.d.	Missed Approach.
5.d.1.	All engines operating.
5.d.2.	One or more engines inoperative.
5.d.3.	Stability augmentation system failure.
6. Normal and Abnormal Procedures (any phase of flight)	
6.a.	Helicopter and powerplant systems operation (as applicable).
6.a.1.	Anti-icing/deicing systems.
6.a.2.	Auxiliary power-plant.
6.a.3.	Communications.

TABLE D3D—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 6 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
6.a.4.	Electrical system.
6.a.5.	Environmental system.
6.a.6.	Fire detection and suppression.
6.a.7.	Flight control system.
6.a.8.	Fuel system.
6.a.9.	Engine oil system.
6.a.10.	Hydraulic system.
6.a.11	Landing gear.
6.a.12.	Oxygen.
6.a.13.	Pneumatic.
6.a.14.	Powerplant.
6.a.15.	Flight control computers.
6.a.16.	Stability augmentation and control augmentation system(s).
6.b.	Flight management and guidance system (as applicable).
6.b.1.	Airborne radar.
6.b.2.	Automatic landing aids.
6.b.3.	Autopilot.*
6.b.4.	Collision avoidance system.
6.b.5.	Flight data displays.
6.b.6.	Flight management computers.
6.b.7.	Navigation systems.
7. Postflight Procedures	
7.a.	Parking and Securing.
7.b.	Engine and systems operation.
7.c.	Parking brake operation.
7.d.	Rotor brake operation.
7.e.	Abnormal/emergency procedures.
8. Instructor Operating Station (IOS), as appropriate	
8.a.	Power Switch(es).
8.b.1.	Helicopter conditions.
8.b.2.	Gross weight, center of gravity, fuel loading and allocation, etc.
8.b.3.	Helicopter systems status.
8.b.4.	Ground crew functions (e.g., ext. power).
8.c.	Airports and landing areas.
8.c.1.	Number and selection.
8.c.2.	Runway or landing area selection.

TABLE D3D—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 6 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
8.c.3.	Preset positions (e.g., ramp, over FAF).
8.c.4.	Lighting controls.
8.d.	Environmental controls.
8.d.1	Temperature.
8.d.2.	Climate conditions (e.g., ice, rain).
8.d.3.	Wind speed and direction.
8.e.	Helicopter system malfunctions.
8.e.1.	Insertion/deletion.
8.e.2.	Problem clear.
8.f.	Locks, Freezes, and Repositioning.
8.f.1.	Problem (all) freeze/release.
8.f.2.	Position (geographic) freeze/release.
8.f.3.	Repositioning (locations, freezes, and releases).
8.f.4.	Ground speed control.
8.g.	Sound Controls. On/off/adjustment.
8.h.	Control Loading System (as applicable) On/off/emergency stop.
8.i.	Observer Stations.
8.i.1.	Position.
8.i.2.	Adjustments.

* "Autopilot" means attitude retention mode of operation.

TABLE D3E—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 5 FTD

QPS requirements	
Entry No.	Operations tasks
Tasks in this table are subject to evaluation if appropriate for the helicopter simulated as indicated in the SOQ Configuration List or for a Level 5 FTD. Items not installed or not functional on the FTD and not appearing on the SOQ Configuration List, are not required to be listed as exceptions on the SOQ.	
1. Preflight Procedures	
1.a.	Preflight Inspection (Flight Deck Only) switches, indicators, systems, and equipment.
1.b.	APU/Engine start and run-up.
1.b.1.	Normal start procedures.
1.b.2.	Alternate start procedures.
1.b.3.	Abnormal starts and shutdowns.
2. Climb	
2.a.	Normal.
3. Inflight Maneuvers	
3.a.	Performance.
3.b.	Turns, Normal.

TABLE D3E—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 5 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
4. Instrument Procedures	
4.a.	Coupled instrument approach maneuvers (as applicable for the systems installed).
5. Normal and Abnormal Procedures (any phase of flight)	
5.a.	Normal system operation (installed systems).
5.b.	Abnormal/Emergency system operation (installed systems).
6. Postflight Procedures	
6.a.	Parking and Securing.
6.b.	Engine and systems operation.
6.c.	Parking brake operation.
6.d.	Rotor brake operation.
6.e.	Abnormal/emergency procedures.
7. Instructor Operating Station (IOS), as appropriate	
7.a.	Power Switch(es).
7.b.	Preset positions (ground; air)
7.c.	Helicopter system malfunctions.
7.c.1.	Insertion/deletion.
7.c.2.	Problem clear.
7.d.	Control Loading System (as applicable) On/off/emergency stop.
7.e.	Observer Stations.
7.e.1.	Position.
7.e.2.	Adjustments.

TABLE D3F—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 4 FTD

QPS requirements	
Entry No.	Operations tasks
Tasks in this table are subject to evaluation if appropriate for the helicopter simulated as indicated in the SOQ Configuration List or for a Level 4 FTD. Items not installed or not functional on the FTD and not appearing on the SOQ Configuration List, are not required to be listed as exceptions on the SOQ.	
1. Preflight Procedures	
1.a.	Preflight Inspection (Flight Deck Only) switches, indicators, systems, and equipment.
1.b.	APU/Engine start and run-up.
1.b.1.	Normal start procedures.
1.b.2.	Alternate start procedures.
1.b.3.	Abnormal starts and shutdowns.
2. Normal and Abnormal Procedures (any phase of flight)	
2.a.	Normal system operation (installed systems).
2.b.	Abnormal/Emergency system operation (installed systems).

TABLE D3F—TABLE OF FUNCTIONS AND SUBJECTIVE TESTS LEVEL 4 FTD—Continued

QPS requirements	
Entry No.	Operations tasks
3. Postflight Procedures	
3.a.	Parking and Securing.
3.b.	Engine and systems operation.
3.c.	Parking brake operation.
4. Instructor Operating Station (IOS), as appropriate	
4.a.	Power Switch(es).
4.b.	Preset positions (ground; air)
4.c.	Helicopter system malfunctions.
4.c.1.	Insertion/deletion.
4.c.2.	Problem clear.

ATTACHMENT 4 TO APPENDIX D TO PART 60—SAMPLE DOCUMENTS

TABLE OF CONTENTS

ATTACHMENT 4 TO APPENDIX D TO PART 60—FIGURE D4A—SAMPLE LETTER, REQUEST FOR INITIAL, UPGRADE, OR REINSTATEMENT EVALUATION

INFORMATION

Date _______

RE: Request for Initial/Upgrade Evaluation Date

This is to advise you of our intent to request an (initial or upgrade) evaluation of our (FTD Manufacturer), (Aircraft Type/Level) Flight Training Device (FTD), (FAA ID Number, if previously qualified), located in (City, State) at the (Facility) on (Proposed Evaluation Date). (The proposed evaluation date shall not be more than 180 days following the date of this letter.) The FTD will be sponsored by (Name of Training Center/Air Carrier), FAA Designator (4 Letter Code). The FTD will be sponsored as follows; (Select One)

☐ The FTD will be used within the sponsor's FAA approved training program and placed on the sponsor's Training/Operations Specifications.

☐ The FTD will be used for dry lease only.

We agree to provide the formal request for the evaluation to your staff as follows: (check one)

☐ For QTG tests run at the factory, not later, than 45 days prior to the proposed evaluation date with the additional "l/3 on-site" tests provided not later than 14 days prior to the proposed evaluation date.

☐ For QTG tests run on-site, not later than 30 days prior to the proposed evaluation date.

We understand that the formal request will contain the following documents:

1. Sponsor's Letter of Request (*Company Compliance Letter*).
2. Principal Operations Inspector (POI) or Training Center Program Manager's (TCPM) endorsement.
3. Complete QTG.

If we are unable to meet the above requirements, we understand this may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation.

(The sponsor should add additional comments as necessary).

Please contact (Name Telephone and Fax Number of Sponsor's Contact) to confirm the date for this initial evaluation. We understand a member of your National Simulator Program staff will respond to this request within 14 days.

A copy of this letter of intent has been provided to (Name), the Principal Operations Inspector (POI) and/or Training Center Program Manager (TCPM).

