November 24, 2003

Mr. Nicholas A. Sabatini
Associate Administrator for Regulation and Certification
Federal Aviation Administration
800 Independence Ave., SW
Washington, DC 20591

Dear Mr. Sabatini:

In response to your request of the Flight Simulation Device Aviation Rulemaking Committee (FSD ARC), we have completed our review of the Part 60 Notice of Proposed Rule Making and have the attached recommendations that we believe are clarifying and are within the scope of the NPRM.

The overwhelming majority of the FSD ARC members present at the ARC meeting held October 20-24 have reached consensus that the part 60 rulemaking effort should go forward with the changes we have recommended in the attached documents. All of the representatives present, without any objection, believe it is imperative that the ARC QPS revision effort continue, including its pursuit of harmonization with the International Civil Aviation Organization (ICAO) and European regulatory authorities regarding flight simulation qualification requirements.

This same majority of FSD ARC members have reached consensus to remove Level 2/3 Flight Training Devices (FTDs) from the rule making effort. However, we believe that standards for Level 1/2/3 FTDs must be codified and it would be appropriate for the FSD ARC members to be tasked to resolve the concerns regarding these FTD levels. We believe that removing these generic simulations of aircraft from the current part 60 rulemaking effort will not pose a threat to the continued functioning of those levels of devices under current authorizations nor threaten the continued functioning of cockpit specific simulations of aircraft, represented by Level 4/5/6 FTDs under part 60. Two FSD ARC members (FlightSafety International and CAE) do not concur with the committee’s recommendation to remove Level 2/3 flight training devices (FTD) from the part 60 rulemaking effort. Their objection stems largely from the fact that this action does not resolve the issue of lesser technically complex devices continuing to be granted simulation device authorizations absent structured and equally imposed standards. They would rather take the time now to resolve this issue than postpone the effort until a future rulemaking effort could be tasked to the FSD ARC and yield successful results.

Despite these two objections to the majority consensus that Level 2/3 FTDs can be removed from the part 60 requirements until such time as the disputed FTD levels can be codified, all of the FSD ARC members present October 20-24, without objection, believe it is essential that the part 60 rule language not include waiver provisions regarding Level 4/5/6 FTDs as proposed in the Aircraft Owners and Pilots Association letter to you dated September 3, 2003. We believe such waiver language would be inappropriate because failure to have consistent standards for Level 4/5/6 FTDs by which these devices are determined to be qualified to fulfill specified training, certification and experience requirements would create several problems: First, it would create uncertainty in the FTD manufacturing market. Second, it could create an unleveled playing field among manufacturers and among FTD operators. Finally, and most importantly, this failure would create uncertainty that devices that might be similarly classified in the future will actually provide greatly variant levels of safety, training, and experience. Accordingly, we recommend that the part 60 rule language not include waiver provisions regarding Level 4/5/6 FTDs. Instead, we believe the exemption process is available to examine, on a case-by-case basis, whether any specific level 4/5/6 FTD should be exempt from the part 60 requirements.

Everyone present at the ARC meeting held October 20-24 recommends that you task the FSD ARC to begin work on the first revision of the QPS appendices beginning in January 2004. In doing so, the QPS changes that will be necessary to achieve the desired level of harmonization will be ready to publish as an NPRM, the FAA can obtain public comment on these revisions, and greater harmonization may be realized in the shortest time possible after publication of the final rule.

Additionally, and similar to the above position regarding continuation of the ARC QPS revision process for harmonization, we agree that it is important to continue the FSD ARC effort to resolve the disposition of and codify those FTDs now referred to as Levels 1/2/3. Our recommendation would be that these additional tasking efforts run in parallel.

We believe the FSD ARC is a very worthwhile process for both the current effort and to meet changes that may be appropriate to make in the future. The members and participants appreciate the opportunity to participate in this innovative approach to rulemaking that affords the aviation industry an opportunity to provide advice and recommendations on regulations that affect our industry and will help ensure that our regulatory process and standards continue to occupy a preeminent position in world aviation matters.

Once again, thank you for the opportunity to participate in this innovative approach to rulemaking, and we look forward to additional tasking.

Sincerely,

/s/ Ron Shoulars	/s/ Ed Cook
Industry Co-Chair	FAA Co-Chair

Attachments
(1) FSD ARC members and participants at 10/6-10 and 10/20-24 meetings
(2) FSD ARC Recommendation on part 60 rule language and QPS appendices

Flight Simulation Device Aviation Rulemaking Committee
October 6-10, 2003

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Flight Simulation Device Aviation Rulemaking Committee
October 6-10, 2003

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Flight Simulation Device Aviation Rulemaking Committee
October 20-24, 2003

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October 20-24, 2003

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Flight Simulation Device Aviation Rulemaking Committee
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October 20-24, 2003

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The Amendment

The Federal Aviation Administration amends Title 14, Chapter I of the Code of Federal Regulations as follows:

PART 1 – DEFINITIONS AND ABBREVIATIONS

1. The authority citation for part 1 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701.

2. Section 1.1 is amended by adding new definitions in alphabetical order to read as follows:

§ 1.1 General definitions.

* * * * *

Flight simulation training device (FSTD) means a flight simulator or a flight training device.

Full flight simulator (FFS) means a replica of a specific type; or make, model, and series aircraft cockpit. It includes the assemblage of equipment and computer programs necessary to represent aircraft operations in ground and flight conditions, a visual system providing an out-of-the-cockpit 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 qualification performance standards (QPS) for a specific FFS qualification level.

* * * * *

Flight training device (FTD) means a replica of aircraft instruments, equipment, panels, and controls in an open flight deck area or an enclosed aircraft cockpit 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.

* * * * *

3. Section 1.2 is amended by adding new abbreviations in alphabetical order to read as follows:

§ 1.2 Abbreviations and symbols.

* * * * *

FSTD means flight simulation training device.

FFS means full flight simulator.

FTD means flight training device.

*   *   *   *   *

4. Part 60 is added to subchapter D to read as follows:

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

Sec.

Authority: 49 U.S.C. 106(g), 40113, and 44701.

§ 60.1 Applicability.

(a) This part prescribes the rules governing the initial and continuing qualification and use of all aircraft flight simulation devices (FSTD) used for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member 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 flightcrew member 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, for the purpose of this part, the following terms and definitions apply:

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.

Evaluation. With respect to an individual, the checking, testing, or review associated with flightcrew member qualification, training, and certification under parts 61, 63, 121, or 135 of this chapter. With respect to an FSTD, the qualification activities (e.g., the objective and subjective tests, the inspections, the continuing qualification evaluations.) associated with the requirements of this part.

Flight experience. Flight experience means recency of flight experience for landing credit purposes.

Flight test data. Actual aircraft data collected by the aircraft manufacturer (or other supplier of data that are acceptable to the NSPM) during an aircraft flight test program.

FSTD Directive. A document issued by the FAA to an FSTD sponsor, requiring a modification to the FSTD due to a recognized safety-of-flight issue and amending the qualification basis for the FSTD.

FSTD Performance. The overall performance of the FSTD includes aircraft performance (e.g., thrust/drag relationships, climb, range) as well as flight and ground handling.

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.

National Simulator Program Manager (NSPM). The FAA manager responsible for the overall administration and direction of the National Simulator Program (NSP), or a person approved by the NSPM .

Objective test. A quantitative measurement and evaluation of FSTD performance..

Predicted data. Estimations or extrapolations of either existing flight test data or data from other simulation models using engineering analyses, engineering simulations, design data, and/or wind tunnel data.

Qualification level. The categorization of an FSTD established by the NSPM, based on the FSTD's demonstrated technical and operational capabilities as set out in this part.

Qualification Performance Standard (QPS). The collection of procedures and criteria published by the FAA to be used when conducting objective tests and subjective tests, including general FSTD requirements, for establishing FSTD qualification levels. . The QPS are set forth in the following FAA appendices: Appendix A, for Airplane Simulators; Appendix B, for Airplane Flight Training Devices; Appendix C, for Helicopter Simulators; Appendix D, for Helicopter Flight Training Devices; and Appendix E for Quality Management Systems for Flight Simulation Training Devices.

Qualification Test Guide (QTG). The primary reference document used for initially 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. The addition of the FAA-witnessed tests, conducted during the successful initial evaluation, into the QTG converts this document into the Master Qualification Test Guide (MQTG).

Set of aircraft. Aircraft that share similar handling, performance, and operating characteristics; similar operating envelopes; and have the same number and type of propulsion systems (i.e., engines, or engine and propeller/rotor combinations).

Sponsor. A certificate holder who seeks or maintains FSTD qualification and is responsible for the prescribed actions as set out in this part and the QPS for the appropriate FSTD and qualification level.

Subjective test. A qualitative assessment of the performance and operation of the FSTD.

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.

Upgrade. The improvement or enhancement of an FSTD for the purpose of achieving a higher qualification level.

§ 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 FSTD's.

(f) Appendix F contains the QPS for Definitions and Abbreviations for FSTD's.

§ 60.5 Quality management system.

(a) After [insert date 24 months after effective date of the final rule], no sponsor may use or allow the use of or offer the use of an FSTD for flightcrew member 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 NSPM, 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.

(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 NSPM 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 NSPM, change the program so the procedures meet the requirements of this part. Each such change must be approved by the NSPM prior to implementation.

(d) Within 30 days after the sponsor receives a notice described in § 60.5(c), the sponsor may file a petition with the Director of Flight Standards Service (the Director) for reconsideration of the NSPM finding. The sponsor must address its petition to the Director, Flight Standards Service, AFS-1, 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 Director. However, if the Director finds that there is 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.

§ 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 NSPM.

(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 subparagraphs (5) or (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 subparagraphs (5) or (6) of this section.

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

(4) The NSPM 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 § 60.7(b)(2)(i) or (ii)] that is initially qualified on or after [insert effective date of this rule], 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 § 60.7(b)(2)(i) or (ii)] that was qualified prior to [insert effective date of this rule], 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 NSP after [insert the effective date of this rule] 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 FSTD's regardless of specific aircraft or set of aircraft provided either–

(1) All of the other FSTD's 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 NSPM.

§ 60.9 Additional responsibilities of the sponsor.

(a) The sponsor must allow the NSPM 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, for each FSTD –

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

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

(c) Each sponsor of an FSTD must identify to the NSPM 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 FSTD's 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;

(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 NSPM regarding the qualification of that FSTD as provided for in this part.

(4) The MR may delegate the duties described in § 60.9(c)(2) and (3) to an individual at each of the sponsor's locations.

§ 60.11 FSTD use.

No person may use or allow the use of or offer the use of an FSTD for flightcrew member 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 –-

(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 appropriate 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 NSPM 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.

§ 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 and handling qualities during evaluation for qualification, the data made available to the NSPM (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 flightcrew member 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 appropriate 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 NSPM and, if found acceptable, 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 NSPM.

(e) The NSPM 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 appropriate QPS appendix.

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

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

§ 60.15 Initial qualification requirements.

(a) For each FSTD, the sponsor must submit a request to the NSPM to evaluate the FSTD for initial qualification at a specific level and simultaneously request the TPAA forward a concurring letter to the NSPM. The request must be submitted in the form and manner described in the appropriate 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:

(i) The performance and handling qualities of the FSTD represents 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 (e) of this section after having flown all of the operations tasks listed in the Table of Functions and Subjective Tests set out in the FSTD subject tests attachment to the appropriate 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 NSPM upon request.

(ii) 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)(i) 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 NSPM upon request.

(iii) 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)(i) 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 NSPM upon request.

(c) Except for those FSTD's 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 NSPM

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 NSPM that an FSTD has been ordered;

(ii) Within 90 days of the NSPM 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, unless circumstances beyond the control of the sponsor prevent the evaluation from occurring within that time.

(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 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.

(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 except as provided for in the appropriate QPS.

(f) The person seeking to qualify the FSTD must provide the NSPM access to the FSTD for the length of time necessary for the NSPM 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 appropriate QPS, to determine that the FSTD meets the standards in that QPS.

(g) When the FSTD passes an evaluation for initial qualification, the NSPM 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, navigation or other systems, etc.).

(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 NSPM and for which qualification is not sought) the qualification of the FSTD includes the tasks set out in the appropriate QPS appendix relevant to the qualification level of the FSTD.

(h) After the NSPM completes the evaluation for initial qualification, the sponsor must update the QTG, with the results of the FAA-witnessed tests and demonstrations together with the results of all the objective tests and demonstrations described in the appropriate QPS.

(i) Upon issuance of the Statement of Qualification the updated QTG becomes the MQTG and must be made available to the NSPM upon request.

§ 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 NSPM all modifications to the MQTG that are required to support the additional qualification.

(ii) Must describe to the NSPM all modifications to the FSTD that are required to support the additional qualification.

(iii) Must submit to the NSPM 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 accordance with § 60.15, in those circumstances where the NSPM 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 (e.g., objective tests or subjective tests) designated as necessary by the NSPM.

(b) In making the determinations described in paragraph (a)(2) of this section, the NSPM 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 NSPM 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.

§ 60.17 Previously qualified FSTD's.

(a) Unless otherwise specified by an FSTD Directive, further referenced in the appropriate QPS, or as specified in paragraph (e) of this section, an FSTD qualified before [Insert effective date of final rule] 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 [Insert effective date of the final rule], no sponsor may use or allow the use of or offer the use of such an FSTD after [Insert date 6 years after the effective date of the final rule] for flightcrew member 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 Restrictions to the Qualification List in accordance with the procedures set out in the appropriate QPS.

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

(i) Restored under § 60.27 in less than (2) years, 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, 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 [Insert the effective date of this rule] 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 NSPM 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 NSPM, 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.

§ 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 flightcrew member training, evaluation, or flight experience to meet any of the requirements of this chapter unless the sponsor does the following:

(1) Accomplishes all appropriate QPS Attachment 2 objective tests each year as specified in the appropriate 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 appropriate QPS or as may be amended by an FSTD Directive.

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

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

(4) The frequency of NSPM-conducted continuing qualification evaluations for each FSTD will be established by the NSPM and specified in the MQTG.

(5) Continuing qualification evaluations conducted in the calendar month 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 flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet any requirement of this chapter unless the FSTD has passed an NSPM-conducted continuing qualification evaluation within the timeframe specified in the MQTG 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 appropriate QPS appendix. No sponsor may use or allow the use of or offer the use of an FSTD for flightcrew member 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 must be 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.

§ 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 FSTD's for new aircraft types or models.

(a) A sponsor may apply for and the NSPM 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 NSPM—

(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 NSPM rescinds the qualification. Interim qualification terminates two years after its issuance, unless the NSPM 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 NSPM determines that specific conditions warrant otherwise.

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

§ 60.23 Modifications to FSTD's.

(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 the Statement of Qualification, or change the MQTG; or

(2) Changes are made to either software or hardware that are intended to impact flight or ground dynamics; changes 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 added to or removed from the Statement of Qualification; or change the MQTG.

(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 flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet any requirement of this chapter unless:

(1) The sponsor has notified the NSPM 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 NSPM and the TPAA of the proposed modification and the sponsor has not received any response from either the NSPM or the TPAA;

(ii) Twenty-one days have passed since the sponsor notified the NSPM 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 NSPM and the TPAA of the proposed modification and the NSPM and TPAA both approve the proposed modification;

(iv) The sponsor has successfully completed any evaluation the NSPM 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 appropriate 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.

§ 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 flightcrew member 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 NSPM.

(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 will be satisfactory. The discrepancy log may be used to satisfy this requirement provided each currently MMI component is listed in the discrepancy log.

§ 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 NSPM 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 NSPM.

(2) The NSPM advises the sponsor that an evaluation is not necessary.

(c) In making the determinations described in paragraph (b) of this section, the NSPM considers factors including 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 last evaluation.

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

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

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

(2) The NSPM 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 NSPM notifies the sponsor about the determination with regard to the qualification of the FSTD.

(4) When the NSPM notifies the sponsor that some or all of the FSTD is no longer qualified, it becomes effective not less than 30 days after the sponsor receives notice of it unless--

(i) The NSPM 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 Director of Flight Standards Service for reconsideration of the NSPM finding under paragraph (b) of this section.

(b) When a sponsor seeks reconsideration of a decision from the NSPM 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 Director, Flight Standards Service, AFS-1, 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 NSPM that the FSTD is no longer qualified unless the NSPM 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 NSPM 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 NSPM 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 NSPM 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 NSPM 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 NSPM.

(e) In making the determinations described in paragraph (d) of this section, the NSPM 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.

§ 60.31 Record keeping 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 NSPM.

§ 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 FFS 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 appropriate QPS, attachment 4, figure 4) by the NSPM 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 will contain any conditions and limitations on validation and issuance of such qualification by the U.S.

Appendix A to Part 60—Qualification Performance Standards for

Airplane Full Flight Simulators

Begin Information

This appendix establishes the standards for Airplane Full Flight Simulator (FFS) evaluation and qualification. The Flight Standards Service, National Simulator Program (NSP) staff, under the direction of the NSP Manager (NSPM), is responsible for the development, application, and interpretation of the standards contained within this appendix. The procedures and criteria specified in this appendix will be used by the NSPM, or a person or persons assigned by the NSPM (e.g., FAA pilots and/or FAA aeronautical engineers, assigned to and trained under the direction of the NSP – referred to as NSP pilots or NSP engineers, other FAA personnel, etc.) when conducting airplane FFS evaluations.

End Information

Table of Contents

Attachment 4 to Appendix A to Part 60--Sample Documents.

Attachment 5 to Appendix A to Part 60--Simulator Qualification Requirements for Windshear Training Program Use.

1. Introduction.

Begin Information

a. This appendix contains background information as well as material that is either directive or informative in nature as described later in this section. Except for this Introduction section, the directive or the informative material is presented in sections that correspond with sections of part 60. This material provides additional requirements and/or provides information regarding that subject. Some sections will have neither additional regulatory or informational material. In these instances the corresponding section in the Table of Contents will show "(No Info)."

b. To assist the reader in determining what areas are directive or required and what areas are guiding or permissive –

(1) The text in this appendix is contained within one of two sections: regulatory requirements that are in addition to the requirements in part 60 but are found only in this appendix, referred to as "QPS Requirements;" and advisory or informative material, referred to as "Information."

(a) The FAA has chosen to place into special QPS Requirements sections those requirements that are more likely to change on a more regular basis for a variety of reasons, e.g., increased knowledge about human factors, analysis of incident/accident data, and/or changes in aircraft or simulation technology. Using this capability, the FAA will be able to use information resulting from these factors to expeditiously modify the regulatory requirements without compromising the timeliness of those changes and without violating the Administrative Procedure Act (APA). In accordance with the APA, the FAA intends to treat all such QPS Requirements changes as Notices of Proposed Rule Making (NPRM), will seek input and suggestions from a representative cross-section of the affected industry through an Aviation Rulemaking Committee, will seek public comment through announcement of any proposed change in the Federal Register, and will review changes before final action on them is complete. The FAA does not expect that many changes to these QPS Requirements will justify the expenditure of time and resources at the highest levels of the agency and will therefore streamline the process for making technical changes to these QPS Requirements by delegating authority for final review and issuance from the Administrator to the Director, Flight Standards Service.

(b) Similarly, the FAA has chosen to place into special Information sections additional material regarding the adjacent regulatory requirements such as acceptable examples of practices and either additional or clarifying information that may be useful to the public in identifying the intent of the FAA.

(2) The text presented between horizontal lines beginning with the heading "Begin QPS Requirements" and ending with the heading "End QPS Requirements," contains the regulatory requirements that are in addition to the requirements in the body of the part 60 language but found only in this appendix.

(3) The text presented between horizontal lines beginning with the heading "Begin Information" and ending with the heading "End Information," is advisory or informative.

(4) The tables in this appendix have rows across the top of each table –

(a) The data presented in columns under the heading "QPS REQUIREMENTS" is regulatory but is found only in this appendix.

(b) The data presented in columns under the heading "INFORMATION" is advisory or informative.

c. Questions regarding the contents of this publication should be sent to the U.S. Department of Transportation, Federal Aviation Administration, Flight Standards Service, National Simulator Program Staff, AFS-205, PO Box 20636, Atlanta, Georgia, 30320. Telephone contact numbers for the NSP are: phone, 404-305-6100; fax, 404-305-6118. The NSP Internet Web Site address is: http://www.faa.gov/nsp. On this Web Site you will find an NSP personnel list with contact information, a list of qualified flight simulation devices, advisory circulars, a description of the qualification process, NSP policy, and an NSP

"In-Works" section. Also linked from this site are additional information sources, handbook bulletins, frequently asked questions, a listing and text of the Federal Aviation Regulations, Flight Standards Inspector's handbooks, and other FAA links.

d. The NSPM encourages the use of electronic media for communication and the gathering, storage, presentation, or transmission of any record, report, request, test, or statement required by this appendix provided the media used has adequate provision for security and is acceptable to the NSPM. The NSPM recommends inquiries on system compatibility prior to any such activity. Minimum System requirements may be found on the NSP Website.

e. Related Reading References.

(1) 14CFR part 60

(2) 14CFR part 61.

(3) 14CFR part 63.

(4) 14CFR part 119

(5) 14CFR part 121.

(6) 14CFR part 125

(7) 14CFR part 135.

(8) 14CFR part 141

(9) 14CFR part 142

(10) Advisory Circular (AC) 120-28C, Criteria for Approval of Category III Landing Weather Minima.

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

(12) AC 120-35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.

(13) AC 120-41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.

(14) AC 120-57A, Surface Movement Guidance and Control System (SMGS).

(15) AC 150/5300-13, Airport Design.

(16) AC 150/5340-1G, Standards for Airport Markings.

(17) AC 150/5340-4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.

(18) AC 150/5340-19, Taxiway Centerline Lighting System.

(19) AC 150/5340-24, Runway and Taxiway Edge Lighting System.

(20) AC 150/5345-28D, Precision Approach Path Indicator (PAPI) Systems

(21) International Air Transport Association document, "Flight Simulator 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 Simulators, as amended.

(25) Airplane Flight Simulator Evaluation Handbook, Volume I, as amended and Volume II, as amended, The Royal Aeronautical Society, London, UK.

(26) FAA Publication FAA-S-8081 series (Practical Test Standards for Airline Transport Pilot Certificate, Type Ratings, Commercial Pilot, and Instrument Ratings).

(27) The FAA Aeronautical Information Manual (AIM), FAA Handbook XXXXX

f. Background.

(1) In the late 1980's several regulatory authorities around the world, including the FAA, published new or revised documents stating the requirements for the qualification of FFS's as applicable under their respective country's rules, regulations, and/or policies. As a result, those who used airplane FFS's to train and/or check flightcrew members flying under more than one country's regulatory authority found themselves having to

provide unique documentation for each authority. With the encouragement of persons from several wide-ranging governmental and non-governmental interests, the Flight Simulation Group of the United Kingdom's Royal Aeronautical Society (RAeS) agreed to organize and conduct two international seminars to focus attention on this situation. The result was the formulation of an RAeS working group consisting of recognized simulation experts and regulatory authorities representatives from around the world. Utilizing the FAA's Advisory Circular (AC) 120-40B document as its practical foundation, this working group devoted over 10,000 man-hours toward the development of a set of FFS evaluation criteria that was acceptable to all parties involved.

(2) This set of evaluation criteria was presented for review and comment in an international conference hosted by RAeS in London on January 16 and 17, 1992. Following detailed explanation and considerable discussion, the conference delegates unanimously agreed to forward these criteria to the International Civil Aviation Organization (ICAO), recommending that ICAO adopt these criteria as appropriate for international FFS evaluation criteria. After reviewing this material, ICAO agreed to translate the information into the appropriate language necessary for ICAO purposes; and the resulting ICAO document, "Manual of Criteria for the Qualification of Flight Simulators," 1st Ed., 1994, is available through the Office of the Secretary General.

(3) In 2001 an international industry working group convened under the joint auspices of the FAA and JAA to develop the second edition of the ICAO Manual 9625. Two meetings were held; one in Hoofddorp, the Netherlands, at Central JAA in March 2001, and one in Atlanta, Georgia, USA, at NSP headquarters in June 2001. During both meetings there were representatives from the FAA, JAA, Transport Canada, CASA Australia (Atlanta only), airplane manufacturers, flight simulator manufacturers and flight simulator operators from the US, the JAA coverage area, and Canada. More than 500 man-days were invested during these two meetings and many more outside the

meetings. The work was shared by four subgroups (Data, Visual, Sound and Motion) and was thoroughly reviewed by the larger working group in frequent plenary sessions. An editing team, consisting of representatives of each of the four subgroups, the FAA, and Central JAA met in August 2001 to consolidate the proposals of the subgroups and ensure consistency throughout the document. A final manuscript was submitted to ICAO in January 2002. The second edition of ICAO Manual 9625 provides standards only for the highest level of flight simulator qualification equivalent to FAA Level D. The FAA, together with the other participating regulatory authorities (Australia, Canada, Finland, France, Germany, Scandinavia, Switzerland, The Netherlands, and the United Kingdom), provided letters of support to the ICAO regarding this second edition and have committed to integrating the resulting changes into their own regulation/documentation for flight simulator standards. The goal of the requirements in this appendix is to match the ICAO requirements for the evaluation and qualification of the highest level of airplane FFS addressed herein: i.e., the requirements for Level D FFS's set out in this appendix match the requirements for the ICAO simulator.

(4) For information purposes, the following is a chronological listing of the documents preceding part 60 that have addressed the qualification criteria for airplane FFS evaluation and qualification by the FAA, including the effective dates of those documents:

14 CFR part 121, appendix B	01/09/65 to 02/02/70
AC 121-14	12/19/69 to 02/09/76
AC 121-14A	02/09/76 to 10/16/78
AC 121-14B	10/16/78 to 08/29/80

14 CFR part 121, appendix H	06/30/80 to (date TBD)
AC 121-14C	08/29/80 to 01/31/83
AC 120-40	01/31/83 to 07/31/86
AC 120-40A	07/31/86 to 07/29/91
AC 120-40B	07/29/91 to (date TBD)
AC 120-40C (draft)	dates -- dates

End Information

2. Applicability (§§ 60.1 & 60.2)

There is no additional regulatory or informational material that 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)

Begin Information

See Appendix F 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)

There is no additional regulatory or informational material that applies to § 60.4, Qualification Performance Standards.

5. Quality Management System (§ 60.5).

Begin Information

Additional regulatory material and informational material regarding Quality Management Systems for Flight Simulation Training Devices 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 used in § 60.7(b) is to have a specific FFS, identified by the sponsor, used by the sponsor at least once in the sponsor's 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 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. To assist in avoiding confusion regarding the requirements for use of a qualified FFS the following examples/descriptions are provided to describe acceptable operational practices:

(1) Example One.

(a) A sponsor is sponsoring a single, specific FFS for their own use, in their 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 airplane simulated. This 12-month period is established according to the following:

(i) If the FFS was qualified prior to [insert the effective date of this rule] the 12-month period begins on the date of the first NSPM-conducted continuing qualification after [insert the effective date of this rule] and continues for each subsequent 12-month period;

(ii) If the FFS satisfactorily completes an initial or upgrade evaluation on or after [insert the effective date of this rule] the 12-month period begins on the date of that completed initial or upgrade evaluation and continues for each subsequent 12-month period.

(b) There is no minimum number of hours or minimum FFS periods 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 FFS's, in their facility or elsewhere. Each such 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)] 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 in the same manner as in example one);

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)] at least once in each 12-month period in that certificate holder's FAA-approved flight training program for the airplane simulated (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) There is no minimum number of hours or minimum FFS periods required.

(3) Example Three.

(a) A sponsor (in this example, a Part 142 certificate holder) in "New York" (having at least one FFS used at least once per year in the sponsor's FAA-approved flight training program) establishes a "satellite" training center in "Chicago" and/or a satellite center in "Moscow."

(b) The satellite function means that the "Chicago" and/or "Moscow" center(s) 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, etc.).

(c) All of the FFS's in the "Chicago" center and/or the "Moscow" center could be dry-leased (i.e., the certificate holder does not have and utilize FAA-approved flight training programs for the FFS's in the "Chicago" and/or the "Moscow" center) because –

(i) Each FFS in the "Chicago" center and/or 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" center and/or each FFS in the "Moscow" center represent the airplane [as described in § 60.7(d)(2)].

End Information

7. Additional Responsibilities of the Sponsor (§ 60.9).

Begin Information

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

End Information

8. Simulator Use (§ 60.11).

There is no additional regulatory or informational material that applies to § 60.11, Simulator Use.

9. Simulator Objective Data Requirements (§ 60.13).

Begin QPS Requirements

a. The FFS sponsor must 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/or, if appropriate, with the person having supplied the aircraft data package for the FFS in order to facilitate the notification described in this paragraph. The sponsor must immediately notify the NSPM when 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/or operate a qualified FFS. 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 notification must also provide technical information about this data to the NSPM relative to the data's significance for training, evaluation, or flight experience activities in the FFS.

b. 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, that contains:

(a) The required maneuvers and procedures.

(b) For each maneuver or procedure --

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

(ii) The atmospheric and environmental conditions.

(iii) The initial flight conditions.

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

(v) The data that is to be gathered.

(vi) Any other appropriate factors.

(2) Appropriately qualified flight test personnel.

(3) An understanding of the accuracy of the data to be gathered.

(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.

(5) Calibration of data acquisition equipment and airplane performance instrumentation must be current and traceable to a recognized standard.

c. The data, regardless of source, must be presented:

(1) in a format that supports the flight 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 of this appendix.

(4) with any necessary guidance information provided; and

(5) without alteration, adjustments, or bias; however the data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation.

d. 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.

End QPS Requirements

Begin Information

e. It is the intent of the NSPM 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 NSPM for approval, a descriptive document (a validation data roadmap) 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 rationale or explanations for cases where data or data parameters are missing, where engineering simulation data are used, where flight test methods require further explanations, etc. and provide a brief narrative describing the cause and effect of any deviation from data requirements. This document may be provided by the aircraft manufacturer.

f. There is no requirement for any flight test data supplier to submit a flight test plan/program prior to gathering flight test data. However, the NSP staff has experience that indicates at least some data gatherers, primarily those that do not have a satisfactory “history” of supplying such data, often provide data that is irrelevant, not properly marked, without adequate justification for selection, without adequate information regarding initial conditions, without adequate information regarding the test maneuver, etc. The NSP staff has been forced to not accept such data submissions as validation data for FFS evaluation. It is for this reason that the NSP staff 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 NSP staff well in advance of commencing the flight tests.

g. The NSPM will consider, on a case-by-case basis, whether or not 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 Simulator (§ 60.14).

Begin Information

a. In the event that the NSPM determines that special equipment or (a) specifically qualified person(s) will be required for the conduct of any evaluation, the NSPM 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, sound analyzer, etc. Examples of specially qualified personnel would be those specifically qualified to install or use any special equipment when its use is required.

b. Examples of a special evaluation would be an evaluation conducted after the move of a FFS; at the request of the TPAA; as a result of comments received from users of the FFS that, upon analysis and confirmation, might cause a question as to the continued qualification or use of the FFS; etc.