Sincerely,

Attachment: FTD Information Form
cc: POI/TCPM

Attachment 4 to Appendix D to Part 60—
Figure D4B – Sample Letter, Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FSTD Information Form

INFORMATION

Date: ____					
Section 1. FSTD Information and Characteristics					
Sponsor Name:	____	**FSTD Location:**			
Address:	____ ____	**Physical Address:**	____ ____		
City:	____	**City:**	____		
State:	____	**State:**	____		
Country:	____	**Country:**	____		
ZIP:	____	**ZIP:**	____		
Manager	____				
Sponsor ID No: (Four Letter FAA Designator)	____	**Nearest Airport:** (Airport Designator)	____		
Type of Evaluation Requested:	☐ **Initial** ☐ **Upgrade** ☐ **Continuing Qualification** ☐ **Special** ☐ **Reinstatement**				
Aircraft Make/model/series:	____				
Initial Qualification: (If Applicable)	**Date:** ____ **Level** ____ MM/DD/YYYY	**Manufacturer's Identification or Serial Number**	____________		
Upgrade Qualification: (If Applicable)	**Date:** ____ **Level** ____ MM/DD/YYYY	☐ **eMQTG**			
Qualification Basis:____________	☐ **A**	☐ **B**	☐ **Interim C**	☐ **C**	☐ **D**
	☐ **6**	☐ **7**	☐ **Provisional Status**		
Other Technical Information:					
FAA FSTD ID No: (If Applicable)	____	**FSTD Manufacturer:**	____		
Convertible FSTD:	☐Yes:	**Date of Manufacture:**	____ MM/DD/YYYY		
Related FAA ID No. (If Applicable)	____ ____ ____	**Sponsor FSTD ID No:** ________			
Engine model(s) and data revision: ________		**Source of aerodynamic model:** ________			
FMS identification and revision level: ________		**Source of aerodynamic coefficient data:** ________			
Visual system manufacturer/model: ________		**Aerodynamic data revision number:** ________			
Flight control data revision: ________		**Visual system display:** ________			
Mot ion system manufacturer/type: ________		**FSTD computer(s) identification:** ________			
National Aviation Authority (NAA): (If Applicable)	________				
NAA FSTD ID No:	________	**Last NAA Evaluation Date:**	________		
NAA Qualification Level:	________				
NAA Qualification Basis:	____				
Visual System Manufacturer and Type:	________	**FSTD Seats Available:** ________	**Motion System Manufacturer and Type:**	________:	

Attachment 4 to Appendix D to Part 60—
Figure D4B – Sample Letter, Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FSTD Information Form

INFORMATION

Aircraft Equipment:	Engine Type(s):	Flight Instrumentation:	Engine Instrumentation:
	____ ____	☐ EFIS ☐ HUD ☐ HGS ☐ EFVS ☐ TCAS ☐ GPWS ☐ Plain View ☐ GPS ☐ FMS Type: __ ☐ WX Radar ☐ Other: __	☐ EICAS ☐ FADEC ☐ Other: __

Airport Models:	3.6.1 _____ Airport Designator	3.6.2_____ Airport Designator	3.6.3 _____ Airport Designator
Circle to Land:	3. 7.1 _____ Airport Designator	3. 7.2_____ Approach	3. 7.3 _____ Landing Runway
Visual Ground Segment	3.8.1 _____ Airport Designator	3.8 .2_____ Approach	3. 8.3 _____ Landing Runway

Section 2. Supplementary Information

FAA Training Program Approval Authority:		☐ POI ☐ TCPM ☐ Other: ______	
Name:	________	**Office:**	________
Tel:	________	**Fax:**	________
Email:	________		
FSTD Scheduling Person:			
Name:	________		
Address 1:	________	**Address 2**	________
City:	________	**State:**	________
ZIP:	________	**Email:**	________
Tel:	________	**Fax:**	________
FSTD Technical Contact:			
Name:	________		
Address 1:	________	**Address 2**	________
City:	________	**State:**	________
ZIP:	________	**Email:**	________
Tel:	________	**Fax:**	________

Section 3. Training, Testing and Checking Considerations

Area/Function/Maneuver	Requested	Remarks
Private Pilot - Training / Checks: (142)	☐	________
Commercial Pilot - Training /Checks:(142)	☐	________
Multi-Engine Rating - Training / Checks (142)	☐	________
Instrument Rating -Training / Checks (142)	☐	________
Type Rating - Training / Checks (135/121/142)	☐	________
Proficiency Checks (135/121/142)	☐	________
CAT I: (RVR 2400/1800 ft. DH200 ft)	☐	________

Attachment 4 to Appendix D to Part 60—
Figure D4B – Sample Letter, Request for Initial, Upgrade, or Reinstatement Evaluation
Attachment: FSTD Information Form

INFORMATION

CAT II: (RVR 1200 ft. DH 100 ft)	☐	_________
CAT III * (lowest minimum) _________ RVR _________ ft. * State CAT III (≤ 700 ft.), CAT IIIb (≤ 150 ft.), or CAT IIIc (0 ft.)	☐	_________
Circling Approach	☐	_________
Windshear Training:	☐	_________
Windshear Training IAW 121.409(d) (121 Turbojets Only)	☐	_________
Generic Unusual Attitudes and Recoveries within the Normal Flight Envelope	☐	_________
Specific Unusual Attitudes Recoveries	☐	_________
Auto-coupled Approach/Auto Go Around	☐	_________
Auto-land / Roll Out Guidance	☐	_________
TCAS/ACAS I / II	☐	_________
WX-Radar	☐	_________
HUD	☐	_________
HGS	☐	_________
EFVS	☐	_________
Future Air Navigation Systems	☐	_________
GPWS / EGPWS	☐	_________
ETOPS Capability	☐	_________
GPS	☐	_________
SMGCS	☐	_________
Helicopter Slope Landings	☐	_________
Helicopter External Load Operations	☐	_________
Helicopter Pinnacle Approach to Landings	☐	_________
Helicopter Night Vision Maneuvers	☐	_________
Helicopter Category A Takeoffs	☐	_________

ATTACHMENT 4 TO APPENDIX D TO PART 60—
FIGURE D4C—SAMPLE LETTER OF COMPLIANCE

INFORMATION

aworley on LAPBH6H6L3 with DISTILLER

VerDate Sep<11>2014 14:00 Mar 14, 2024 Jkt 262047 PO 00000 Frm 00451 Fmt 8010 Sfmt 8002 Q:\14\14V2.TXT PC31

ER09MY08.057</GPH>

(Date)

Mr. (Name of Training Program Approval Authority):
(Name of responsible Flight Standards office)
(Address)
(City/State/Zip)

Dear Mr. (Name of TPAA):

RE: Letter of Compliance

(Operator Sponsor Name) requests evaluation of our (Aircraft Type) FTD for Level (__) qualification. The (FTD Manufacturer Name) FTD with (Visual System Manufacturer Name/Model) system is fully defined on the FTD Information page of the accompanying Qualification Test Guide (QTG). We have completed the tests of the FTD and certify that it meets all applicable requirements of FAR parts 121, 125, or 135), and the guidance of (AC 120-40B or 14 CFR Part 60). Appropriate hardware and software configuration control procedures have been established. Our Pilot(s), (Name(s)), who are qualified on (Aircraft Type) aircraft have assessed the FTD and have found that it conforms to the (Operator/Sponsor) (Aircraft Type) flight deck configuration and that the simulated systems and subsystems function equivalently to those in the aircraft. The above named pilot(s) have also assessed the performance and the flying qualities of the FTD and find that it represents the respective aircraft.