End Information

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11. Initial (and Upgrade) Qualification Requirements (§ 60.15).

Begin QPS Requirements

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

(1) A statement that the FSTD 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 NSPM 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 NSPM via traditional or electronic means.

(3) A qualification test guide (QTG), acceptable to the NSPM, that includes all of the following:

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

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

(iii) The result of FSTD subjective tests prescribed in the appropriate QPS.

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

b. 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 of this appendix.

c. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, to the NSPM 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 automatically and manually conducted tests;

(3) A means of comparing the FFS's 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.

d. 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 2, for a sample QTG cover page).

(2) A continuing qualification evaluation schedule requirements page – to be used by the NSPM to establish and record the frequency with which continuing qualification evaluations must be conducted and any subsequent changes that may be determined by the NSPM. See Attachment 4, Figure 4, for a sample Continuing Qualification Evaluation Schedule Requirements page.

(3) A FFS information page that provides the information listed in this paragraph (see Attachment 4, Figure 3, for a sample FFS information page). For convertible FFS's, a separate page is submitted 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 engine model(s) and its data revision number or reference.

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

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

(g) The FFS model and manufacturer.

(h) The date of FFS manufacture.

(i) The FFS computer identification.

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

(k) 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's) with certain requirements. SOC's must provide references to the sources of information for showing the capability of the FFS to comply with the requirement, a rationale explaining how the referenced material is used, mathematical equations and parameter values used, and the conclusions reached; i.e. that the FFS complies with the requirement. Refer to the "Additional Details" column in attachment 1, "Simulator Standards," or in the “Test Details” column in attachment 2, “Simulator Objective Tests,” to see when SOC's are required.

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

(10) The following information for each objective test designated in attachment 2, 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.

e. 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 NSPM, that will allow 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, etc.).

(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 of this appendix.

(5) For 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 FFS 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. Over-plots must not obscure the reference data.

f. The sponsor may elect to complete the QTG objective tests at the manufacturer’s facility. Tests performed at this location must be conducted after assembly of the FFS has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate FFS performance at the sponsor’s training facility by repeating a representative sampling of all the objective tests in the QTG and submitting these repeated test results to the NSPM. This sample must consist of at least one-third of the

QTG objective tests. The QTG must be clearly annotated to indicate when and where each test was accomplished.

g. While the subjective tests are normally accomplished at the sponsor's training facility, the sponsor may elect to complete the subjective tests at the manufacturer's facility. Tests performed at this location will be conducted after assembly of the FFS has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate FFS performance at the sponsor's training facility by having the pilot(s) who performed these tests originally (or similarly qualified pilot(s)), repeat a representative sampling of these subjective tests (need not take more than one normal FFS period – e.g., 4 hours) and submit a statement to the NSPM that the FFS has not changed from the original determination. This statement must clearly indicate when and where these repeated tests were completed.

h. The sponsor must maintain a copy of the MQTG at the FFS location. j. All FFS's for which the initial qualification is conducted after [insert 6 years after effective date of this rule] 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 general FFS performance or demonstration results (reformatted or digitized) prescribed in this appendix, and a description of the equipment necessary to perform the evaluation for initial qualification and the continuing qualification evaluations for continuing qualification. This 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. An eMQTG must be provided to the NSPM.

i. All other FFS's (not covered in subparagraph "i") must have an electronic copy of the MQTG by and after [insert 6 years after effective date of this rule], a copy of which must be provided to the NSPM. This may be provided by an electronic scan presented in a Portable Document File (PDF), or similar format, acceptable to the NSPM.

End QPS Requirements

Begin Information

j. Only those FFS's that are sponsored by a certificate holder (as defined for use in part 60 and this QPS appendix) will be evaluated by the NSPM. 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.

k. 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 and performance demonstrations in attachment 1, the objective tests listed in attachment 2, and the subjective tests listed in attachment 3 of this appendix. The evaluation(s) described herein will include, but not necessarily be limited to the following, as appropriate, for the qualification level of the FFS:

(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 NSPM in the areas of ground operations, takeoff, climb, cruise, descent, approach, and

landing as well as abnormal and emergency operations (see paragraph [check reference] and attachment 2 of this appendix);

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

(4) Cockpit 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 complexity of the FFS 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.

l. The NSPM administers the objective and subjective tests, which includes an examination of functions. The tests include a qualitative assessment of the FFS by an NSP pilot. The NSP 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.

m. The tolerances for the test parameters listed in attachment 2 of this appendix are the maximum acceptable to the NSPM 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 NSPM 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.

n. In addition to the scheduled continuing qualification evaluation (see paragraph [check reference]), each FFS is subject to evaluations conducted by the NSPM at any time with no 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 flightcrew member 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.

o. Problems with objective test results are handled according to the following:

(1) If a problem with an objective test result is detected by the NSP evaluation team during an evaluation, the test may be repeated and/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 NSPM 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.

p. After the NSPM issues a statement of qualification to the sponsor when a FFS is successfully evaluated, the FFS is recommended to the TPAA, who will exercise authority on behalf of the Administrator in approving the FFS in the appropriate airplane flight training program.

q. Under normal circumstances, the NSPM 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; however, once a schedule is agreed to, any slippage of the evaluation date at the sponsor's request may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation. A sponsor may commit to an initial evaluation date under this early process, in coordination with and the agreement of the NSPM, but the request must be in writing and must include an acknowledgment of the potential schedule impact if the sponsor slips the evaluation from this early-committed date. See Attachment 4, figure 5, Sample Request for Initial Evaluation Date.

r. 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. An NSP evaluation is required for each configuration. For example, if a sponsor seeks qualification for two models of an airplane type using a convertible FFS, two QTG's, or a supplemented QTG, and two evaluations are required.

s. The numbering system used for objective test results in the QTG should closely follow the numbering system set out in attachment 2, Simulator Objective Tests.

t. If additional information is needed regarding the preferred qualifications of pilots used to meet the requirements of §60.15(e), the reader should contact the NSPM or visit the NSPM website.

u. Examples of the exclusions for which the FFS might not have been subjectively tested by the sponsor or the NSPM and for which qualification might not be sought or granted, as described in §60.15(h)(6), include windshear training, circling approaches, etc.

End Information

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12. Additional Qualifications for a Currently Qualified Simulator (§ 60.16).

There is no additional regulatory or informational material that applies to § 60.16, Additional Qualifications for a Currently Qualified FFS.

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13. Previously Qualified Simulators (§ 60.17).

Begin QPS Requirements

a. In instances where a sponsor plans to remove a FFS from active status for prolonged periods, the following procedures will apply:

(1) The NSPM must be advised in writing and the advisement must include an estimate of the period that the FFS will be inactive;

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

(3) The NSPM will remove the FFS from the list of qualified FSTD's 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 may be restored to qualified status, it will require an evaluation by the NSPM. The evaluation content and time required for accomplishment will be based on the number of continuing qualification evaluations and sponsor-conducted 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;

(5) The sponsor must notify the NSPM of any changes to the original scheduled time out of service;

(6) The FFS will normally be re-qualified 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 a review of the qualification basis and will likely result in the re-qualification to be against the standards in effect and current at the time of re-qualification.

End QPS Requirements

Begin Information

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

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

d. The intent of the requirement listed in § 60.17(b), for each FFS to have a Statement of Qualification 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.

e. Downgrading of a FFS is a permanent change in qualification level. If a temporary restriction is placed on a FFS because of a missing, malfunctioning, or inoperative component or some repair is in progress, the restriction is not a permanent change in qualification level and such a temporary restriction can, and is, removed when the reason for the restriction has been resolved. It would be inappropriate to permanently downgrade a FFS and, at some undetermined time in the future, allow that FFS to be returned to its original status (i.e., accomplish an "upgrade") using the original qualification standards.

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 in this sequence will be developed by the sponsor and will be acceptable to the NSPM.

b. The description of what constitutes the functional preflight inspection will 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.

End QPS Requirements

Begin Information

d. In determining the acceptability of the sponsor’s test sequence and the content of each quarterly inspection required in § 60.19(a)(1), the NSPM looks for a balance and a mix from the performance demonstrations and 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.

e. If the NSP 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. These tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests.

f. The continuing qualification evaluations, described in § 60.19(b), normally will require 4 hours of FFS time. Flexibility is necessary to address those situations that are not normal or those that involve aircraft with additional levels of complexity (e.g. computer controlled aircraft) and may require additional time. The continuing qualification evaluations will consist of the following:

(1) Review of the results of the objective tests and all the designated FFS performance demonstrations (quarterly inspections) conducted by the sponsor since the last scheduled continuing qualification evaluation.

(2) At the discretion of the evaluator, a selection of approximately 8 to 15 objective tests from the MQTG, that will, in the opinion of the evaluator, provide an adequate opportunity to evaluate, first hand, the performance of the FFS. The tests chosen will be performed either automatically or manually, at the discretion of the evaluator 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, selected at the discretion of the evaluator. 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, to include, but not necessarily limited to, the motion system, visual system, sound system, instructor operating station, and the normal functions and simulated malfunctions of the simulated airplane systems. This examination is normally accomplished simultaneously with the subjective evaluation requirements noted in subparagraph d(3).

g. The requirement established in § 60.19(b)(4) regarding the frequency of NSPM-conducted continuing qualification evaluations for each FFS is typically 12 months. However, the establishment and satisfactory operation of an approved quality management system for a sponsor will provide a basis for adjusting the interval between evaluations on some FFS's at a given sponsor's location to exceed this 12-month interval.

End Information

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15. Logging Simulator Discrepancies (§ 60.20).

There is no additional regulatory or informational material that applies to § 60.20. Logging FFS Discrepancies.

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16. Interim Qualification of Simulators for New Airplane Types or Models (§ 60.21).

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

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17. Modifications to Simulators (§ 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 that have been run with the modification incorporated, including any necessary updates to the MQTG must be acceptable to the NSPM; and

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

End QPS Requirements

Begin Information

See Attachment 4 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. Once the sponsor fairly and accurately advises the user of a FFS's current status, including any missing, malfunctioning, or inoperative (MMI) component(s), the sponsor's responsibility with respect to § 60.25(a) will have been satisfied.

b. 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 intent of the FAA is to automatically extend the deadline until the next business day.

c. In accordance with the authorization described in § 60.25(b)**,** the NSPM may find as acceptable a discrepancy prioritizing system wherein the length of time authorized to repair or replace any given MMI component is based on the level of impact on the capability of the FFS to provide the required training, evaluation, or flight experience, with the larger impact on this capability associated with 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 is to 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, etc.) there is a greater likelihood of being able to determine the amount of testing that would be required for re-qualification.

End Information

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 is to 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, etc.) there is a greater likelihood of being able to determine the amount of testing that would be required for re-qualification.

End Information

21. Recordkeeping and Reporting (§ 60.31).

Begin QPS Requirements

a. The minimally acceptable record of programming changes, as described in § 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 illegal or inappropriate alteration of such records after the fact.

End QPS Requirements

22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements (§ 60.33).

There are no additional QPS requirements or informational material that apply to § 60.33, Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements.

23. Specific Simulator Compliance Requirements (§ 60.35).

There are no additional QPS requirements or informational material that apply to § 60.35, Specific FFS Compliance Requirements.

24. [Reserved].

25. Simulator Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA) (§ 60.37).

There are no additional QPS requirements or informational material that apply to § 60.37, FFS Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA).

Attachment 1 to Appendix A to Part 60--

GENERAL SIMULATOR REQUIREMENTS

Begin QPS Requirements

1. Requirements.

Certain requirements included in this appendix must be supported with a Statement of Compliance and Capability (SOC) and/or, in some designated cases, an Objective Test. The SOC will describe how the requirement was met, such as gear modeling approach, coefficient of friction sources, etc. The test results must show that the requirement has been attained. Other requirements are satisfied by either a Subjective Test or a Subjective Test. In the following tabular listing, requirements for SOCs and tests are indicated in the "Additional Details" column.

End QPS Requirements

Begin Information

2. Discussion.

a. This attachment describes the minimum general simulator requirements for qualifying airplane full flight simulators (FFS). To determine the complete requirements for a specific level simulator the objective tests in attachment 2 and the examination of functions and subjective tests listed in attachment 3 must also be consulted.

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

(1) General cockpit configuration.

(2) Simulator programming.

(3) Equipment operation.

(4) Equipment and facilities for instructor/evaluator functions.

(5) Motion system.

(6) Visual system.

(7) Sound system.

End Information

1. General Cockpit Configuration.							
a. The simulator must have a cockpit that is a full-scale replica of the airplane simulated with controls, equipment, observable cockpit 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.	**X**	**X**	**X**	**X**	An SOC is required. Pilot seats must afford the capability for the occupant to be able to achieve the design "eye position" established for the airplane being simulated. Equipment for the operation of the cockpit windows must be included, but the actual windows need not be operable. Fire axes, extinguishers, spare light bulbs, etc., must be available in the flight simulator 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.		For simulator purposes, the cockpit 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 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 or extinguishers, spare light bulbs, aircraft documents pouches etc., are not considered essential and may be omitted.
b. Those circuit breakers that affect procedures and/or result in observable cockpit indications must be properly located and functionally accurate.	**X**	**X**	**X**	**X**	An SOC is required.		
2. Programming.							
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.	**X**	**X**	**X**	**X**	An SOC is required.		
b. The simulator must have the computer capacity, accuracy, resolution, and dynamic response needed to meet the qualification level sought.	**X**	**X**	**X**	**X**	An SOC is required.		
c. Ground operations must be represented to the extent that allows turns within the confines of the	**X**				A subjective test is required.		

runway and adequate controls on the landing and roll-out from a crosswind approach to a landing.							
d. Ground handling and aerodynamic programming must include the following:					An SOC is required.		
(1) Ground effect.		**X**	**X**	**X**			Applicable areas include: roundout, flare, and touchdown and necessarily requires modeling of lift, drag, pitching moment, trim, and power while in ground effect..
(2) Ground reaction.		**X**	**X**	**X**			This necessarily requires modeling that accounts for strut deflections, tire friction, side forces, etc. and is the reaction of the airplane upon contact with the runway during landing, and may differ with changes in gross weight, airspeed, rate of descent on touchdown, etc.
(3) Ground handling characteristics, including aerodynamic and ground reaction modeling including steering inputs, operations with crosswind, braking, thrust reversing, deceleration, and turning radius.		**X**	**X**	**X**			
e. The simulator 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. (4) On final approach, below 500 ft AGL.			**X**	**X**	Objective tests are required for qualification; see Attachment 2 and Attachment 6 of this appendix. 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		If desired, Level A and B simulators may qualify for windshear training by meeting these standards; see Attachment 6 of this appendix. Windshear models may consist of independent variable winds in multiple simultaneous components. The FAA Windshear Training Aid presents one acceptable

					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.		means of compliance with simulator wind model requirements.
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.			**X**	**X**	An SOC is required.		Automatic "flagging" of out-of-tolerance situations is encouraged.
g. Relative responses of the motion system, visual system, and cockpit	**X**	**X**			Response must be within 300 milliseconds of the airplane response. Objective Tests are required.		
instruments must be coupled closely to provide integrated sensory cues.			**X**	**X**	Response must be within 150 milliseconds of the airplane response. Objective Tests are required.		
Visual change may start before motion response, but motion acceleration must be initiated before completion of the visual scan of the first video field containing different information.					Visual scene changes from steady state disturbance (i.e., the start of the scan of the first video field containing different information) and motion system onset must occur within the system dynamic response limit of 150/300 milliseconds.		
(1) Latency: These systems must respond to abrupt input at the pilot's position. The response must not be prior to that time when the airplane responds and may respond up to 150/300 milliseconds after that time under the same conditions.					Simultaneously record: 1) the output from the pilot's controller(s); 2) the output from an accelerometer attached to the motion system platform located at an acceptable location near the pilots' seats; 3) the output signal to the visual system display (including visual system analog delays); and 4) the output signal to the pilot's attitude indicator or an equivalent test approved by the Administrator.		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 response, acceleration in the appropriate, corresponding rotational axis is preferred. Simulator Latency is measured from the start of a

							control input to the appropriate perceivable change in flight instrument indication; visual system response; or motion system response (this does not include airplane response time as per the manufacturer's data).
(2) Transport Delay: (As an alternative to the Latency requirement, above, a transport delay objective test may be used to demonstrate that the simulator 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 the control loading electronics and interfacing through all the simulation software modules in the correct order, using a handshaking protocol, finally through the normal output interfaces to the instrument displays, the motion system, and the visual system.)					An SOC is required. A recordable start time for the test must be provided with the pilot flight control input. The migration of the signal must permit normal computation time to be consumed and must not alter the flow of information through the hardware/software system.		The transport delay is the time between the control input and the individual hardware (i.e., instruments, motion system, visual system) responses. If Transport Delay is the chosen method to demonstrate relative responses, it is expected that, when reviewing those existing tests where latency can be identified (e.g., short period, roll response, rudder response, etc.) the sponsor and the NSPM will apply additional scrutiny to ensure proper simulator response.
h. The simulator must accurately reproduce the following runway conditions: (1) Dry; (2) Wet; (3) Icy; (4) Patchy Wet. (5) Patchy Icy. (6) Wet on Rubber Residue in Touchdown Zone.			**X**	**X**	An SOC is required. Objective tests are required only for dry, wet, and icy runway conditions; see Attachment 2.		
i. The simulator must simulate: 1) brake and tire failure dynamics (including antiskid failure).			**X**	**X**	An SOC is required.		Simulator pitch, side loading, and directional control characteristics should be

2) decreased brake efficiency due to high brake temperatures, if applicable.							representative of the airplane.
j. The simulator must replicate the effects of airframe icing.			**X**	**X**	A Subjective Test is required.		
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.			**X**	**X**	An SOC is required and must include references to computations of aeroelastic representations and of nonlinearities due to sideslip.		See Attachment 2, paragraph 4, for further information on ground effect.
l. The simulator must have aerodynamic and ground reaction modeling for the effects of reverse thrust on directional control, if applicable.		**X**	**X**	**X**	An SOC is required.		
3. Equipment Operation.							
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.	**X**	**X**	**X**	**X**	Numerical values must be presented in the appropriate units. A subjective test is required.		
b. Communications, navigation, caution, and warning equipment must be installed and operate within the tolerances applicable for the airplane.	**X**	**X**	**X**	**X**	A subjective test is required.		See Attachment 3, paragraph 1d for further information regarding long-range navigation equipment.
c. Simulator systems must operate as the airplane systems would operate under normal, abnormal, and emergency operating conditions on the ground and in flight.	**X**	**X**	**X**	**X**	A subjective test is required.		
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.	**X**	**X**	**X**	**X**	An objective test is required.		
4. Instructor or Evaluator Facilities.							
a. In addition to the flight crew member stations,	**X**	**X**	**X**	**X**	All seats other than flight crew seats need not		The NSPM will consider

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.					represent those found in the airplane but must be adequately secured to the floor and equipped with similar positive restraint devices. A subjective test is required.		alternatives to this standard for additional seats based on unique cockpit configurations.
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 FAA-approved training program; or as described in the relevant operating manual as appropriate.	**X**	**X**	**X**	**X**	A subjective test is required.		
c. The simulator must have instructor controls for environmental conditions including wind speed and direction.	**X**	**X**	**X**	**X**	A subjective test is required.		
d. The simulator must provide the instructor or evaluator the ability to present ground and air hazards.			**X**	**X**	A subjective test is required.		For example, another airplane crossing the active runway and converging airborne traffic; etc.
5. Motion System.							
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**	A subjective test is required.		For example, touchdown cues should be a function of the rate of descent (RoD) of the simulated airplane.
b. The simulator must have a motion (force cueing) system with a minimum of three degrees of freedom (at least pitch, roll, and heave).	**X**	**X**			An SOC is required.		
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).			**X**	**X**	An SOC is required.		
d. The simulator must provide for the recording of the motion system response time.	**X**	**X**	**X**	**X**	An SOC is required.		
e. The simulator must provide motion effects programing to include: (1) Thrust effect with brakes set.		**X**	**X**	**X**	A subjective test is required.		

(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. (8) Representative touchdown cues for main and nose gear. (9) Nosewheel scuffing, if applicable. (10) Mach and maneuver buffet.							
f. The simulator must provide characteristic motion vibrations that result from operation of the airplane, in so far as vibration marks an event or airplane state, which can be sensed in the cockpit.				**X**	An objective test is required.		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.							
a. The simulator must have a visual system providing an out-of-the-cockpit view.	**X**	**X**	**X**	**X**	A subjective test is required.		
b. The simulator must provide a continuous minimum collimated field of view of 45° horizontally and 30° vertically per pilot seat. Both pilot seat visual systems must be operable simultaneously.	**X**	**X**			An SOC is required.		
c. The simulator must provide a continuous minimum collimated visual field of view of 75° horizontally and 30° vertically per pilot seat. Both pilot seat visual systems must be operable simultaneously.			**X**	**X**	An SOC is required. Wide angle systems providing cross cockpit viewing (for both pilots simultaneously) must provide a minimum field of view of 150° horizontally.		Optimization of the vertical field of view may be considered with respect to the specific airplane cockpit cut-off

							angle.
d. The simulator must have operational landing lights for night scenes.	**X**	**X**	**X**	**X**	A subjective test is required Where used, dusk (or twilight) scenes require operational landing lights.		
e. The simulator must have instructor controls for the following: (1) Cloudbase. (2) Visibility in statute miles (km) and runway visual range (RVR) in ft. (m). (3) Airport selection. (4) Airport lighting.	**X**	**X**	**X**	**X**	A subjective test is required.		
f. Each airport scene displayed must include the following: (1) Airport runways and taxiways. (2) Runway definition. (i) Runway surface and markings. (ii) Lighting for the runway in use, including runway threshold, edge, centerline, touchdown zone, VASI (or PAPI), and approach lighting of appropriate colors, as appropriate. (iii) Taxiway lights.	**X**	**X**	**X**	**X**	A subjective test is required.		
g. The distances at which runway features are visible, as measured from runway threshold to an airplane aligned with the runway on an extended 3° glide slope must not be less than listed below: (1) Runway definition, strobe lights, approach lights, runway edge white lights and Visual Approach Slope Indicator (VASI) or Precision Approach Path Indicator (PAPI) system lights from 5 statute miles (8 kilometers (km)) of the runway threshold. (2) Runway centerline lights and taxiway definition from 3 statute miles (4.8 km). (3) Threshold lights and touchdown zone lights from 2 statute miles (3.2 km). (4) Runway markings within range of landing	**X**	**X**	**X**	**X**	A funtional test is required.		

lights for night scenes and as required by three (3) arc-minutes resolution on day scenes.							
h. The simulator must provide visual system compatibility with dynamic response programming.	**X**	**X**	**X**	**X**	A Subjective Test is required.		
i. The simulator must be verified for visual ground segment and visual scene content for the airplane in landing configuration and a main wheel height of 100 feet (30 meters) above the touchdown zone. Data submitted must include at least the following: (1) Static airplane 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 cockpit 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) Airplane pitch angle on approach. (3) Airplane data for manual testing: (i) Gross weight. (ii) Airplane configuration. (iii) Approach airspeed.	**X**	**X**	**X**	**X**	An SOC is required. The QTG must contain appropriate calculations and a drawing showing the pertinent data used to establish the airplane location and the segment of the ground that is visible considering the airplane attitude (cockpit cut-off angle) and a runway visual range of 1,200 feet or 350 meters. Simulator performance must be measured against the QTG calculations. Sponsors must provide this data for each simulator (regardless of previous qualification standards) to qualify the simulator for all precision instrument approaches.		
j. The simulator must provide visual cues necessary to assess sink rates (provide depth perception) during landings, to include: (1) Surface on runways, taxiways, and ramps. (2) Terrain features.		**X**	**X**	**X**	A subjective test is required.		
k. The simulator must have night and dusk (or twilight) visual scene capability, including general terrain characteristics and significant landmarks, free from apparent quantization.			**X**	**X**	A subjective test is required. Dusk (or twilight) scene must enable identification of a visible horizon and general terrain characteristics.		Examples of general terrain characteristics are fields, roads, and bodies of water.
l. The simulator must provide for	**X**	**X**	**X**	**X**	A subjective test is required.		Visual attitude vs. simulator

(1) accurate portrayal of the environment relating to the simulator attitude.							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.
(2) quick confirmation of visual system color, RVR, focus, and intensity.			X	X	An SOC is required. A subjective test is required.		
m. The simulator must provide a minimum of three airport scenes including: (1) Surfaces on runways, taxiways, and ramps. (2) Lighting of appropriate color for all runways, including runway threshold, edge, centerline, VASI (or PAPI), and approach lighting for the runway in use. (3) Airport taxiway lighting. (4) Ramps and buildings that correspond to the sponsor's Line Oriented scenarios, as appropriate.			X	X	A subjective test is required.		
n. The simulator must be capable of producing at least 10 levels of occulting.			X	X	A subjective test is required.		
o. The simulator must be able to provide weather representations including the following: (1) Variable cloud density. (2) Partial obscuration of ground scenes; i.e., the effect of a scattered to broken cloud deck. (3) Gradual break out. (4) Patchy fog. (5) The effect of fog on airport lighting.			X	X	A subjective test is required. The weather representations must be provided at and below an altitude of 2,000 ft (610 m) height above the airport and within a radius of 10 miles (16 km) from the airport.		
p. The simulator must have daylight, night, and either 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.				X	An SOC is required. A subjective test is required. Any ambient lighting must not "washout" the displayed visual scene. These requirements are applicable to any level of simulator equipped with a "daylight" visual system.		Brightness capability may be demonstrated with a test pattern of white light using a spot photometer. Daylight visual system is defined as a visual system capable of producing, at a minimum, full color presentations, scene content comparable in detail to that produced by 4,000

							edges or 1,000 surfaces for daylight and 4,000 lightpoints for night and dusk scenes, 6 foot-lamberts (20 cd/m^2) of light measured at the pilot's eye position (highlight brightness) and a display which is free of apparent quantization and other distracting visual effects while the simulator is in motion.
q. The simulator must provide operational visual scenes that portray physical relationships known to cause landing illusions to pilots.				**X**	A subjective test is required.		For example: short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path, unique topographic features, etc.
r. The simulator must provide special weather representations of light, medium, and heavy precipitation near a thunderstorm on takeoff and during approach and landing.				**X**	A subjective test is required. 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.		
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**	A subjective test is required.		
t. The simulator must present realistic color and directionality of all airport lighting.				**X**	A subjective test is required.		
7. Sound System.							
a. The simulator must provide cockpit sounds that result from pilot actions that correspond to those that occur in the airplane.	**X**	**X**	**X**	**X**			
b. The simulator must accurately simulate the sound of precipitation, windshield wipers, and			**X**	**X**	An SOC is required. A subjective test is required.		

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.							
c. The simulator must provide realistic amplitude and frequency of cockpit noises and sounds.				**X**	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. .		

Flight Simulation Device Aviation Rulemaking Committee
October 6-10, 2003

Make √ if present (and make any changes to contact information)

Attachment 2 to Appendix A to Part 60--

FULL FLIGHT SIMULATOR (FFS) OBJECTIVE EVALUATION

1. General

Begin QPS Requirements

a. Test requirements.

(1) The ground and flight tests required for qualification are listed in the following Table of Objective Tests. Computer generated simulator test results must be provided for each test except where specifically authorized an alternate means by the NSPM. If a flight condition or operating condition is required for the test but which does not apply to the airplane being simulated or to the qualification level sought, it may be disregarded (for example: an engine out missed approach for a single-engine airplane; a maneuver using reverse thrust for an airplane without reverse thrust capability; a landing test for a Level A simulator; etc.). Each test result is compared against the validation data described in § 60.13, and Paragraph 9 in the main body of 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 NSPM 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 the Table of Objective Tests. All results must be labeled using the tolerances and units given.

(2) The Table of Objective Tests 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/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.

(3) Certain tests included in this attachment must be supported with a Statement of Compliance and Capability (SOC). In the following tabular listing of simulator tests, requirements for SOC's are indicated in the "Test Details" column.

(4) 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.

(5) Unless noted otherwise, simulator tests must represent airplane performance and handling qualities at operating weights and centers of gravity (CG) typical of normal operation. If a test is supported by airplane data at one extreme weight or CG, another test supported by airplane data at mid-conditions or as close as possible to the other extreme must be included, except as may be authorized by the NSPM. Tests of handling qualities must include validation of augmentation devices.

(6) 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 ±5 pounds (2.2 daN) in 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 clearly annotated as to indicated, calibrated, etc., and like values used for comparison.

(7) The QTG provided by the sponsor must describe clearly and distinctly how the simulator will be set up and operated for each test. Overall integrated testing of the simulator must be accomplished to assure that the total simulator system meets the prescribed standards; i.e., it is not acceptable to test only each simulator subsystem

independently. A manual test procedure with explicit and detailed steps for completion of each test must also be provided.

(8) 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 from at least 5 seconds prior to, through at least 2 seconds after, the instant of time captured by the “snapshot.”

(9) For previously qualified simulators, the tests and tolerances of this attachment may be used in subsequent continuing qualification evaluations for any given test providing the sponsor has submitted a proposed MQTG revision to the NSPM and has received NSPM approval.

(10) 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. Where thrust is more than 5% greater or more than 15% less than that of the flight test engine, flight test data from an airplane equipped with the alternative engine is required. However, if the validation data supplier shows that a thrust increase greater than 5% will not significantly change the airplane’s flight characteristics, then flight validation data are not needed. Where the airplane data supplier certifies that the only impact on the simulator model is thrust, and that other variables related to the alternative engine (such as drag and thrust vector) are unchanged or are insignificantly changed, additional simulator tests may be run with the same initial conditions using the thrust from the flight test data as a driven parameter for the alternative engine model.

(11) For testing Computer Controlled Airplane (CCA) simulators, or other highly augmented airplane simulators, flight test data may be 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 the Table of Objective Tests require test results in the Normal control state unless specifically noted otherwise in the additional requirements section following the CCA designation. Tests for other levels of control state degradation may be required as detailed by the NSPM at the time of definition of a set of specific airplane tests for simulator data. 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:

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

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

(12) For computer controlled airplanes using airplane hardware (e.g., “side stick controller”) in the simulator cockpit, some tests will not be required. Those tests are annotated in the “Additional Requirements” column with the Computer Controlled Airplane (CCA) note – “test not required if cockpit controller is installed in the simulator.” However, in these cases the sponsor must supply a statement that the airplane hardware meets and will continue to meet the appropriate manufacturer’s specifications and the sponsor must have supporting information to that fact available for NSPM review.

End QPS Requirements

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b. Discussion.

Begin Information

(1) 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.

(2) In the following Table of Objective Tests, the last column is titled “Paragraph 12.” A “yes” indication in that column directs the reader to paragraph 12 of this attachment for additional information relative to sources of data, procedures used to acquire the data, and instrumentation that may be used, as an alternative to those expected under normal flight test procedures and that may be used for that particular test for Level A or Level B simulators. Paragraph 12 also contains notes, reminders, and information applicable to that particular test for

those simulator levels. These data sources, procedures, and instrumentation, if used, would be submitted in accordance with the alternative data provisions of § 60.13 of Part 60 and Section 9 of this QPS attachment.