(Added Comments may be placed here)

Sincerely,
(Sponsor Representative)

ATTACHMENT 4 TO APPENDIX D TO PART 60—FIGURE D4D—SAMPLE QUALIFICATION TEST GUIDE COVER PAGE

INFORMATION

SPONSOR NAME

SPONSOR ADDRESS

FAA QUALIFICATION TEST GUIDE

(SPECIFIC HELICOPTER MODEL)

(*for example*)

(Vertiflite AB-320)

(FTD Identification Including Manufacturer, Serial Number, Visual System Used)

(FTD Level)

(Qualification Performance Standard Used)

(FTD Location)

FAA Initial Evaluation

Date: _____________

____ Date: ___________

(Sponsor)

____ Date: ___________

FAA

ATTACHMENT 4 TO APPENDIX D TO PART 60—FIGURE D4E—SAMPLE STATEMENT OF QUALIFICATION—CERTIFICATE

INFORMATION

aworley on LAPBH6H6L3 with DISTILLER

VerDate Sep<11>2014 14:00 Mar 14, 2024 Jkt 262047 PO 00000 Frm 00453 Fmt 8010 Sfmt 8002 Q:\14\14V2.TXT PC31

ER09DE22.125</GPH> ER09DE22.126</GPH>

Federal Aviation Administration

Certificate of Qualification

This is to certify that representatives of the FAA
Completed an evaluation of the

Go-Fast Training Center
Vertiflite AB-320 Flight Training Device

FAA Identification Number 889

And found it to meet the standards set forth in
14 CFR Part 60, Appendix D
Qualification Performance Standards

The Master Qualification Test Guide and the attached
Configuration List and List of Qualified Tasks
Provide the Qualification Basis for this device to operate at

Level 6

Until April 30, 2010

Unless sooner rescinded or extended by the FAA

March 15, 2009	C. *Nordlie*
(date)	(for the FAA)

Attachment 4 to Appendix D to Part 60—
Figure D4F – Sample Statement of Qualification – Configuration List
INFORMATION

STATEMENT of QUALIFICATION
CONFIGURATION LIST

Date: _____			
Section 1. FSTD Information and Characteristics			
Sponsor Name:	_____	**FSTD Location:**	
Address:	_____ _____	**Physical Address:**	_____ _____
City:	_____	**City:**	_____
State:	_____	**State:**	_____
Country:	_____	**Country:**	_____
ZIP:	_____	**ZIP:**	_____
Manager	_____		
Sponsor ID No: (Four Letter FAA Designator)	_____	**Nearest Airport:** (Airport Designator)	_____

Type of Evaluation Requested:	☐ **Initial** ☐ **Upgrade** ☐ **Continuing Qualification** ☐ **Special** ☐ **Reinstatement**
Aircraft Make/model/series:	_____

Initial Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY	**Manufacturer's Identification or Serial Number**	_____________
Upgrade Qualification: (If Applicable)	**Date:** _____ **Level** _____ MM/DD/YYYY	☐ **eMQTG**	

Qualification Basis:______________	☐ **A**	☐ **B**	☐ **Interim C**	☐ **C**	☐ **D**
	☐ **6**	☐ **7**	☐ **Provisional Status**		

Other Technical Information:			
FAA FSTD ID No: (If Applicable)	_____	**FSTD Manufacturer:**	_____
Convertible FSTD:	☐**Yes:**	**Date of Manufacture:**	_____ MM/DD/YYYY
Related FAA ID No. (If Applicable)	_____ _____ _____	**Sponsor FSTD ID No:** _________	
Engine model(s) and data revision: _________		**Source of aerodynamic model:** _________	
FMS identification and revision level: _________		**Source of aerodynamic coefficient data:** _________	
Visual system manufacturer/model: _________		**Aerodynamic data revision number:** _________	
Flight control data revision: _________		**Visual system display:** _________	
Mot ion system manufacturer/type: _________		**FSTD computer(s) identification:** _________	

National Aviation Authority (NAA): (If Applicable)	_________		
NAA FSTD ID No:	_________	**Last NAA Evaluation Date:**	_________
NAA Qualification Level:	_________		
NAA Qualification Basis:	_____		

Attachment 4 to Appendix D to Part 60—
Figure D4F – Sample Statement of Qualification – Configuration List
INFORMATION

Visual System Manufacturer and Type:	________	**FSTD Seats Available:** ________	**Motion System Manufacturer and Type:**	________:	
Aircraft Equipment:	**Engine Type(s):** ____ ____	**Flight Instrumentation:** ☐ EFIS ☐ HUD ☐ HGS ☐ EFVS ☐ TCAS ☐ GPWS ☐ Plain View ☐ GPS ☐ FMS Type: __ ☐ WX Radar ☐ Other: __		**Engine Instrumentation:** ☐ EICAS ☐ FADEC ☐ Other: __	

Airport Models:	3.6.1 ____ Airport Designator	3.6.2____ Airport Designator	3.6.3 ____ Airport Designator
Circle to Land:	3. 7.1 ____ Airport Designator	3. 7.2____ Approach	3. 7.3 ____ Landing Runway
Visual Ground Segment	3.8.1 ____ Airport Designator	3.8 .2____ Approach	3. 8.3 ____ Landing Runway

Section 2. Supplementary Information

FAA Training Program Approval Authority:		☐ POI ☐ TCPM ☐ Other: _____	
Name:	________	**Office:**	________
Tel:	________	**Fax:**	________
Email:	________		
FSTD Scheduling Person:			
Name:	________		
Address 1:	________	**Address 2**	________
City:	________	**State:**	________
ZIP:	________	**Email:**	________
Tel:	________	**Fax:**	________
FSTD Technical Contact:			
Name:	________		
Address 1:	________	**Address 2**	________
City:	________	**State:**	________
ZIP:	________	**Email:**	________
Tel:	________	**Fax:**	________

Section 3. Training, Testing and Checking Considerations

Area/Function/Maneuver	Requested	Remarks
Private Pilot - Training / Checks: (142)	☐	________
Commercial Pilot - Training /Checks:(142)	☐	________
Multi-Engine Rating - Training / Checks (142)	☐	________
Instrument Rating -Training / Checks (142)	☐	________
Type Rating - Training / Checks (135/121/142)	☐	________
Proficiency Checks (135/121/142)	☐	________

aworley on LAPBH6H6L3 with DISTILLER VerDate Sep<11>2014 14:00 Mar 14, 2024 Jkt 262047 PO 00000 Frm 00456 Fmt 8010 Sfmt 8006 Q:\14\14V2.TXT PC31
ER09MY08.062</GPH>

Attachment 4 to Appendix D to Part 60—
Figure D4F – Sample Statement of Qualification – Configuration List
INFORMATION

CAT I: (RVR 2400/1800 ft. DH200 ft)	☐	_________
CAT II: (RVR 1200 ft. DH 100 ft)	☐	_________
CAT III * (lowest minimum) _________ RVR _________ ft. * State CAT III (≤ 700 ft.), CAT IIIb (≤ 150 ft.), or CAT IIIc (0 ft.)	☐	_________
Circling Approach	☐	_________
Windshear Training:	☐	_________
Windshear Training IAW 121.409(d) (121 Turbojets Only)	☐	_________
Generic Unusual Attitudes and Recoveries within the Normal Flight Envelope	☐	_________
Specific Unusual Attitudes Recoveries	☐	_________
Auto-coupled Approach/Auto Go Around	☐	_________
Auto-land / Roll Out Guidance	☐	_________
TCAS/ACAS I / II	☐	_________
WX-Radar	☐	_________
HUD	☐	_________
HGS	☐	_________
EFVS	☐	_________
Future Air Navigation Systems	☐	_________
GPWS / EGPWS	☐	_________
ETOPS Capability	☐	_________
GPS	☐	_________
SMGCS	☐	_________
Helicopter Slope Landings	☐	_________
Helicopter External Load Operations	☐	_________
Helicopter Pinnacle Approach to Landings	☐	_________
Helicopter Night Vision Maneuvers	☐	_________
Helicopter Category A Takeoffs	☐	_________

Attachment 4 to Appendix D to Part 60—
Figure D4G – Sample Statement of Qualification – List of Qualified Tasks
INFORMATION

STATEMENT of QUALIFICATION
LIST of QUALIFIED TASKS

Go-Fast Training Center Vertiflite AB-320 -- Level C -- FAA ID# 888

The FTD is qualified to perform all of the Maneuvers, Procedures, Tasks, and Functions Listed in Appendix D, Attachment 1, Table D1B, Minimum FTD Requirements In Effect on [mm/dd/yyyy] except for the following listed Tasks or Functions.

(*Example*) **Excepted Tasks:** **6.f.** Fire Detection and Extinguisher System. **7.d.** Ditching.
Excepted Simulator Systems: Remote IOS
Additional Qualified Tasks or Functions in addition to those listed in Appendix D, Attachment 3, Table D1B, Minimum FTD Requirements. (None)

ATTACHMENT 4 TO APPENDIX D TO PART 60—FIGURE D4H [RESERVED]

Attachment 4 to Appendix D to Part 60—
Figure D4I – Sample MQTG Index of Effective FTD Directives
INFORMATION

Index of Effective FSTD Directives Filed in this Section			
Number	**Effective Date**	**Date of Notification**	**Details**

Continue as Necessary....