(3) 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 Advisory Circulars (AC) 25-7, as may be amended, Flight Test Guide for Certification of Transport Category Airplanes, and (AC) 23-8, as may be amended, Flight Test Guide for Certification of Part 23 Airplanes, for references and examples regarding flight testing requirements and techniques.

End Information

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS								INFORMATION	PARA 12
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	
			A	B	C	D			
1. Performance									
a. Taxi									
(1) Minimum Radius Turn	±3 ft (0.9m) or 20% of airplane turn radius	Ground		X	X	X	Record both Main and Nosegear loci. This test is to be accomplished without the use of brakes and only minimum thrust required to maintain a steady turn, except for airplanes requiring asymmetric thrust or braking to turn.	The term “loci” describes the sequential points that make up the path that the respective landing gear follow during a turn.	Yes
(2) Rate of Turn vs. Nosewheel Steering Angle (NWA)	±10% or ±2º/sec. turn rate	Ground		X	X	X	Record a minimum of two speeds, greater than minimum turning radius speed, with a spread of at least 5 knots groundspeed.		Yes
b. Takeoff							All commonly used takeoff flap settings are to be demonstrated at least once in the tests for minimum unstick (1b3), normal takeoff (1b4), critical engine failure on takeoff (1b5), or crosswind takeoff (1b6).		
(1) Ground Acceleration Time and Distance	±5% time and distance or ±5% time and ±200 ft (61 m) of distance	Takeoff	X	X	X	X	Record acceleration time and distance for a minimum of 80% of the total time from brake release to V_R.	May be combined with normal takeoff (1b4) or rejected takeoff (1b7). Plotted data must be shown using appropriate scales for each portion of the maneuver. Preliminary aircraft certification data	Yes

TABLE OF OBJECTIVE TESTS									
QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
								may be used.	
(2) Minimum Control Speed - ground (V_{mcg}) using aerodynamic controls only (per applicable airworthiness standard or alternative) or engine inoperative test to demonstrate ground control characteristics	±25% of maximum airplane lateral deviation or ±5 ft (1.5 m). Additionally, for those simulators of airplanes with reversible flight control systems: Rudder pedal force; ±10% or ± 5 lb (2.2 daN).	Takeoff	X	X	X	X	Engine failure speed must be within ±1 knot of airplane engine failure speed. Engine thrust decay must be that resulting from the mathematical model for the engine variant applicable to the flight simulator under test. If the modeled engine variant is not the same as the airplane manufacturer's flight test engine, then a further test may be run with the same initial conditions using the thrust from the flight test data as the driving parameter.	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 knots, followed by control of heading using aerodynamic control only. Recovery should be achieved with the main gear on the ground. To ensure only aerodynamic control is used, nosewheel steering should be disabled (i.e., castored) or the nosewheel held slightly off the ground.	Yes
(3) Minimum Unstick Speed (V_{mu}) or equivalent test to demonstrate early rotation takeoff characteristics.	±3 Kts airspeed ±1.5º pitch angle	Takeoff	X	X	X	X	Record main landing gear strut compression or equivalent air/ground signal. Time history data must be recorded from 10 knots before the start of the rotation until at least 5 seconds after the occurrence of main gear lift off.	V_{mu} is the minimum speed at which the last main landing gear leaves the ground. If a V_{mu} test is not available, alternative acceptable flight	Yes

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS								INFORMATION	
TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**SIMULATOR LEVEL**				**TEST DETAILS**	**NOTES**	**PARA 12**
			A	**B**	**C**	**D**			
								tests are a constant high-attitude takeoff recorded through main gear lift off or an early rotation takeoff.	
(4) Normal Takeoff	±3 Kts airspeed ±1.5° pitch ±1.5° angle of attack ±20 ft (6 m) altitude. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/Column Force; ± 10% or ± 5 lb (2.2 daN).	Takeoff	X	X	X	X	Data are required for a takeoff weight at near maximum takeoff weight with a mid-center of gravity and for a light takeoff weight with an aft center of gravity. If the airplane has more than one certificated takeoff configurations, a different configuration must be used for each weight. Record takeoff profile from brake release to at least 200 ft (61 m) above ground level (AGL). Plotted data must be shown using appropriate scales for each portion of the maneuver. This test may be used for ground acceleration time and distance (1b1).	.	Yes
(5) Critical Engine Failure on Takeoff	±3 kts airspeed ±1.5° pitch, ±1.5° angle of attack, ±20 ft (6 m) altitude, ±3° heading, ±2° bank and sideslip	Takeoff	X	X	X	X	Record takeoff profile at near maximum takeoff weight from prior to engine failure to at least 200 ft (61 m) AGL. Engine failure speed must be within ±3 kts of airplane data.		Yes

TABLE OF OBJECTIVE TESTS									PARA 12
QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	
			A	B	C	D			
	angle. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/ Column Force; ±10% or ±5 lb (2.2 daN)); Wheel Force; ±10% or ±1.3 daN (3 lb)); and Rudder Pedal Force; ±10% or ±5 lb (2.2 daN).								
(6) Crosswind Takeoff	±3 kts airspeed, ±1.5° pitch, ±1.5° angle of attack, ±20 ft (6 m) altitude, ±2° bank and sideslip angle; ±3° heading. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/Column Force; ±10% or ±5 lb (2.2 daN); Wheel Force; ±10% or ±3 lb (1.3daN); and Rudder Pedal Force; ±10% or ±5 lb (2.2 daN).	Takeoff	X	X	X	X	Record takeoff profile from brake release to at least 200 ft (61 m) AGL. Requires test data, including information on wind profile for a crosswind component of at least 60% of the maximum described in the Airplane Flight Manual, as measured at 33 ft (10m) above the runway.	In those situations where a maximum crosswind or a maximum demonstrated crosswind is not included in the AFM, contact the NSPM.	Yes
(7) Rejected Takeoff	±5% time or ±1.5 sec ±7.5% distance or ±250 ft (±76 m	Takeoff	X	X	X	X	Record time and distance from brake release to full stop. Speed for initiation of the reject must be at least 80% of V_1 speed. The weight must be at or near the maximum takeoff	Autobrakes will be used where applicable.	Yes

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
							gross weight. Use maximum braking effort, auto or manual.		
(8) Dynamic Engine Failure After Takeoff	±20% or ±2°/sec body angular rates	Takeoff			X	X	Engine failure speed must be within ±3 Kts of airplane data. Record Hands Off from 5 secs. before to at least 5 secs. after engine failure or 30º Bank, whichever occurs first. Engine failure may be a snap deceleration to idle. (**CCA**: Test in Normal and Non-normal control state.)	For safety considerations, airplane flight test may be performed out of ground effect at a safe altitude, but with correct airplane configuration and airspeed.	
c. Climb									
(1) Normal Climb, all engines operating.	±3 kts airspeed, ±5% or ±100 FPM (0.5 m/Sec.) climb rate	Clean configuration.	X	X	X	X	Record results at nominal climb speed and at mid-initial climb altitude. Flight test data or airplane performance manual data may be used. Flight simulator performance must be recorded over an interval of at least 1,000 ft. (300m).		Yes
(2) One engine Inoperative Second Segment Climb	±3 kts airspeed, ±5% or ±100 FPM (0.5 m/Sec.) climb rate, but not less than the FAA-Approved Airplane Flight Manual (AFM) values.	Second Segment Climb	X	X	X	X	Record results at airplane limiting conditions of weight, altitude, & temperature. Flight test data or airplane performance manual data may be used. Record at nominal climb speed. Flight simulator performance must be recorded over an interval of at least 1,000 ft. (300m).		Yes
(3) One Engine Inoperative En route	±10% time, ±10% distance, ±10% fuel used	Clean configuration			X	X	Record results for at least a 5000 ft (1550 m) climb		

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS								INFORMATION	PARA 12
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	
			A	B	C	D			
Climb							segment. Flight test data or airplane performance manual data may be used.		
(4) One Engine Inoperative Approach Climb (if the approved AFM requires specific performance in icing conditions)	±3 kts airspeed, ±5% or ±100 FPM (0.5 m/Sec.) climb rate, but not less than the Approved AFM values.	Approach	X	X	X	X	Record results at near maximum landing weight. Flight test data or airplane performance manual data may be used Flight simulator performance must be recorded over an interval of at least 1,000 ft. (300m)..	The airplane should be configured with all anti-ice and de-ice systems operating normally, with the gear up and go-around flaps set. All icing accountability considerations should be applied in accordance with the AFM for an approach in icing conditions.	Yes
d. Cruise / Descent									
(1) Level flight acceleration	±5% Time	Cruise	X	X	X	X	Record results for a minimum of 50 kts speed increase using maximum continuous thrust rating or equivalent.		
(2) Level flight deceleration.	±5% Time	Cruise	X	X	X	X	Record results for a minimum of 50 kts. speed decrease using idle power.		
(3) Cruise performance	±0.05 EPR or ±5% of N_1, or ±5% of Torque, ±5% of fuel flow	Cruise			X	X	May be a single snapshot showing instantaneous fuel flow or a minimum of 2 consecutive snapshots with a spread of at least 3 minutes in steady flight.		
e. Stopping									

TABLE OF OBJECTIVE TESTS									
QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
(1) Deceleration time and distance, using manual application of wheel brakes and no reverse thrust on a dry runway.	±5% of time. For distance up to 4000 ft (1220 m): ±200 ft (61 m) or ±10%, whichever is smaller. For distance greater than 4000 ft (1220 m): ±5% of distance.	Landing,	X	X	X	X	Record time and distance for at least 80% of the total time from touch down to full stop. Data is required for weights at medium and near maximum landing weights. Data for brake system pressure and position of ground spoilers (including method of deployment, if used) must be provided. Engineering data may be used for the medium gross weight condition.		Yes
(2) Deceleration time and distance, using reverse thrust and no wheel brakes on a dry runway.	±5% time and the smaller of ±10% or ±200 ft (61 m) of distance	Landing,	X	X	X	X	Record time and distance for at least 80% of the total time from initiation of reverse thrust to the minimum operating speed with full reverse thrust. Data is required for medium, and near maximum landing gross weights. Data on the position of ground spoilers, (including method of deployment, if used) must be provided. Engineering data may be used for the medium gross weight condition.		Yes
(3) Deceleration distance, using wheel brakes and no reverse thrust on a wet runway.	±10% of distance or ±200 ft (61 m)	Landing,			X	X	Either flight test data or manufacturer's performance manual data must be used where available. Engineering data, based on dry runway flight test stopping distance modified by the effects of		

TABLE OF OBJECTIVE TESTS									PARA 12
QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	
			A	B	C	D			
							contaminated runway braking coefficients are an acceptable alternative.		
(4) Deceleration distance, using wheel brakes and no reverse thrust on an icy runway.	±10% of distance or ±200 ft (61 m)	Landing,			X	X	Either flight test data or manufacturer's performance manual data must be used where available. Engineering data, based on dry runway flight test stopping distance modified by the effects of contaminated runway braking coefficients are an acceptable alternative.		
f. Engines									
(1) Acceleration	±10% $T_{i,}$ or ±0.25 sec. ±10% T_t	Approach or landing	X	X	X	X	Record engine power (N_1, N_2, EPR, Torque, etc.) from flight idle to go-around power for a rapid (slam) throttle movement.	$T_{i,}$ is the total time from initial throttle movement until reaching a 10% response of engine power. T_t is the total time from initial throttle movement to reaching 90% of go around power.	Yes
(2) Deceleration	±10% $T_{i,}$ or ±0.25 sec. ±10% T_t	Ground					Record engine power (N_1, N_2, EPR, Torque, etc.) from Max T/O power to 90% decay of Max T/O power for a rapid (slam) throttle movement.	$T_{i,}$ is the total time from initial throttle movement until reaching a 10% response of engine power. T_t is the total time from initial throttle	Yes

TABLE OF OBJECTIVE TESTS									PARA 12
QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	
			A	B	C	D			
								movement to reaching 90% decay of maximum takeoff power.	
2. Handling Qualities									
For simulators requiring Static or Dynamic tests at the controls (i.e., column, wheel, rudder 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, that show satisfactory agreement. Repeat of the alternative method during the initial or upgrade evaluation would then satisfy this test requirement. For initial and upgrade evaluations, the control dynamic characteristics must be measured at and recorded directly from the cockpit controls, and must be accomplished in takeoff, cruise, and landing flight conditions and configurations. Testing of position versus force is not applicable if forces are generated solely by use of airplane hardware in the flight simulator. Contact the NSPM for clarification of any issue regarding airplanes with reversible controls.									
a. Static Control Checks									
(1) Pitch Controller Position vs. Force and Surface Position Calibration	Breakout: ±2 lb (0.9 daN). Force: ±10% or±5 lb (2.2 daN) and ±2° Elevator	Ground	**X**	**X**	**X**	**X**	Record results for an uninterrupted control sweep to the stops. (	Test results should be validated (where possible) with in-flight data from tests such as longitudinal static stability, stalls, etc. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures.	Yes
(2) Roll Controller Position vs. Force and Surface Position Calibration	Breakout: ±2 lb (0.9 daN). Force: ±10% or ±3 lb (1.3 daN) and ±2° Aileron, ±3° Spoiler Angle	Ground	**X**	**X**	**X**	**X**	Record results for an uninterrupted control sweep to the stops.	Test results should be validated with in-flight data from tests such as engine out trims, steady state sideslips, etc. Static and dynamic flight	Yes

TABLE OF OBJECTIVE TESTS									
QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
								control tests should be accomplished at the same feel or impact pressures.	
(3) Rudder Pedal Position vs. Force and Surface Position Calibration	Breakout: ±5 lb (2.2 daN). Force ±10% or ±5 lb (2.2 daN) and ±2° Rudder Angle	Ground	X	X	X	X	Record results for an uninterrupted control sweep to the stops.	Test results should be validated with in-flight data from tests such as engine out trims, steady state sideslips, etc. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures.	Yes
(4) Nosewheel Steering Controller Force & Position	Breakout: ±2 lb (0.9 daN). Force: ±10% or ±3 lb (1.3 daN) and ±2° Nosewheel Angle	Ground	X	X	X	X	Record results of an uninterrupted control sweep to the stops.		Yes
(5) Rudder Pedal Steering Calibration	±2° Nosewheel Angle	Ground	X	X	X	X	Record results of an uninterrupted control sweep to the stops.		Yes
(6) Pitch Trim Indicator vs. Surface Position Calibration.	±0.5° of Computed Trim Angle,	Ground	X	X	X	X		The purpose of the test is to compare flight simulator against design data or equivalent.	Yes
(7) Alignment of Cockpit Throttle Lever vs. Selected Engine Parameter.	±5° of Throttle Lever Angle, or ±3% N1, or ±.03 EPR, or ±3% torque. For propeller-driven	Ground	X	X	X	X	Requires simultaneous recording for all engines. The tolerances apply against airplane data and between engines. In the case of propeller powered airplanes, if		Yes

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS								INFORMATION	PARA 12
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	
			A	B	C	D			
	airplanes where the propeller control levers do not have angular travel, a tolerance of ±0.8 inch (±2 cm.) applies.						a propeller lever is present, it must also be checked. For airplanes with throttle "detents," all detents must be presented. May be a series of snapshot test results		
(8) Brake Pedal Position vs. Force and Brake System Pressure Calibration.	±5 lb (2.2 daN) or 10% Force, ±150 psi (1.0 MPa) or ±10% brake system pressure	Ground	X	X	X	X	Hydraulic system pressure must be related to pedal position through a ground static test. Flight simulator computer output results may be used to show compliance.		Yes
b. Dynamic Control Checks								Tests 2b1, 2b2, and 2b3 are not applicable if dynamic response is generated solely by use of airplane hardware in the flight simulator. Power setting may be that required for level flight unless otherwise specified.	
(1) Pitch Control	For Underdamped systems: ±10% of time from 90% of initial displacement (A_d) to first zero crossing and ±10 (n+1)% of period thereafter. ±10% amplitude of first	Takeoff, Cruise, and Landing			X	X	Data must show normal control displacement in both directions. Tolerances apply against the absolute values of each period (considered independently). Normal control displacement for this test is 25% to 50% of full throw or approximately 25% to 50% of the maximum allowable	"n" is the sequential period of a full cycle of oscillation. Refer to paragraph 6 of this attachment for more information.	

<table>
<tr><th colspan="9">TABLE OF OBJECTIVE TESTS</th><th rowspan="4">P
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A
12</th></tr>
<tr><th colspan="8">QPS REQUIREMENTS</th><th>INFORMATION</th></tr>
<tr><th>TEST</th><th>TOLERANCE</th><th>FLIGHT CONDITIONS</th><th colspan="4">SIMULATOR LEVEL</th><th>TEST DETAILS</th><th>NOTES</th></tr>
<tr><th></th><th></th><th></th><th>A</th><th>B</th><th>C</th><th>D</th><th></th><th></th></tr>
<tr><td></td><td>overshoot applied to all overshoots greater than 5% of initial displacement (A_d).
±1 overshoot (first significant overshoot must be matched).
For overdamped systems: ±10% of time from 90% of initial displacement (A_d) to 10% of initial displacement (0.1 A_d)</td><td></td><td></td><td></td><td></td><td></td><td>pitch controller deflection for flight conditions limited by the maneuvering load envelope.</td><td></td><td></td></tr>
<tr><td>(2) Roll Control</td><td>For underdamped systems: ±10% of time from 90% of initial displacement (A_d) to first zero crossing, and
±10 (n±1)% of period thereafter.
±10% amplitude of first overshoot, applied to all overshoots greater than 5% of initial displacement (A_d),
±1 overshoot (first significant overshoot must be matched).
For overdamped systems: ±10% of time from 90% of initial displacement</td><td>Takeoff, Cruise, and Landing</td><td></td><td></td><td>X</td><td>X</td><td>Data must show normal control displacement in both directions. Tolerances apply against the absolute values of each period (considered independently). Normal control displacement for this test is 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..</td><td>“n” is the sequential period of a full cycle of oscillation. Refer to paragraph 6 of this attachment for more information.</td><td></td></tr>
</table>

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	P A R A 12
			A	B	C	D			
	(A_d) to 10% of initial displacement ($0.1A_d$).								
(3) Yaw Control	For underdamped systems: ±10% of time from 90% of initial displacement (A_d) to first zero crossing, and ±10 (n±1)% of period thereafter. ±10% amplitude of first overshoot applied to all overshoots greater than 5% of initial displacement (A_d). ±1 overshoot (first significant overshoot must be matched). For overdamped systems: ±10% of time from 90% of initial displacement (A_d) to 10% of initial displacement ($0.1A_d$).	Takeoff, Cruise, and Landing			X	X	Data must show normal control displacement in both directions. Tolerances apply against the absolute values of each period (considered independently). Normal control displacement for this test is 25% to 50% of full throw.	"n" is the sequential period of a full cycle of oscillation. Refer to paragraph 6 of this attachment for more information.	
(4) Small Control Inputs - Pitch	±0.15°/sec body pitch rate or ±20% of peak body pitch rate applied throughout the time history.	Approach or Landing			X	X	Control inputs must be typical of minor corrections made while established on an ILS approach course (approximately 0.5°/sec to 2°/sec pitch rate). The test must be in both directions, showing time history data from 5 seconds before until at least 5 seconds after initiation of		

TABLE OF OBJECTIVE TESTS									
QPS REQUIREMENTS								INFORMATION	PARA 12
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	
			A	B	C	D			
							control input. **CCA**: Test in normal and non-normal control states.		
(5) Small Control Inputs - Roll	±0.15°/sec body roll rate or ±20% of peak body roll rate applied throughout the time history	Approach or landing			X	X	Control inputs must be typical of minor corrections made while established on an ILS approach course (approximately 0.5°/sec to 2°/sec roll rate). The test may be run in only one direction; however, for airplanes that exhibit non-symmetrical behavior, the test must include both directions. Time history data must be recorded from 5 seconds before until at least 5 seconds after initiation of control input. **CCA**: Test in normal and non-normal control states		
(6) Small Control Inputs - Yaw	±0.15°/sec body yaw rate or ±20% of peak body yaw rate applied throughout the time history	Approach or landing			X	X	Control inputs must be typical of minor corrections made while established on an ILS approach course (approximately 0.5°/sec to 2°/sec yaw rate). The test may be run in only one direction; however, for airplanes that exhibit non-symmetrical behavior, the test must include both directions. Time history data must be recorded from 5 seconds before until at least 5		

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QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
							seconds after initiation of control input. **CCA**: Test in normal and non-normal control states		
c. Longitudinal							Note: Power setting may be that required for level flight unless otherwise specified.		
(1) Power Change Dynamics	±3 kts airspeed, ±100 ft (30 m) altitude, ±20% or ±1.5° pitch angle	Approach	**X**	**X**	**X**	**X**	Power is changed from the thrust setting required for approach or level flight to maximum continuous thrust or go-around power setting. Record the uncontrolled free response from at least 5 seconds before the power change is initiated to 15 seconds after the power change is completed. (**CCA:** Test in Normal and Non-normal control state.)		Yes
(2) Flap/Slat Change Dynamics	±3 kts airspeed, ±100 ft (30 m) altitude, ±20% or ±1.5° pitch angle	Takeoff through initial flap retraction, and approach to landing.	**X**	**X**	**X**	**X**	Record the uncontrolled free response from at least 5 seconds before the configuration change is initiated to 15 seconds after the configuration change is completed. (**CCA:** Test in Normal and Non-normal control state.)		Yes
(3) Spoiler/Speedbrake Change Dynamics	±3 kts airspeed, ±100 ft (30 m) altitude, ±20% or ±1.5° pitch angle	Cruise	**X**	**X**	**X**	**X**	Record the uncontrolled free response from at least 5 seconds before the configuration change is initiated to 15 seconds after the		Yes

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QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
							configuration change is completed. Record results for both extension and retraction. (**CCA:** Test in Normal and Non-normal control state.)		
(4) Gear Change Dynamics	±3 kts airspeed, ±100 ft (30 m) altitude, ±20% or ±1.5° pitch angle	Takeoff (retraction), and Approach (extension).	X	X	X	X	Record the time history of uncontrolled free response for a time increment from at least 5 seconds before the configuration change is initiated to 15 seconds after the configuration change is completed. (**CCA:** Test in Normal and Non-normal control state.)		Yes
(5) Longitudinal Trim	±0.5° stabilizer; ±1°elevator; ±1° pitch angle; ±5% net thrust or equivalent	Cruise, Approach, and Landing	X	X	X	X	Record steady-state condition with wings level and thrust set for level flight. May be a series of snapshot tests. (**CCA:** Test in Normal or Non-normal control state.)		Yes
(6) Longitudinal Maneuvering Stability (Stick Force/g)	±5 lb (±2.2 daN) or ±10% pitch controller force. Alternative method; ±1° or ±10% change of elevator.	Cruise, Approach, and Landing	X	X	X	X	Continuous time history data or a series of snapshot tests may be used. Record results up to approximately 30° of bank for approach and landing configurations. Record results for up to approximately 45° of bank for the cruise configuration. The force tolerance is not applicable if forces are generated solely by the use of airplane hardware in the flight simulator.		Yes

QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
							The alternative method applies to airplanes that do not exhibit "stick-force-per-g" characteristics. (**CCA:** Test in Normal and Non-normal control state as applicable.)		
(7) Longitudinal Static Stability	±5 lb (±2.2 daN) or ±10% pitch controller force. Alternative method: ±1° or ±10% change of elevator.	Approach	X	X	X	X	Record results for at least 2 speeds above and 2 speeds below trim speed. May be a series of snapshot test results. The force tolerance is not applicable if forces are generated solely by the use of airplane hardware in the flight simulator. The alternative method applies to airplanes that do not exhibit speed stability characteristics. (**CCA:** Test in Normal or Non-normal control state, as applicable.)		Yes
(8) Stall Characteristics	±3 kts airspeed for initial buffet, stall warning, and stall speeds. The tolerances for airplanes with reversible flight control systems are: ±10% or ±5 lb (2.2 daN)) Stick/Column force (prior to "g break" only).	Second Segment Climb, and Approach or Landing	X	X	X	X	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. The stall warning signal must occur in the proper relation to buffet/stall. Airplanes exhibiting a sudden pitch attitude change or "g break" must demonstrate this characteristic. (**CCA:** Test in Normal and		Yes

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QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
							Non-normal control state.)		
(9) Phugoid Dynamics	±10% of period, ±10% of time to ½ or double amplitude or ±.02 of Damping Ratio.	Cruise	X	X	X	X	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 time to ½ or double amplitude. (**CCA:** Test in Non-normal control state.		Yes
(10) Short Period Dynamics	±1.5° pitch angle or ±2°/sec. pitch rate, ±0.10g acceleration.	Cruise		X	X	X	(**CCA:** Test in Normal and Non-normal control state.)		Yes
d. Lateral Directional								Power setting may be that required for level flight unless otherwise specified	
(1) Minimum Control Speed, Air (V_{mca} or V_{mcl}), per Applicable Airworthiness Standard or Low Speed Engine Inoperative Handling Characteristics in the Air	±3 kts airspeed	Takeoff or Landing (Whichever is most critical in the airplane)	X	X	X	X	Takeoff thrust must be used on the operating engine(s). A time history or a series of snapshot tests may be used. (**CCA:** Test in Normal or Non-normal control state.)	Low Speed Engine Inoperative Handling may be governed by a performance or control limit that prevents demonstration of V_{mca} in the conventional manner.	Yes
(2) Roll Response (Rate)	±10% or ±2°/sec roll rate Additionally, for those simulators of airplanes with reversible flight control systems:	Cruise, and Approach or Landing	X	X	X	X	Record results for normal roll controller deflection (about 30%). May be combined with step input of flight deck roll controller test (2d3)		

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QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
	wheel force ±10% or ±3lb (1.3 daN)								
(3) Roll Response to Cockpit Roll Controller Step Input	±10% or ±2° bank angle	Approach or Landing	X	X	X	X	Record from initiation of roll through 10 seconds after control is returned to neutral and released. May be combined with roll response (rate) test (2d2). (**CCA:** Test in Normal and Non-normal control state.)	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.	Yes
(4) Spiral Stability	Correct trend and ±2° or ±10% bank angle in 20 seconds. Alternate test requires correct trend and ±2° aileron.	Cruise	X	X	X	X	Record results for both directions. Airplane data averaged from multiple tests may be used. As an alternate test, demonstrate the lateral control required to maintain a steady turn with a bank angle of approximately 30°. (**CCA:** Test in Non-normal control state.)		Yes
(5) Engine Inoperative Trim	±1° rudder angle or ±1° tab angle or equivalent pedal, ±2° Sideslip angle.	Second Segment Climb, and Approach or Landing	X	X	X	X	May be a series of snapshot tests.	The test should be performed in a manner similar to that for which a pilot is trained to trim an engine	Yes

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QPS REQUIREMENTS								INFORMATION	
TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**SIMULATOR LEVEL**				**TEST DETAILS**	**NOTES**	**PARA 12**
			A	**B**	**C**	**D**			
								failure condition. Second segment climb test should be at takeoff thrust. Approach or landing test should be at thrust for level flight.	
(6) Rudder Response	±2°/sec. or ±10% yaw rate	Approach or Landing	**X**	**X**	**X**	**X**	Record results for stability augmentation system ON and OFF. A rudder step input of 20%-30% rudder pedal throw is used. (**CCA:** Test in Normal and Non-normal control state.)		Yes
(7) Dutch Roll, (Yaw Damper OFF)	±0.5 sec. or ±10% of period; ±10% of time to ½ or double amplitude or ±.02 of damping ratio; ±20% or ±1 sec. of time difference between peaks of bank and sideslip.	Cruise, and Approach or Landing		**X**	**X**	**X**	Record results for at least 6 complete cycles with stability augmentation OFF. (**CCA:** Test in Non-normal control state.)		Yes
(8) Steady State Sideslip	For given rudder position – ±2° bank angle, ±1° sideslip angle, ±10% or ±2° aileron, ±10% or ±5° Spoiler or equivalent roll controller position or force. Additionally, for those simulators of airplanes with reversible flight	Approach or Landing	**X**	**X**	**X**	**X**	Propeller driven airplanes must test in each direction**.** May be a series of snapshot test results using at least two rudder positions.		Yes

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QPS REQUIREMENTS								INFORMATION	
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	PARA 12
			A	B	C	D			
	control systems: wheel force, ±10% or ±3 lb (1.3 daN), and rudder pedal force, ±10% or ±5 lb (2.2 daN).								
e. Landings									
(1) Normal Landing	±3 kts airspeed, ±1.5° pitch, ±1.5° angle of attack, ±10% or ±10 ft (3 m) altitude. Additionally, for those simulators of airplanes with reversible flight control systems: stick/column force ±10% or ±5 lbs (±2.2 daN).	Landing		X	X	X	Record results from a minimum of 200 ft (61 m) AGL to nose-wheel touchdown (**CCA:** Test in Normal and Non-normal control state if applicable.)		Yes
(2) Minimum Flap Landing	±3 kts airspeed, ±1.5° pitch, ±1.5° angle of attack, ±10% or ±10 ft (3 m) altitude. Additionally, for those simulators of airplanes with reversible flight control systems: stick/column force, ±10% or ±5 lbs (2.2 daN).	Minimum Certified Landing Flap Configuration			X	X	Record results from a minimum of 200 ft (61 m) AGL to nosewheel touchdown with airplane at near Maximum Landing Weight.		
(3) Crosswind Landing	±3 kts airspeed, ±1.5° pitch, ±1.5° angle of attack, ±10% or ±10 ft (3 m) altitude, ±2° bank angle, ±2° sideslip angle; ±3° heading. Additionally, for those	Landing		X	X	X	Record results from a minimum of 200 ft (61 m) AGL, through nosewheel touch down, to 50% decrease in main landing gear touchdown speed. Requires test data, including information on wind profile for a crosswind		Yes

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QPS REQUIREMENTS								INFORMATION	PARA 12
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			A	**B**	**C**	**D**			
	simulators of airplanes with reversible flight control systems: wheel force, ±10% or ±3 lb (1.3 daN) and rudder pedal force, ±10% or ±5 lb (2.2 daN).						component of at least 60% of the maximum described in the Airplane Flight Manual, as measured at 33 ft (10m) above the runway.		
(4) One Engine Inoperative Landing (Not required for Single-engine airplanes.)	±3 kts airspeed, ±1.5° pitch, ±1.5° angle of attack, ±10% altitude or ±10 ft (3 m), ±2° bank angle, ±2° sideslip angle, ±3° heading.	Landing		**X**	**X**	**X**	Record results from a minimum of 200 ft (61 m) AGL, through nosewheel touch down, to 50% decrease in main landing gear touchdown speed or less.		Yes
(5) Autopilot landing (if applicable)	±5 ft (1.5 m) flare height, ±0.5 sec T_f , ±140 ft/min (.7 m/sec) rate of descent at touch-down, ±10 ft (3 m) lateral deviation during rollout.	Landing		**X**	**X**	**X**	If autopilot provides rollout guidance, record lateral deviation from touchdown to a 50% decrease in main landing gear touchdown speed or less. Time of autopilot flare mode engage and main gear touchdown must be noted.	T_f= duration of flare.	
(6) All engines operating, autopilot, go around	±3 kts airspeed, ±1.5° pitch, ±1.5° angle of attack	As per AFM		**X**	**X**	**X**	Normal, all-engines-operating, Go Around with the autopilot engaged (if applicable) at medium landing weight. (**CCA:** Test in Normal and Non-normal control state.)		
(7) One engine inoperative go around	±3 kts airspeed, ±1.5° pitch, ±1.5° angle of attack, ±2° bank angle, ±2° sideslip angle	As per AFM		X	X	X	The one engine inoperative go around is required at near maximum certificated landing weight with the critical engine inoperative using manual		