[Doc. No. FAA–2002–12461, 73 FR 26490, May 9, 2008, as amended by Amdt. 60–6, 83 FR 30276, June 27, 2018; Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75832, Dec. 9, 2022]

APPENDIX E TO PART 60—QUALIFICATION PERFORMANCE STANDARDS FOR QUALITY MANAGEMENT SYSTEMS FOR FLIGHT SIMULATION TRAINING DEVICES

BEGIN QPS REQUIREMENTS

a. Not later than May 30, 2010, each current sponsor of an FSTD must submit to the responsible Flight Standards office a proposed Quality Management System (QMS) program as described in this appendix. The responsible Flight Standards office will notify the sponsor of the acceptability of the program, including any required adjustments. Within 6 months of the notification of acceptability, the sponsor must implement the program, conduct internal audits, make required program adjustments as a result of any internal audit, and schedule the responsible Flight Standards office initial audit.

b. First-time FSTD sponsors must submit to the responsible Flight Standards office the proposed QMS program no later than 120 days before the initial FSTD evaluation. The responsible Flight Standards office will notify the sponsor of the acceptability of the program, including any required adjustments. Within 6 months of the notification of acceptability, the sponsor must implement the program, conduct internal audits, make required program adjustments as a result of any internal audit, and schedule the responsible Flight Standards office initial audit.

c. The Director of Operations for a Part 119 certificate holder, the Chief Instructor for a Part 141 certificate holder, or the equivalent for a Part 142 or Flight Engineer School sponsor must designate a Management Representative (MR) who has the authority to establish and modify the sponsor's policies, practices, and procedures regarding the QMS program for the recurring qualification and the daily use of each FSTD.

d. The minimum content required for an acceptable QMS is found in Table E1. The policies, processes, or procedures described in this table must be maintained in a Quality Manual and will serve as the basis for the following:

(1) The sponsor-conducted initial and recurring periodic assessments;

(2) The responsible Flight Standards office-conducted initial and recurring periodic assessments; and

(3) The continuing surveillance and analysis by the responsible Flight Standards office of the sponsor's performance and effectiveness in providing a satisfactory FSTD for use on a regular basis.

e. The sponsor must conduct assessments of its QMS program in segments. The segments will be established by the responsible Flight Standards office at the initial assessment, and the interval for the segment assessments will be every 6 months. The intervals for the segment assessments may be extended beyond 6 months as the QMS program matures, but will not be extended beyond 12 months. The entire QMS program must be assessed every 24 months.

f. The periodic assessments conducted by the responsible Flight Standards office will be conducted at intervals not less than once every 24 months, and include a comprehensive review of the QMS program. These reviews will be conducted more frequently if warranted.

END QPS REQUIREMENTS

BEGIN INFORMATION

g. An example of a segment assessment—At the initial QMS assessment, the responsible Flight Standards office will divide the QMS program into segments (e.g., 6 separate segments). There must be an assessment of a certain number of segments every 6 months (i.e., segments 1 and 2 at the end of the first 6 month period; segments 3 and 4 at the end of the second 6 month period (or one year); and segments 5 and 6 at the end of the third 6 month period (or 18 months). As the program matures, the interval between assessments may be extended to 12 months (e.g., segments 1, 2, and 3 at the end of the first year; and segments 4, 5, and 6 at the end of the second year). In both cases, the entire QMS program is assessed at least every 24 months.

h. The following materials are presented to assist sponsors in preparing for an responsible Flight Standards office evaluation of the QMS program. The sample documents include:

(1) The desk assessment tool for initial evaluation of the required elements of a QMS program.

(2) The on-site assessment tool for initial and continuing evaluation of the required elements of a QMS program.

(3) An Element Assessment Table that describes the circumstances that exist to warrant a finding of ''non-compliance,'' or ''non-conformity''; ''partial compliance,'' or ''partial conformity''; and ''acceptable compliance,'' or ''acceptable conformity.''

(4) A sample Continuation Sheet for additional comments that may be added by the sponsor or the responsible Flight Standards office during a QMS evaluation.

(5) A sample Sponsor Checklist to assist the sponsor in verifying the elements that comprise the required QMS program.

(6) A table showing the essential functions, processes, and procedures that relate to the required QMS components and a cross-reference to each represented task.

i. Additional Information.

(1) In addition to specifically designated QMS evaluations, the responsible Flight Standards office will evaluate the sponsor's QMS program as part of regularly scheduled FSTD continuing qualification evaluations and no-notice FSTD evaluations, focusing in part on the effectiveness and viability of the QMS program and its contribution to the overall capability of the FSTD to meet the requirements of this part.

(2) The sponsor or MR may delegate duties associated with maintaining the qualification of the FSTD (e.g., corrective and preventive maintenance, scheduling and conducting tests or inspections, functional preflight checks) but retain the responsibility and authority for the day-to-day qualification of the FSTD. One person may serve as the sponsor or MR for more than one FSTD, but one FSTD may not have more than one sponsor or MR.

(3) A QMS program may be applicable to more than one certificate holder (e.g., part 119 and part 142 or two part 119 certificate holders) and an MR may work for more than one certificate holder (e.g., part 119 and part 142 or two part 119 certificate holders) as long as the sponsor's QMS program requirements and the MR requirements are met for each certificate holder.

j. The FAA does not mandate a specific QMS program format, but an acceptable QMS program should contain the following:

(1) A Quality Policy. This is a formal written Quality Policy Statement that is a commitment by the sponsor outlining what the Quality System will achieve.

(2) A MR who has overall authority for monitoring the on-going qualification of assigned FSTDs to ensure that all FSTD qualification issues are resolved as required by this part. The MR should ensure that the QMS program is properly implemented and maintained, and should:

(a) Brief the sponsor's management on the qualification processes;

(b) Serve as the primary contact point for all matters between the sponsor and the responsible Flight Standards office regarding the qualification of the assigned FSTDs; and

(c) Oversee the day-to-day quality control.

(3) The system and processes outlined in the QMS should enable the sponsor to monitor compliance with all applicable regulations and ensure correct maintenance and

performance of the FSTD in accordance with part 60.

(4) A QMS program and a statement acknowledging completion of a periodic review by the MR should include the following:

(a) A maintenance facility that provides suitable FSTD hardware and software tests and maintenance capability.

(b) A recording system in the form of a technical log in which defects, deferred defects, and development projects are listed, assigned and reviewed within a specified time period.

(c) Routine maintenance of the FSTD and performance of the QTG tests with adequate staffing to cover FSTD operating periods.

(d) A planned internal assessment schedule and a periodic review should be used to verify that corrective action was complete and effective. The assessor should have adequate knowledge of FSTDs and should be acceptable to the responsible Flight Standards office.

(5) The MR should receive Quality System training and brief other personnel on the procedures.

END INFORMATION

TABLE E1—FSTD QUALITY MANAGEMENT SYSTEM

Entry No.	QPS Requirement	Information (Reference)
E1.1.	A QMS manual that prescribes the policies, processes, or procedures outlined in this table.	§ 60.5(a).
E1.2.	A policy, process, or procedure specifying how the sponsor will identify deficiencies in the QMS.	§ 60.5(b).
E1.3.	A policy, process, or procedure specifying how the sponsor will document how the QMS program will be changed to address deficiencies.	§ 60.5(b).
E1.4.	A policy, process, or procedure specifying how the sponsor will address proposed program changes (for programs that do not meet the minimum requirements as notified by the responsible Flight Standards office) to the responsible Flight Standards office and receive approval prior to their implementation.	§ 60.5(c).
E1.5.	A policy, process, or procedure specifying how the sponsor will document that at least one FSTD is used within the sponsor's FAA-approved flight training program for the aircraft or set of aircraft at least once within the 12-month period following the initial or upgrade evaluation conducted by the responsible Flight Standards office and at least once within each subsequent 12-month period thereafter.	§ 60. 7(b)(5).
E1.6.	A policy, process, or procedure specifying how the sponsor will document that at least one FSTD is used within the sponsor's FAA-approved flight training program for the aircraft or set of aircraft at least once within the 12-month period following the first continuing qualification evaluation conducted by the responsible Flight Standards office and at least once within each subsequent 12-month period thereafter.	§ 60.7(b)(6).
E1.7.	A policy, process, or procedure specifying how the sponsor will obtain an annual written statement from a qualified pilot (who has flown the subject aircraft or set of aircraft during the preceding 12-month period) that the performance and handling qualities of the subject FSTD represents the subject aircraft or set of aircraft (within the normal operating envelope). Required only if the subject FSTD is not used in the sponsor's FAA-approved flight training program for the aircraft or set of aircraft at least once within the preceding 12-month period.	§ 60.5(b)(7) and § 60.7(d)(2).
E1.8.	A policy, process, or procedure specifying how independent feedback (from persons recently completing training, evaluation, or obtaining flight experience; instructors and check airmen using the FSTD for training, evaluation or flight experience sessions; and FSTD technicians and maintenance personnel) will be received and addressed by the sponsor regarding the FSTD and its operation.	§ 60.9(b)(1).
E1.9.	A policy, process, or procedure specifying how and where the FSTD SOQ will be posted, or accessed by an appropriate terminal or display, in or adjacent to the FSTD.	§ 60.9(b)(2).
E1.10.	A policy, process, or procedure specifying how the sponsor's management representative (MR) is selected and identified by name to the responsible Flight Standards office.	§ 60.9(c) and Appendix E, paragraph(d).
E1.11.	A policy, process, or procedure specifying the MR authority and responsibility for the following:	§ 60.9(c)(2), (3), and (4).
E1.11.a.	Monitoring the on-going qualification of assigned FSTDs to ensure all matters regarding FSTD qualification are completed as required by this part.	
E1.11.b.	Ensuring that the QMS is properly maintained by overseeing the QMS policies, practices, or procedures and modifying as necessary.	
E1.11.c.	Regularly briefing sponsor's management on the status of the on-going FSTD qualification program and the effectiveness and efficiency of the QMS.	

TABLE E1—FSTD QUALITY MANAGEMENT SYSTEM—Continued

Entry No.	QPS Requirement	Information (Reference)
E1.11.d.	Serving as the primary contact point for all matters between the sponsor and the responsible Flight Standards office regarding the qualification of assigned FSTDs.	
E1.11.e.	Delegating the MR assigned duties to an individual at each of the sponsor's locations, as appropriate.	
E1.12.	A policy, process, or procedure specifying how the sponsor will:	§ 60.13; QPS Appendices A, B, C, and D.
E1.12.a.	Ensure that the data made available to the responsible Flight Standards office (the validation data package) includes the aircraft manufacturer's flight test data (or other data approved by the responsible Flight Standards office) and all relevant data developed after the type certificate was issued (*e.g.,* data developed in response to an airworthiness directive) if the data results from a change in performance, handling qualities, functions, or other characteristics of the aircraft that must be considered for flight crewmember training, evaluation, or experience requirements.	
E1.12.b.	Notify the responsible Flight Standards office within 10 working days of becoming aware that an addition to or a revision of the flight related data or airplane systems related data is available if this data is used to program or operate a qualified FSTD.	
E1.12.c.	Maintain a liaison with the manufacturer of the aircraft being simulated (or with the holder of the aircraft type certificate for the aircraft being simulated if the manufacturer is no longer in business), and if appropriate, with the person who supplied the aircraft data package for the FFS for the purposes of receiving notification of data package changes.	
E1.13.	A policy, process, or procedure specifying how the sponsor will make available all special equipment and qualified personnel needed to conduct tests during initial, continuing qualification, or special evaluations.	§ 60.14.
E1.14.	A policy, process, or procedure specifying how the sponsor will submit to the responsible Flight Standards office a request to evaluate the FSTD for initial qualification at a specific level and simultaneously request the TPAA forward a concurring letter to the responsible Flight Standards office; including how the MR will use qualified personnel to confirm the following:.	§ 60.15(a)–(d); § 60.15(b); § 60.15(b)(i); § 60.15(b)(ii); § 60.15(b)(iii).
E1.14.a.	That the performance and handling qualities of the FSTD represent those of the aircraft or set of aircraft within the normal operating envelope.	
E1.14.b.	The FSTD systems and sub-systems (including the simulated aircraft systems) functionally represent those in the aircraft or set of aircraft.	
E1.14.c.	The flight deck represents the configuration of the specific type or aircraft make, model, and series aircraft being simulated, as appropriate.	
E1.15.	A policy, process, or procedure specifying how the subjective and objective tests are completed at the sponsor's training facility for an initial evaluation.	§ 60.15(e).
E1.16.	A policy, process, or procedure specifying how the sponsor will update the QTG with the results of the FAA-witnessed tests and demonstrations together with the results of the objective tests and demonstrations after the responsible Flight Standards office completes the evaluation for initial qualification.	§ 60.15(h).
E1.17.	A policy, process, or procedure specifying how the sponsor will make the MQTG available to the responsible Flight Standards office upon request.	§ 60.15(i).
E1.18.	A policy, process, or procedure specifying how the sponsor will apply to the responsible Flight Standards office for additional qualification(s) to the SOQ.	§ 60.16(a); § 60.16(a)(1)(i); and § 60.16(a)(1)(ii).
E1.19.	A policy, process, or procedure specifying how the sponsor completes all required Attachment 2 objective tests each year in a minimum of four evenly spaced inspections as specified in the appropriate QPS.	§ 60.19(a)(1) QPS Appendices A, B, C, or D.
E1.20.	A policy, process, or procedure specifying how the sponsor completes and records a functional preflight check of the FSTD within the preceding 24 hours of FSTD use, including a description of the functional preflight.	§ 60.19(a)(2) QPS Appendices A, B, C, or D.
E1.21.	A policy, process, or procedure specifying how the sponsor schedules continuing qualification evaluations with the responsible Flight Standards office.	§ 60.19(b)(2).
E1.22.	A policy, process, or procedure specifying how the sponsor ensures that the FSTD has received a continuing qualification evaluation at the interval described in the MQTG.	§ 60.19(b)(5)–(6).
E1.23.	A policy, process, or procedure describing how discrepancies are recorded in the FSTD discrepancy log, including.	§ 60.19(c); § 60.19(c)(2)(i); § 60.19(c)(2)(ii).
E1.23.a.	A description of how the discrepancies are entered and maintained in the log until corrected.	
E1.23.b.	A description of the corrective action taken for each discrepancy, the identity of the individual taking the action, and the date that action is taken.	