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							controls. If applicable, an additional engine inoperative go around test must be accomplished with the autopilot engaged. (CCA: Non-autopilot test in non-normal control state.)		
(8) Directional control (rudder effectiveness) with symmetric reverse thrust	±5 kts airspeed ±2°/sec. yaw rate	Landing		X	X	X	Record results from a speed approximating touchdown speed to the minimum thrust reverser operation speed. With full reverse thrust, apply yaw control in both directions until reaching minimum thrust reverser operation speed.		
(9) Directional control (rudder effectiveness) with asymmetric reverse thrust	±5 kts airspeed ±3° heading angle.	Landing		X	X	X	Maintain heading with yaw control with full reverse thrust on the operating engine(s). Record results from a speed approximating touchdown speed to a speed at which control of yaw cannot be maintained or until reaching minimum thrust reverser operation speed, whichever is higher. The tolerance applies to the low speed end of the data recording.		
f. Ground Effect									
Test to demonstrate Ground Effect	±1° elevator; ±0.5° stabilizer angle; and ±5% net thrust or equivalent; ±1° angle of attack; ±10%	Landing		X	X	X	The Ground Effect model must be validated by the test selected and a rationale must be provided for selecting the	See paragraph 7, Ground Effect, in this attachment for additional	Yes

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	height or ±5 ft (1.5 m); ±3 kts airspeed, and ±1° pitch angle						particular test.	information.	
g. Windshear.									
Four tests, two takeoff and two landing, with one of each conducted in still air and the other with windshear active to demonstrate windshear models.	See Attachment 6	Takeoff and Landing			X	X	Requires windshear models that provide training in the specific skills needed to recognize windshear phenomena and to execute recovery procedures. See Attachment 6 for tests, tolerances, and procedures.	See Attachment 6 for information related to Level A and B simulators.	
h. Flight Maneuver and Envelope Protection Functions									
The requirements of tests h (1) through (6) of this attachment, are applicable to computer controlled airplanes only. Time history results are required for simulator response to control inputs during entry into envelope protection limits including both normal and degraded control states if the function is different. Set thrust as required to reach the envelope protection function.									
(1) Overspeed	±5 Kts Airspeed	Cruise		X	X	X			
(2) Minimum Speed	±3 Kts Airspeed	Takeoff, Cruise, and Approach or Landing		X	X	X			
(3) Load Factor	±0.1g	Takeoff and Cruise		X	X	X			
(4) Pitch Angle	±1.5° pitch angle	Cruise, and Approach		X	X	X			
(5) Bank Angle	±2° or ±10% bank angle	Approach		X	X	X			
(6) Angle of Attack	±1.5° AOA	Second Segment Climb, and Approach or Landing		X	X	X			
3. Motion System									
a. Frequency Response	As specified by the	N/A	X	X	X	X	The test must demonstrate		

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	applicant for flight simulator qualification.						frequency response of the motion system.		
b. Motion system repeatability.	±0.05g actual platform linear acceleration	None	X	X	X	X	A demonstration is required and must be made part of the MQTG. The assessment procedures must be designed to ensure that the motion system hardware and software (in normal flight simulator operating mode) continue to perform as originally qualified.		
a. Field of View									
(1) Continuous collimated visual field of view	Minimum continuous collimated field of view providing 45° horizontal and 30° vertical field of view for each pilot simultaneously.	N/A	X	X				A vertical field of view of 30° may be insufficient to meet visual ground segment requirements.	
b. Surface contrast ratio.	Not less than 5:1	N/A			X	X	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.	Measurements should 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	

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								testing, simulator aft-cab and flight deck ambient light levels should be zero.	
c. Highlight brightness	Not less than six (6) foot-lamberts (20 cd/m^2)	N/A			X	X	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 lightpoints is not acceptable.	Measurements should 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.	
d. Vernier resolution (surface resolution)	Not greater than three (3) arc minutes	N/A			X	X	An SOC is required and must include the appropriate calculations and an explanation of those calculations.	The eye will subtend two arc minutes when positioned on a 3° glide slope, 6,876 ft slant range from the centrally located threshold of a black runway surface painted with white threshold bars that are 16 ft wide with 4-foot gaps between the bars.	
f. Lightpoint size	Not greater than six (6)	N/A			X	X	An SOC is required and must	Lightpoint size	

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TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES	
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	arc-minutes.						include the relevant calculations and an explanation of those calculations.	should be measured using a test pattern consisting of a centrally located single row of lightpoints reduced in length until modulation is just discernible in each visual channel. A row of 48 lights will form a 4° angle or less.	
g. Lightpoint contrast ratio:									
(1) Level C and D simulators.	Not less than 25:1	N/A			X	X	An SOC is required and must include the relevant calculations.	A 1° spot photometer is used to measure a square of at least 1° filled with lightpoints (where lightpoint 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.	

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Begin Information

2. Control Dynamics.

a. The characteristics of an airplane flight control system have a major effect on the handling qualities. A significant consideration in pilot acceptability of an airplane is the “feel” provided through the cockpit controls. Considerable effort is expended on airplane feel system design in order to deliver a system with which pilots will be comfortable and consider the airplane desirable to fly. In order for a simulator to be representative, it too must present the pilot with the proper feel; that of the respective airplane. Aircraft control feel dynamics shall duplicate the airplane simulated. This shall be determined by comparing a recording of the control feel dynamics of the simulator to airplane measurements in the takeoff, cruise, and landing configuration.

b. 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 simulator control loading system to the airplane systems is essential. The required control feel dynamic tests are described in this attachment. This is usually accomplished by measuring the free response of the controls using a step or pulse input to excite the system.

c. 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. If either or both considerations apply, engineering validation or airplane manufacturer rationale must be submitted as justification for ground tests or for eliminating a configuration.

(1) Control Dynamics Evaluations. The dynamic properties of control systems are often stated in terms of frequency, damping, and a number of other measurements, which can be found in texts on control systems. In order to establish a consistent means of validating test results for simulator 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.

(2) For Levels C and D Simulators. Tests to verify that control feel dynamics represent the airplane show that the dynamic damping cycles (free response of the control) match that of the airplane within the specified tolerances. An acceptable method of evaluating the response and the tolerance to be applied are described below for the underdamped and critically damped cases.

d. Tolerances.

(1) Underdamped Response.

(a) 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.

(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 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 airplane data, the process would begin by overlaying or aligning the simulator and airplane 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 would show the same number of significant overshoots to within one when compared against the airplane data. This procedure for evaluating the response is illustrated in Figure 1 of this attachment.

(2) 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 would be the same as the airplane within ±10 percent. The simulator response must be critically damped also. Figure 2 illustrates the procedure.

(3)(a) The following summarizes the tolerances, T, for an illustration of the referenced measurements (See Figures 1 and 2 of this attachment):

T(P_0)	±10% of P_0
T(P_1)	±20% of P_1
T(A)	±10% of A_1,
T(A_d)	±5% of A_d = Residual Band
Significant Overshoots:	First overshoot and ±1 subsequent overshoots

(b) In the event the number of cycles completed outside of the residual band, and thereby significant, exceeds the number depicted in figure 1 of this attachment, the following tolerances (T) will apply:

T(P_n) ±10(n+1)% of P_n, where “n” is the next in sequence.

e. Alternative Method for Control Dynamics.

(1) An alternative means for dealing with control dynamics applies to airplanes with hydraulically powered flight controls and artificial feel systems. Instead of free response

measurements, the system would be validated by measurements of control force and rate of movement.

(2) For each axis of pitch, roll, and yaw, the control shall be forced to its maximum extreme position for the following distinct rates. These tests would be conducted at typical taxi, takeoff, cruise, and landing conditions.

(a) Static Test - Slowly move the control such that approximately 100 seconds are required to achieve a full sweep. A full sweep is defined as movement of the controller from neutral to the stop, usually aft or right stop, then through the neutral position to the opposite stop, then to the neutral position.

(b) Slow Dynamic Test - Achieve a full sweep in approximately 10 seconds.

(c) Fast Dynamic Test - Achieve a full sweep in approximately 4 seconds.

(NOTE: Dynamic sweeps may be limited to forces not exceeding 100 lb.)

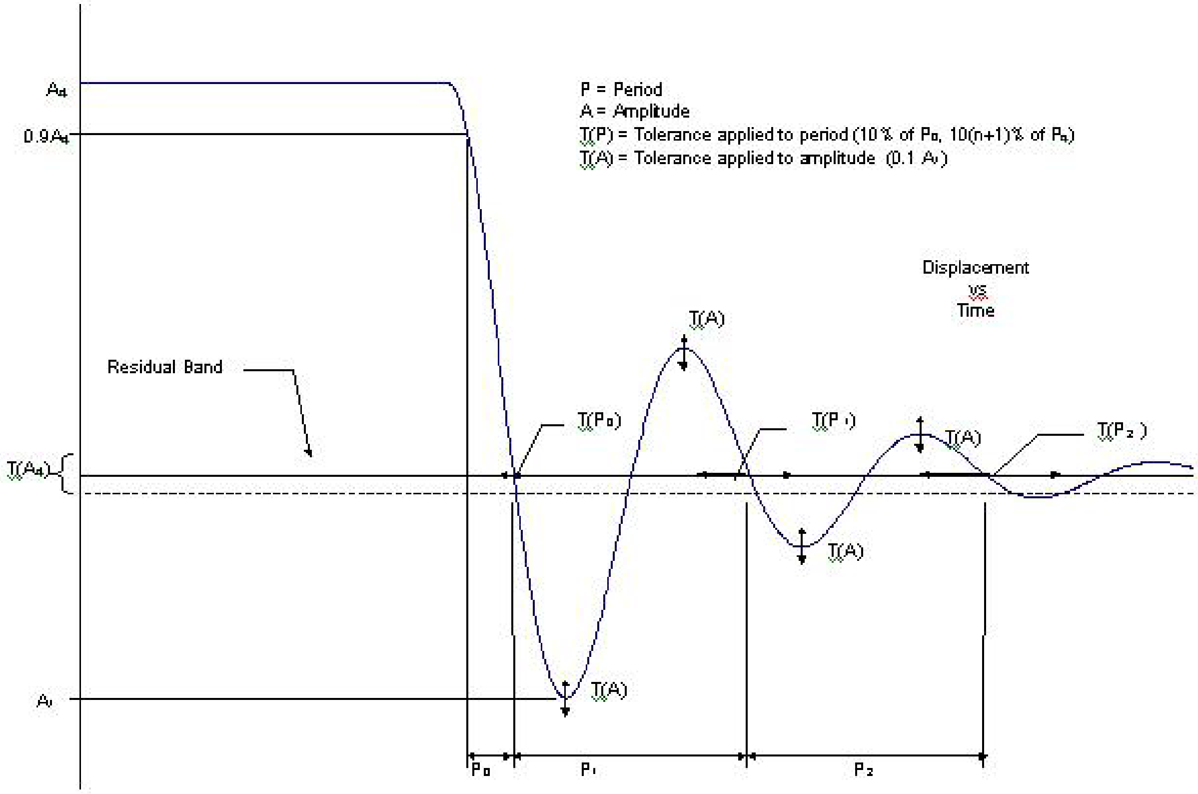
(3) Tolerances.

(a) Static Test - Items 2.a.(1) (2) and (3) of this attachment.

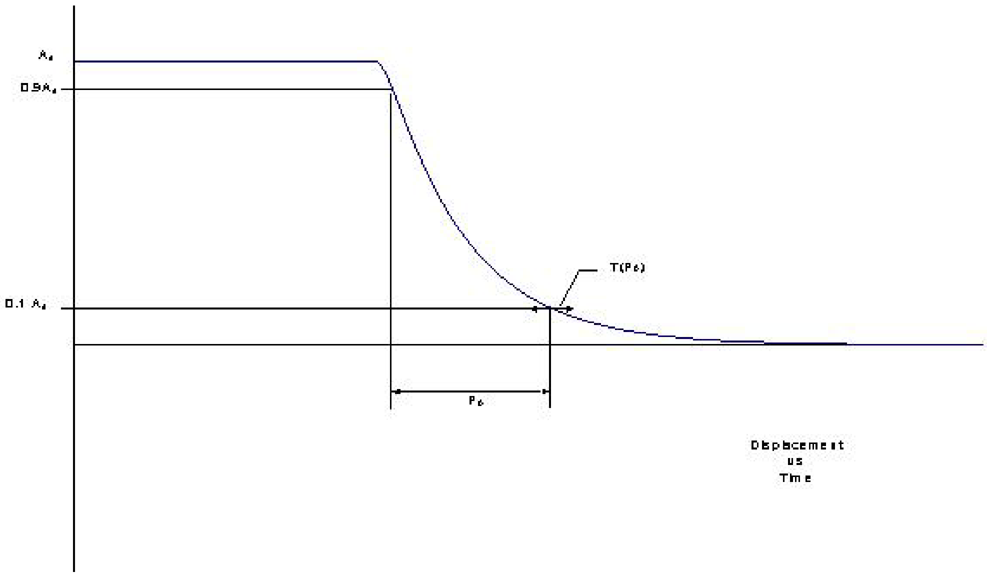
(b) Dynamic Test - 2 lb. or 10 percent on dynamic increment above static test.

f. The NSPM is open to alternative means such as the one described above. Such alternatives, however, would have to be justified and found appropriate to the application. For example, the method described here may not apply to all manufacturers' systems and certainly not to airplanes with reversible control systems. Hence, each case must be considered on its own merit on an ad hoc basis. If the NSPM finds that alternative methods do not result in satisfactory simulator performance, then more conventionally accepted methods must be used.

End Information



"ATTACHMENT 2 TO APPENDIX A TO PART 60—
FIGURE 1. UNDER-DAMPED STEP RESPONSE"



**"ATTACHMENT 2 TO APPENDIX A TO PART 60—
FIGURE 2. CRITICALLY-DAMPED STEP RESPONSE"**

3. Ground Effect.

Begin Information

a. For a flight simulator to be used for take-off and landing it should faithfully reproduce the aerodynamic changes, which occur in ground effect. The parameters chosen for flight simulator validation should be indicative of these changes.

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

(2) The selection of the test method and procedures to validate ground effect is at the option of the organization performing the flight tests; however, the flight test should be performed with enough duration near the ground to validate sufficiently the ground-effect model.

b. Acceptable tests for validation of ground effect include:

(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.

Note: If other methods are proposed, rationale should be provided to conclude that the tests performed validate the ground-effect model.

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 flight simulator 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 flight simulator 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 them are accomplished while transiting heights at which ground effect is an important factor.

End Information

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4. Alternative Data Sources, Procedures, and Instrumentation: Level A and Level B Simulators Only

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Begin Information

a. In recent years, considerable progress has been made by highly experienced aircraft and simulator manufacturers in improvement of aerodynamic modeling techniques. In conjunction with increased accessibility to very high powered computer technology, these techniques have become quite sophisticated. Additionally, those who have demonstrated success in combining these modeling techniques with minimal flight testing have incorporated the use of highly mature flight controls models and have had extensive experience in comparing the output of their effort with actual flight test data - and they have been able to do so on an iterative basis over a period of years.