TABLE E1—FSTD QUALITY MANAGEMENT SYSTEM—Continued

Entry No.	QPS Requirement	Information (Reference)
E1.24.	A policy, process, or procedure specifying how the discrepancy log is kept in a form and manner acceptable to the Administrator and kept in or adjacent to the FSTD. (An electronic log that may be accessed by an appropriate terminal or display in or adjacent to the FSTD is satisfactory.).	§ 60.19(c)(2)(iii).
E1.25.	A policy, process, or procedure that requires each instructor, check airman, or representative of the Administrator conducting training, evaluation, or flight experience, and each person conducting the preflight inspection, who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the FSTD, to write or cause to be written a description of that discrepancy into the discrepancy log at the end of the FSTD preflight or FSTD use session.	§ 60.20.
E1.26.	A policy, process, or procedure specifying how the sponsor will apply for initial qualification based on the final aircraft data package approved by the aircraft manufacturer if operating an FSTD based on an interim qualification.	§ 60.21(c).
E1.27.	A policy, process, or procedure specifying how the sponsor determines whether an FSTD change qualifies as a modification as defined in § 60.23.	§ 60.23(a)(1)–(2).
E1.28.	A policy, process, or procedure specifying how the sponsor will ensure the FSTD is modified in accordance with any FSTD Directive regardless of the original qualification basis.	§ 60.23(b).
E1.29.	A policy, process, or procedure specifying how the sponsor will notify the responsible Flight Standards office and TPAA of their intent to use a modified FSTD and to ensure that the modified FSTD will not be used prior to:.	§ 60.23(c)(1)(i),(ii), and (iv).
E1.29.a.	Twenty-one days since the sponsor notified the responsible Flight Standards office and the TPAA of the proposed modification and the sponsor has not received any response from either the responsible Flight Standards office or the TPAA; or.	
E1.29.b.	Twenty-one days since the sponsor notified the responsible Flight Standards office and the TPAA of the proposed modification and one has approved the proposed modification and the other has not responded; or.	
E1.29.c.	The FSTD successfully completing any evaluation the responsible Flight Standards office may require in accordance with the standards for an evaluation for initial qualification or any part thereof before the modified FSTD is placed in service.	
E1.30	A policy, process, or procedure specifying how, after an FSTD modification is approved by the responsible Flight Standards office, the sponsor will:	§ 60.23(d)–(e).
E1.30.a.	Post an addendum to the SOQ until as the responsible Flight Standards office issues a permanent, updated SOQ.	
E1.30.b.	Update the MQTG with current objective test results and appropriate objective data for each affected objective test or other MQTG section affected by the modification.	
E1.30.c.	File in the MQTG the requirement from the responsible Flight Standards office to make the modification and the record of the modification completion.	
E1.31.	A policy, process, or procedure specifying how the sponsor will track the length of time a component has been missing, malfunctioning, or inoperative (MMI), including:.	§ 60.25(b)–(c), and QPS Appendices A, B, C, or D.
E1.31.a.	How the sponsor will post a list of MMI components in or adjacent to the FSTD.	
E1.31.b.	How the sponsor will notify the responsible Flight Standards office if the MMI has not been repaired or replaced within 30 days.*.	
E1.32.	A policy, process, or procedure specifying how the sponsor will notify the responsible Flight Standards office and how the sponsor will seek requalification of the FSTD if the FSTD is moved and reinstalled in a different location.	§ 60.27(a)(3).
E1.33.	A policy, process, or procedure specifying how the sponsor will maintain control of the following: (The sponsor must specify how these records are maintained in plain language form or in coded form; but if the coded form is used, the sponsor must specify how the preservation and retrieval of information will be conducted.).	§ 60.31.
E1.33.a.	The MQTG and each amendment.	
E1.33.b.	A record of all FSTD modifications required by this part since the issuance of the original SOQ.	
E1.33.c.	Results of the qualification evaluations (initial and each upgrade) since the issuance of the original SOQ.	
E1.33.d.	Results of the objective tests conducted in accordance with this part for a period of 2 years.	
E1.33.e.	Results of the previous three continuing qualification evaluations, or the continuing qualification evaluations from the previous 2 years, whichever covers a longer period..	
E1.33.f.	Comments obtained in accordance with § 60.9(b);.	

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TABLE E1—FSTD QUALITY MANAGEMENT SYSTEM—Continued

Entry No.	QPS Requirement	Information (Reference)
E1.33.g.	A record of all discrepancies entered in the discrepancy log over the previous 2 years, including the following:	
E1.33.g.1.	A list of the components or equipment that were or are missing, malfunctioning, or inoperative.	
E1.33.g.2.	The action taken to correct the discrepancy.	
E1.33.g.3.	The date the corrective action was taken.	
E1.33.g.4.	The identity of the person determining that the discrepancy has been corrected..	

* **Note:** If the sponsor has an approved discrepancy prioritization system, this item is satisfied by describing how discrepancies are prioritized, what actions are taken, and how the sponsor will notify the responsible Flight Standards office if the MMI has not been repaired or replaced within the specified timeframe.

[Doc. No. FAA–2002–12461, 73 FR 26490, May 9, 2008, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75842, Dec. 9, 2022]

APPENDIX F TO PART 60—DEFINITIONS AND ABBREVIATIONS FOR FLIGHT SIMULATION TRAINING DEVICES

BEGIN INFORMATION

1. SOME OF THE DEFINITIONS PRESENTED BELOW ARE REPEATED FROM THE DEFINITIONS FOUND IN 14 CFR PART 1, AS INDICATED PARENTHETICALLY

END INFORMATION

BEGIN QPS REQUIREMENTS

2. DEFINITIONS

1st Segment—the portion of the takeoff profile from liftoff to gear retraction.

2nd Segment—the portion of the takeoff profile from after gear retraction to initial flap/slat retraction.

3rd Segment—the portion of the takeoff profile after flap/slat retraction is complete.

Aircraft Data Package—a combination of the various types of data used to design, program, manufacture, modify, and test the FSTD.

Airspeed—calibrated airspeed unless otherwise specified and expressed in terms of nautical miles per hour (knots).

Airport Model—

Class I. Whether modeling real world or fictional airports (or landing areas for helicopters), these airport models (or landing areas for helicopters) are those that meet the requirements of Table A3B or C3B, found in attachment 2 of Appendix A or C, as appropriate, are evaluated by the responsible Flight Standards office, and are listed on the SOQ.

Class II. Whether modeling real world or fictional airports (or landing areas for helicopters), these airport models (or landing areas for helicopters) are those models that are in excess of those used for simulator qualification at a specified level. The FSTD sponsor is responsible for determining that these models meet the requirements set out in Table A3C or C3C, found in attachment 2 of Appendix A or C, as appropriate.

Class III. This is a special class of airport model (or landing area for helicopters), used for specific purposes, and includes models that may be incomplete or inaccurate when viewed without restriction, but when appropriate limits are applied (e.g., ''valid for use only in visibility conditions less than ½ statute mile or RVR2400 feet,'' ''valid for use only for approaches to Runway 22L and 22R''), those features that may be incomplete or inaccurate may not be able to be recognized as such by the crewmember being trained, tested, or checked. Class III airport models used for training, testing, or checking activities under this Chapter requires the certificate holder to submit to the TPAA an appropriate analysis of the skills, knowledge, and abilities necessary for competent performance of the task(s) in which this particular model is to be used, and requires TPAA acceptance of each Class III model.

Altitude—pressure altitude (meters or feet) unless specified otherwise.

Angle of Attack—the angle between the airplane longitudinal axis and the relative wind vector projected onto the airplane plane of symmetry.

Automatic Testing—FSTD testing where all stimuli are under computer control.

Bank—the airplane attitude with respect to or around the longitudinal axis, or roll angle (degrees).

Breakout—the force required at the pilot's primary controls to achieve initial movement of the control position.

Certificate Holder—a person issued a certificate under parts 119, 141, or 142 of this chapter or a person holding an approved course of training for flight engineers in accordance with part 63 of this chapter.

Closed Loop Testing—a test method where the input stimuli are generated by controllers that drive the FSTD to follow a pre-defined target response.

Computer Controlled Aircraft—an aircraft where all pilot inputs to the control surfaces are transferred and augmented by computers.

Confined Area (helicopter operations)—an area where the flight of the helicopter is limited in some direction by terrain or the presence of natural or man-made obstructions (e.g., a clearing in the woods, a city street, or a road bordered by trees or power lines are regarded as confined areas).

Control Sweep—movement of the appropriate pilot controller from neutral to an extreme limit in one direction (Forward, Aft, Right, or Left), a continuous movement back through neutral to the opposite extreme position, and then a return to the neutral position.

Convertible FSTD—an FSTD in which hardware and software can be changed so that the FSTD becomes a replica of a different model, usually of the same type aircraft. The same FSTD platform, flight deck shell, motion system, visual system, computers, and peripheral equipment can be used in more than one simulation.

Critical Engine Parameter—the parameter that is the most accurate measure of propulsive force.

Deadband—the amount of movement of the input for a system for which there is no reaction in the output or state of the system observed.

Distance—the length of space between two points, expressed in terms of nautical miles unless otherwise specified.

Discrepancy—as used in this part, an aspect of the FSTD that is not correct with respect to the aircraft being simulated. This includes missing, malfunctioning, or inoperative components that are required to be present and operate correctly for training, evaluation, and experience functions to be creditable. It also includes errors in the documentation used to support the FSTD (e.g., MQTG errors, information missing from the MQTG, or required statements from appropriately qualified personnel).

Downgrade—a permanent change in the qualification level of an FSTD to a lower level.

Driven—a test method where the input stimulus or variable is positioned by automatic means, usually a computer input.

Electronic Copy of the MQTG—an electronic copy of the MQTG provided by an electronic scan presented in a format, acceptable to the responsible Flight Standards office.

Electronic Master Qualification Test Guide—an electronic version of the MQTG (eMQTG), where all objective data obtained from airplane testing, or another approved source, together with correlating objective test results obtained from the performance of the FSTD and a description of the equipment necessary to perform the evaluation for the initial and the continuing qualification evaluations is stored, archived, or presented in either reformatted or digitized electronic format.

Engine—as used in this part, the appliance or structure that supplies propulsive force for movement of the aircraft: i.e., The turbine engine for turbine powered aircraft; the turbine engine and propeller assembly for turbo-propeller powered aircraft; and the reciprocating engine and propeller assembly for reciprocating engine powered aircraft. For purposes of this part, engine failure is the failure of either the engine or propeller assembly to provide thrust higher than idle power thrust due to a failure of either the engine or the propeller assembly.

Evaluation—with respect to an individual, the checking, testing, or review associated with flight crewmember qualification, training, and certification under parts 61, 63, 121, or 135 of this chapter. With respect to an FSTD, the qualification activities for the device (e.g., the objective and subjective tests, the inspections, or the continuing qualification evaluations) associated with the requirements of this part.

Fictional Airport—a visual model of an airport that is a collection of ''non-real world'' terrain, instrument approach procedures, navigation aids, maps, and visual modeling detail sufficient to enable completion of an Airline Transport Pilot Certificate or Type Rating.

Flight Experience—recency of flight experience for landing credit purposes.

Flight Simulation Training Device (FSTD)—a full flight simulator (FFS) or a flight training device (FTD). (Part 1)

Flight Test Data—(a subset of objective data) aircraft data collected by the aircraft manufacturer or other acceptable data supplier during an aircraft flight test program.

Flight Training Device (FTD)—a replica of aircraft instruments, equipment, panels, and controls in an open flight deck area or an enclosed aircraft flight deck replica. It includes the equipment and computer programs necessary to represent aircraft (or set of aircraft) operations in ground and flight conditions having the full range of capabilities of the systems installed in the device as described in part 60 of this chapter and the qualification performance standard (QPS) for a specific FTD qualification level. (Part 1)

Free Response—the response of the FSTD after completion of a control input or disturbance.

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Frozen—a test condition where one or more variables are held constant with time.

FSTD Approval—the extent to which an FSTD may be used by a certificate holder as authorized by the FAA.

FSTD Directive—a document issued by the FAA to an FSTD sponsor requiring a modification to the FSTD due to a safety-of-flight issue and amending the qualification basis for the FSTD.

FSTD Latency—the additional time for the FSTD to respond to input that is beyond the response time of the aircraft.

FSTD Performance—the overall performance of the FSTD, including aircraft performance (e.g., thrust/drag relationships, climb, range) and flight and ground handling.

Full Flight Simulator (FFS)—a replica of a specific type, make, model, or series aircraft. It includes the equipment and computer programs necessary to represent aircraft operations in ground and flight conditions, a visual system providing an out-of-the-flight deck view, a system that provides cues at least equivalent to those of a three-degree-of-freedom motion system, and has the full range of capabilities of the systems installed in the device as described in part 60 of this chapter and the QPS for a specific FFS qualification level. (Part 1)

Gate Clutter—the static and moving ground traffic (e.g., other airplanes; tugs; power or baggage carts; fueling, catering, or cargo trucks; pedestrians) presented to pose a potential conflict with the simulated aircraft during ground operations around the point where the simulated airplane is to be parked between flights

Generic Airport Model—a Class III visual model that combines correct navigation aids for a real world airport with a visual model that does not depict that same airport.

Grandfathering—as used in this part, the practice of assigning a qualification basis for an FSTD based on the period of time during which a published set of standards governed the requirements for the initial and continuing qualification of FSTDs. Each FSTD manufactured during this specified period of time is ''grandfathered'' or held to the standards that were in effect during that time period. The grandfathered standards remain applicable to each FSTD manufactured during the stated time period regardless of any subsequent modification to those standards and regardless of the sponsor, as long as the FSTD remains qualified or is maintained in a non-qualified status in accordance with the specific requirements and time periods prescribed in this part.

Gross Weight—For objective test purposes:

Basic Operating Weight (BOW)—the empty weight of the aircraft plus the weight of the following: Normal oil quantity; lavatory servicing fluid; potable water; required crewmembers and their baggage; and emergency equipment.

Light Gross Weight—a weight chosen by the sponsor or data provider that is not more than 120% of the BOW of the aircraft being simulated or the minimum practical operating weight of the test aircraft.

Medium Gross Weight—a weight chosen by the sponsor or data provider that is within 10% of the average of the numerical values of the BOW and the maximum certificated gross weight.

Near Maximum Gross Weight—a weight chosen by the sponsor or data provider that is not less than the BOW of the aircraft being simulated plus 80% of the difference between the maximum certificated gross weight (either takeoff weight or landing weight, as appropriate for the test) and the BOW.

Ground Effect—the change in aerodynamic characteristics due to of the change in the airflow past the aircraft caused by the proximity of the earth's surface to the airplane.

Hands Off—a test maneuver conducted without pilot control inputs.

Hands On—a test maneuver conducted with pilot control inputs as required.

Heave—FSTD movement with respect to or along the vertical axis.

Height—the height above ground level (or AGL) expressed in meters or feet.

''In Use'' Runway—as used in this part, the runway that is currently selected, able to be used for takeoffs and landings, and has the surface lighting and markings required by this part. Also known as the ''active'' runway.

Integrated Testing—testing of the FSTD so that all aircraft system models are active and contribute appropriately to the results. With integrated testing, none of the models used are substituted with models or other algorithms intended for testing only.

Irreversible Control System—a control system where movement of the control surface will not backdrive the pilot's control on the flight deck.

Locked—a test condition where one or more variables are held constant with time.

Manual Testing—FSTD testing conducted without computer inputs except for initial setup, and all modules of the simulation are active.

Master Qualification Test Guide (MQTG)—the FAA-approved Qualification Test Guide with the addition of the FAA-witnessed test results, applicable to each individual FSTD.

Medium—the normal operational weight for a given flight segment.

Near Limiting Performance—the performance level the operating engine must be required to achieve to have sufficient power to land a helicopter after experiencing a single engine failure during takeoff of a multiengine helicopter. The operating engine must be required to operate within at least 5 percent of the maximum RPM or temperature limits of the gas turbine or power turbine, or operate within at least 5 percent of the maximum drive train torque limits. Near limiting performance is based on the existing combination of density altitude, temperature, and helicopter gross weight.

Nominal—the normal operating configuration, atmospheric conditions, and flight parameters for the specified flight segment.

Non-Normal Control—a term used in reference to Computer Controlled Aircraft. It is the state where one or more of the intended control, augmentation, or protection functions are not fully working. Note: Specific terms such as ALTERNATE, DIRECT, SECONDARY, or BACKUP may be used to define an actual level of degradation.

Normal Control—a term used in reference to Computer Controlled Aircraft. It is the state where the intended control, augmentation, and protection functions are fully working.

Objective Data—quantitative data, acceptable to the NSPM, used to evaluate the FSTD.

Objective Test—a quantitative measurement and evaluation of FSTD performance.

Pitch—the airplane attitude with respect to, or around, the lateral axis expressed in degrees.

Power Lever Angle (PLA)—the angle of the pilot's primary engine control lever(s) on the flight deck. This may also be referred to as THROTTLE or POWER LEVER.

Predicted Data—estimations or extrapolations of existing flight test data or data from other simulation models using engineering analyses, engineering simulations, design data, or wind tunnel data.

Protection Functions—systems functions designed to protect an airplane from exceeding its flight maneuver limitations.

Pulse Input—a step input to a control followed by an immediate return to the initial position.

Qualification Level—the categorization of an FSTD established by the NSPM based on the FSTDs demonstrated technical and operational capabilities as prescribed in this part.

Qualification Performance Standard (QPS)—the collection of procedures and criteria used when conducting objective and subjective tests, to establish FSTD qualification levels. The QPS are published in the appendices to this part, as follows: Appendix A, for Airplane Simulators; Appendix B, for Airplane Flight Training Devices; Appendix C, for Helicopter Simulators; Appendix D, for Helicopter Flight Training Devices; Appendix E, for Quality Management Systems for Flight Simulation Training Devices; and Appendix F, for Definitions and Abbreviations for Flight Simulation Training Devices.

Qualification Test Guide (QTG)—the primary reference document used for evaluating an aircraft FSTD. It contains test results, statements of compliance and capability, the configuration of the aircraft simulated, and other information for the evaluator to assess the FSTD against the applicable regulatory criteria.

Quality Management System (QMS)—a flight simulation quality-systems that can be used for external quality-assurance purposes. It is designed to identify the processes needed, determine the sequence and interaction of the processes, determine criteria and methods required to ensure the effective operation and control of the processes, ensure the availability of information necessary to support the operation and monitoring of the processes, measure, monitor, and analyze the processes, and implement the actions necessary to achieve planned results.

Real-World Airport—as used in this part in reference to airport visual models, a computer generated visual depiction of an existing airport.

Representative—when used as an adjective in this part, typical, demonstrative, or characteristic of, the feature being described. For example, "representative sampling of tests" means a sub-set of the complete set of all tests such that the sample includes one or more of the tests in each of the major categories, the results of which provide the evaluator with an overall understanding of the performance and handling characteristics of the FSTD.

Reversible Control System—a control system in which movement of the control surface will backdrive the pilot's control on the flight deck.

Roll—the airplane attitude with respect to, or around, the longitudinal axis expressed in degrees.

Set of Aircraft—aircraft that share similar handling and operating characteristics, similar operating envelopes, and have the same number and type of engines or powerplants.

Sideslip Angle—the angle between the relative wind vector and the airplane plane of symmetry. (Note: this definition replaces the current definition of "sideslip.")

Simulation Quality Management System (SQMS)—the elements of a quality management system for FSTD continuing qualification.

Snapshot—a presentation of one or more variables at a given instant of time.

Special Evaluation—an evaluation of the FSTD for purposes other than initial, upgrade, or continuing qualification. Circumstances that may require a special evaluation include movement of the FSTD to a different location, or an update to FSTD software or hardware that might affect performance or flying qualities.

Sponsor—a certificate holder who seeks or maintains FSTD qualification and is responsible for the prescribed actions as prescribed in this part and the QPS for the appropriate FSTD and qualification level.

Statement of Compliance and Capability (SOC)—a declaration that a specific requirement has been met and explaining how the requirement was met (e.g., gear modeling approach, coefficient of friction sources). The SOC must also describe the capability of the FSTD to meet the requirement, including references to sources of information for showing compliance, rationale to explain how the referenced material is used, mathematical equations and parameter values used, and conclusions reached.

Step Input—an abrupt control input held at a constant value.

Subjective Test—a qualitative assessment of the performance and operation of the FSTD.

Surge—FSTD movement with respect to or along the longitudinal axis.

Sway—FSTD movement with respect to or along the lateral axis.

T_f—Total time of the flare maneuver.

T_i—Total time from initial throttle movement until a 10% response of a critical engine parameter.

T_t—Total time from initial throttle movement to an increase of 90% of go around power or a decrease of 90% from maximum take-off power.

Time History—a presentation of the change of a variable with respect to time.

Training Program Approval Authority (TPAA)—a person authorized by the Administrator to approve the aircraft flight training program in which the FSTD will be used.

Training Restriction—a temporary condition where an FSTD with missing, malfunctioning, or inoperative (MMI) components may continue to be used at the qualification level indicated on its SOQ, but restricted from completing the tasks for which the correct function of the MMI component is required.

Transport Delay or ''Throughput''—the total FSTD system processing time required for an input signal from a pilot primary flight control until motion system, visual system, or instrument response. It is the overall time delay incurred from signal input to output response. It does not include the characteristic delay of the airplane simulated.

Update—an improvement to or modernization of the quality or the accuracy of the FSTD without affecting the qualification level of the FSTD.

Upgrade—the improvement or enhancement of an FSTD for the purpose of achieving a higher qualification level.

Validation Data—objective data used to determine if the FSTD performance is within the tolerances prescribed in the QPS.

Validation Test—an objective test where FSTD parameters are compared to the relevant validation data to ensure that the FSTD performance is within the tolerances prescribed in the QPS.

Visual Data Base—a display that may include one or more airport models.

Visual System Response Time—the interval from a control input to the completion of the visual display scan of the first video field containing the resulting different information.

Yaw—the airplane attitude with respect to, or around, the vertical axis expressed in degrees.

3. Abbreviations

AFM Airplane Flight Manual.
AGL Above Ground Level (meters or feet).
AOA Angle of Attack (degrees).
APD Aircrew Program Designee.
CCA Computer Controlled Aircraft.
cd/m2 candela/meter^2, 3.4263 candela/m^2 = 1 ft-Lambert.
CFR Code of Federal Regulations.
cm(s) centimeter, centimeters.
daN decaNewtons, one (1) decaNewton = 2.27 pounds.
deg(s) degree, degrees.
DOF Degrees-of-freedom.
eMQTG Electronic Master Qualification Test Guide.
EPR Engine Pressure Ratio.
FAA Federal Aviation Administration (U.S.).
FATO Final Approach and Take Off area
fpm feet per minute.
ft foot/feet, 1 foot = 0.304801 meters.
ft-Lambert foot-Lambert, 1 ft-Lambert = 3.4263 candela/m^2.
g Acceleration due to Gravity (meters or feet/sec^2); 1g = 9.81 m/sec^2 or 32.2 feet/sec^2.
G/S Glideslope.
IATA International Airline Transport Association.
ICAO International Civil Aviation Organization.
IGE In ground effect.
ILS Instrument Landing System.
IOS Instructor Operating Station.
IQTG International Qualification Test Guide.
km Kilometers; 1 km = 0.62137 Statute Miles.
kPa KiloPascal (Kilo Newton/Meters2). 1 psi = 6.89476 kPa.
kts Knots calibrated airspeed unless otherwise specified, 1 knot = 0.5148 m/sec or 1.689 ft/sec.
lb(s) pound(s), one (1) pound = 0.44 decaNewton.
LDP Landing decision point.
MQTG Master Qualification Test Guide
M,m Meters, 1 Meter = 3.28083 feet.
Min(s) Minute, minutes.
MLG Main Landing Gear.
Mpa MegaPascals (1 psi = 6894.76 pascals).
ms millisecond(s).
N NORMAL CONTROL Used in reference to Computer Controlled Aircraft.
nm Nautical Mile(s) 1 Nautical Mile = 6,080 feet.
NN NON-NORMAL CONTROL Used in reference to Computer Controlled Aircraft.

N1 Low Pressure Rotor revolutions per minute, expressed in percent of maximum.
N2 High Pressure Rotor revolutions per minute, expressed in percent of maximum.
N3 High Pressure Rotor revolutions per minute, expressed in percent of maximum.
NWA Nosewheel Angle (degrees).
OGE Out of ground effect.
PAPI Precision Approach Path Indicator System.
Pf Impact or Feel Pressure, often expressed as "q."
PLA Power Lever Angle.
PLF Power for Level Flight.
psi pounds per square inch.
QPS Qualification Performance Standard.
QTG Qualification Test Guide.
RAE Royal Aerospace Establishment.
R/C Rate of Climb (meters/sec or feet/min).
R/D Rate of Descent (meters/sec or feet/min).
REIL Runway End Identifier Lights.
RVR Runway Visual Range (meters or feet).
s second(s).
sec(s) second, seconds.
sm Statute Mile(s) 1 Statute Mile = 5,280 feet.
SMGCS Surface Movement Guidance and Control System.
SOC Statement of Compliance and Capability.
SOQ Statement of Qualification.
TIR Type Inspection Report.
TLOF Touchdown and Loft Off area.
T/O Takeoff.
VASI Visual Approach Slope Indicator System.
VGS Visual Ground Segment.
V_1 Decision speed.
V_2 Takeoff safety speed.
Vmc Minimum Control Speed.
Vmca Minimum Control Speed in the air.
Vmcg Minimum Control Speed on the ground.
Vmcl Minimum Control Speed—Landing.
Vmu The speed at which the last main landing gear leaves the ground.
V_R Rotate Speed.
V_S Stall Speed or minimum speed in the stall.
WAT Weight, Altitude, Temperature.

END QPS REQUIREMENTS

[Doc. No. FAA–2002–12461, 73 FR 26490, May 9, 2008, as amended by Docket No. FAA–2022–1355, Amdt. No. 60–7, 87 FR 75845, Dec. 9, 2022]

PART 61—CERTIFICATION: PILOTS, FLIGHT INSTRUCTORS, AND GROUND INSTRUCTORS

SPECIAL FEDERAL AVIATION REGULATION NO. 73

SPECIAL FEDERAL AVIATION REGULATION NO. 100–2

Subpart A—General

Sec.