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; 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 A and Level B simulators.

c. In reviewing this history, the NSPM has concluded that, with proper care, those who are experienced in the development of aerodynamic models for simulator 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 A or Level B simulators, does not compromise the quality of that simulation.

d. The information in the table that follows (Table of Alternative Data Sources, Procedures, and Information) is presented to describe an acceptable alternative to data sources for simulator modeling and validation and as an acceptable alternative to the procedures and instrumentation found in the traditionally accepted flight test methods used to gather such modeling and validation data.

(1) Alternative data sources which 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 NSPM recommends that use of the alternative instrumentation noted in the following Table be coordinated with the NSPM prior to employment in a flight test or data gathering effort.

e. The NSPM 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 simulator aerodynamic program modeling.

(1) While the 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. 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) 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, will be used. Such a model does not require control surface position measurements in the flight test objective data in these limited applications.

(3) The authorized uses of Level A and Level B simulators (as listed in the appropriate Commercial, Instrument, or Airline Transport Pilot and/or Type Rating Practical Test Standards) for "initial," "transition," or "upgrade" training, still requires additional flight training and/or flight testing/checking in the airplane or in a Level C or Level D simulator.

f. The sponsor is urged to contact the NSPM for clarification of any issue regarding airplanes with reversible control systems. This table is not applicable to Computer Controlled Aircraft flight simulators.

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 A or Level B flight simulators.

End Information

Table of Alternative Data Sources, Procedures, and Instrumentation Information				
--Table of Objective Tests -- Test Reference Number and Title	**Sim Level**		**Alternative Data Sources, Procedures, and Instrumentation**	**Notes and Reminders**
	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 NSPM 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: the calibrated airplane instruments and the force/position measurements of cockpit controls.	Rapid throttle reductions at speeds near V_{mcg} may be used while recording appropriate parameters. The nose wheel 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: the calibrated airplane instruments and the force/position measurements of cockpit 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: the calibrated airplane instruments and the force/position measurements of cockpit 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: the calibrated airplane instruments and the force/position measurements of cockpit 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: the calibrated airplane instruments and the force/position measurements of cockpit controls.	The “1:7 law” to 100 feet (30 meters) is an acceptable wind profile.
1.b.(7)	**X**	**X**	Data may be acquired with a synchronized	

Table of Alternative Data Sources, Procedures, and Instrumentation Information				
--Table of Objective Tests -- Test Reference Number and Title	**Sim Level**		**Alternative Data Sources, Procedures, and Instrumentation**	**Notes and Reminders**
	A	**B**		
Performance. Takeoff. Rejected Takeoff			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	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 Second Segment 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 approved AFM requires specific performance in icing conditions)	X	X	Data may be acquired with a synchronized video of: calibrated airplane instruments and engine power throughout the climb range.	
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 the 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.	
2.a.(1) 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 NSPM, using a control surface protractor on the ground with winds less than 5 kts. Force data may be acquired by using a hand held force gauge at the same column position data points.	
2.a.(2) 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 NSPM, using a control surface protractor on	

Table of Alternative Data Sources, Procedures, and Instrumentation Information				
--Table of Objective Tests -- Test Reference Number and Title	**Sim Level**		**Alternative Data Sources, Procedures, and Instrumentation**	**Notes and Reminders**
	A	**B**		
			the ground with winds less than 5 kts. Force data may be acquired by using a hand held force gauge at the same wheel position data points.	
2.a.(3) 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 NSPM, using a control surface protractor on the ground with winds less than 5 kts. Force data may be acquired by using a hand held force gauge at the same rudder pedal position data points.	
2.a.(4) Handling Qualities. Static Control Checks. Nosewheel Steering Controller Force & 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 nose wheel 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 Checks. Alignment of Cockpit 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.	
2.a.(8) Handling Qualities. Static Control Checks. Break 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. Power Change Dynamics	**X**	**X**	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and throttle position.	
2.c.(2) Handling Qualities. Longitudinal. 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. Spoiler/Speedbrake Change	**X**	**X**	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane	

Table of Alternative Data Sources, Procedures, and Instrumentation Information				
--Table of Objective Tests -- Test Reference Number and Title	**Sim Level**		**Alternative Data Sources, Procedures, and Instrumentation**	**Notes and Reminders**
	A	**B**		
Dynamics			instruments and spoiler/speedbrake position.	
2.c.(4) Handling Qualities. Longitudinal. Gear Change Dynamics	**X**	**X**	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and gear position.	
2.c.(5) Handling Qualities. Longitudinal. Longitudinal Trim	**X**	**X**	Data may be acquired through use of an inertial measurement system and a synchronized video of: the cockpit controls position (previously calibrated to show related surface position) and the engine instrument readings.	
2.c.(6) Handling Qualities. Longitudinal. 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: 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. Longitudinal Static Stability	**X**	**X**	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. Stall Characteristics	**X**	**X**	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.
2.c.(9) Handling Qualities. Longitudinal. Phugoid Dynamics	**X**	**X**	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 cockpit controls.	
2.c.(10) Handling Qualities. Longitudinal. Short Period Dynamics	**X**	**X**	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 cockpit controls.	
2.d.(1) Handling Qualities. Lateral Directional. 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: the calibrated airplane instruments and the force/position measurements of cockpit controls.	
2.d.(3) Handling Qualities. Lateral Directional. Roll Response to Cockpit Roll Controller Step Input	**X**	**X**	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 cockpit lateral controls.	
2.d.(4)	**X**	**X**	Data may be acquired by using an inertial	

Table of Alternative Data Sources, Procedures, and Instrumentation Information

--Table of Objective Tests -- Test Reference Number and Title	Sim Level		Alternative Data Sources, Procedures, and Instrumentation	Notes and Reminders
	A	B		
Handling Qualities. Lateral Directional. Spiral Stability			measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls; and a stop watch.	
2.d.(5) Handling Qualities. Lateral Directional. 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: the calibrated airplane instruments; and the force/position measurements of cockpit 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. Rudder Response	X	X	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. Dutch Roll, (Yaw Damper OFF)	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls.	
2.d.(8) Handling Qualities. Lateral Directional. Steady State Sideslip	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit 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: the calibrated airplane instruments; the force/position measurements of cockpit controls.	
2.e.(3) Handling Qualities. Landings Crosswind Landing		X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls.	
2.e.(4) Handling Qualities. Landings One Engine Inoperative Landing (Not required for Single-engine airplanes.)		X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls. Normal and lateral accelerations may be recorded in lieu of AOA and sideslip.	
2.f.		X	Data may be acquired by using calibrated	

Table of Alternative Data Sources, Procedures, and Instrumentation Information				
--Table of Objective Tests -- Test Reference Number and Title	**Sim Level**		**Alternative Data Sources, Procedures, and Instrumentation**	**Notes and Reminders**
	A	**B**		
Handling Qualities. Ground Effect. Test to demonstrate Ground Effect			airplane instruments, an inertial measurement system, and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls.	

Attachment 3 to Appendix A to Part 60--

SIMULATOR SUBJECTIVE EVALUATION

1. Requirements.

Begin QPS Requirements

Airports represented in visual scenes required by this part must be representations of real-world, operational airports or representations of fictional airports.

a. If real-world, operational airports are simulated, the visual representation and scene content is compared to that of the actual airport. This comparison requires accurate simulation of that airport to the extent required by this part and as required by the qualification level sought. It also requires the visual scene to be modified when the airport is modified; e.g., when additional runways or taxiways are added; when existing runway(s) are lengthened or permanently closed; when magnetic bearings to or from a runway are changed; when significant and recognizable changes are made to the terminal, other airport buildings, or surrounding terrain; etc.

b. If fictional airports are used, the navigational aids and all appropriate maps, charts, and other navigational reference material for such airports (and surrounding areas as necessary), are evaluated for compatibility, completeness, and accuracy. These items are compared to the visual presentation and scene content of the fictional airport and require simulation to the extent set out in this document and as required by the qualification level sought. An SOC must be submitted that addresses navigation aid installation and performance (including obstruction clearance protection, etc.) and other criteria for all instrument approaches that are available in the simulator. The SOC must reference and account for information in the Terminal Instrument Procedures Manual (“Terps” Manual, FAA Handbook 8260.3, as amended) and the construction and availability of the required maps, charts, and other navigational material. This material must be appropriately marked "for training purposes only."

End QPS Requirements

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2. Discussion

Begin Information

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 Table of Functions and Subjective Tests are for simulator evaluation purposes only. They must not be used to limit or exceed the authorizations for use of a given level of simulator as described on the Statement of Qualification or as may be approved by the TPAA. All items in the following paragraphs are subject to an examination.

b. The Table of Functions and Subjective Tests in this attachment addresses pilot functions, including maneuvers and procedures (called flight tasks), and is divided by flight phases. The performance of these tasks by the NSPM 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 Table of Functions and Subjective Tests in this attachment addresses the overall function and control of the simulator including the various simulated environmental conditions; simulated airplane system operation (normal, abnormal, and emergency); visual system displays; and special effects necessary to meet flightcrew 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 NSP pilot will include in his report to the TPAA, the effect of the system operation and any system limitation.

Table of Alternative Data Sources, Procedures, and Instrumentation Information

--Table of Objective Tests -- Test Reference Number and Title	Sim Level		Alternative Data Sources, Procedures, and Instrumentation	Notes and Reminders
	A	B		

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 - 14CFR, §91.175(e)).

f. At the request of the TPAA, the NSP 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.

End Information

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS				
QPS REQUIREMENTS				
	Simulator Level			
Operations Tasks	A	B	C	D
1. Operations: Tasks in the Operations Table are subject to evaluation if appropriate for the airplane simulated as indicated in the SOQ Configuration List and/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.				
a. Preparation For Flight Preflight. Accomplish a functions check of all switches, indicators, systems, and equipment at all crewmembers' and instructors' stations and determine that the flight deck design and functions are identical to that of the airplane simulated.	X	X	X	X
b. Surface Operations (Pre-Take-Off)				
(1) Engine Start				
(a) Normal start.	X	X	X	X
(b) Alternate start procedures.	X	X	X	X
(c) Abnormal starts and shutdowns (hot / hung start, tail pipe fire, etc.).	X	X	X	X
(2) Pushback/Powerback.		X	X	X
(3) Taxi				
(a) Thrust response.	X	X	X	X
(b) Power lever friction.	X	X	X	X
(c) Ground handling.	X	X	X	X
(d) Nose wheel scuffing.			X	X
(e) Brake operation (normal and alternate/emergency).	X	X	X	X
(f) Brake fade (if applicable)	X	X	X	X
c. Take-Off (1) Normal				
(a) Airplane/engine parameter relationships.	X	X	X	X
(b) Acceleration characteristics (motion).	X	X	X	X
(c) Nose wheel and rudder steering.	X	X	X	X
(d) Crosswind (maximum demonstrated).	X	X	X	X
(e) Special performance (e.g. reduced V_1, max de-rate, short field operations).	X	X	X	X
(f) Low visibility take-off.	X	X	X	X
(g) Landing gear, wing flap leading edge device operation.	X	X	X	X
(h) Contaminated runway operation.			X	X
(2) Abnormal/emergency.				
(a) Rejected Take-off.	X	X	X	X
(b) Rejected special performance (e.g. reduced V_1, max de-rate, short field operations).	X	X	X	X
(c) With failure of most critical engine at most critical point, continued take-off.	X	X	X	X
(d) With wind shear.	X	X	X	X
(e) Flight control system failures, reconfiguration modes, manual reversion and associated handling.	X	X	X	X
(f) Rejected, brake fade.			X	X

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS				
QPS REQUIREMENTS				
	Simulator Level			
Operations Tasks	**A**	**B**	**C**	**D**
(g) Rejected, contaminated runway.			**X**	**X**
d. Climb				
(1) Normal.	**X**	**X**	**X**	**X**
(2) One or more engines inoperative.	**X**	**X**	**X**	**X**
e. Cruise.				
(1) Performance characteristics (speed vs. power).	**X**	**X**	**X**	**X**
(2) High altitude handling.	**X**	**X**	**X**	**X**
(3) High Mach number handling (Mach tuck, Mach buffet) and recovery (trim change).	**X**	**X**	**X**	**X**
(4) Overspeed warning (in excess of V_{mo} or M_{mo})	**X**	**X**	**X**	**X**
(5) High IAS handling.	**X**	**X**	**X**	**X**
f. Maneuvers.				
(1) High angle of attack, approach to stalls, stall warning, buffet, and g-break (take-off, cruise, approach, and landing configuration).	**X**	**X**	**X**	**X**
(2) Flight envelope protection (high angle of attack, bank limit, overspeed, etc).	**X**	**X**	**X**	**X**
(3) Turns with/without speedbrake/spoilers deployed. (4) Normal and steep turns	**X**	**X**	**X**	**X**
(5) In flight engine shutdown and restart (assisted and windmill).	**X**	**X**	**X**	**X**
(6) Maneuvering with one or more engines inoperative, as appropriate.	**X**	**X**	**X**	**X**
(7) Specific flight characteristics (e.g. direct lift control).	**X**	**X**	**X**	**X**
(8) Flight control system failures, reconfiguration modes, manual reversion and associated handling.	**X**	**X**	**X**	**X**
g. Descent.				
(1) Normal.	**X**	**X**	**X**	**X**
(2) Maximum rate (clean and with speedbrake, etc).	**X**	**X**	**X**	**X**
(3) With autopilot.	**X**	**X**	**X**	**X**
(4) Flight control system failures, reconfiguration modes, manual reversion and associated handling.	**X**	**X**	**X**	**X**
h. Instrument Approaches And Landing. *Those instrument approach and landing tests relevant to the simulated airplane type should be selected from the following list. Some tests should be made with limiting wind velocities, under windshear conditions, and with relevant system failures, including the failure of the Flight Director.* (1) Precision.				
(a) PAR	**X**	**X**	**X**	**X**
(b) CAT I/GBAS (ILS/MLS) published approaches.	**X**	**X**	**X**	**X**
(i) Manual approach with/without flight director including landing.	**X**	**X**	**X**	**X**
(ii) Autopilot/autothrottle coupled approach and manual landing.	**X**	**X**	**X**	**X**
(iii) Manual approach to DH and go-around all engines.	**X**	**X**	**X**	**X**
(iv) Manual one engine out approach to DH and go-around.	**X**	**X**	**X**	**X**
(v) Manual approach controlled with and without flight director to 30	**X**	**X**	**X**	**X**

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS				
QPS REQUIREMENTS				
	Simulator Level			
Operations Tasks	**A**	**B**	**C**	**D**
m (100 ft) below CAT I minima.				
A With cross-wind (maximum demonstrated)	X	X	X	X
B With windshear	X	X	X	X
(vi) Autopilot/autothrottle coupled approach, one engine out to DH and go-around.	X	X	X	X
(vii) Approach and landing with minimum/standby electrical power.	X	X	X	X
(c) CAT II/GBAS (ILS/MLS) published approaches.	X	X	X	X
(i) Autopilot/autothrottle coupled approach to DH and landing.	X	X	X	X
(ii) Autopilot/autothrottle coupled approach to DH and go-around.	X	X	X	X
(iii) Autocoupled approach to DH and manual go-around.	X	X	X	X
(iv) Category II published approach (auto-coupled, autothrottle).	X	X	X	X
(d) CAT III/GBAS (ILS/MLS) published approaches.	X	X	X	X
(i) Autopilot/autothrottle coupled approach to land and rollout.	X	X	X	X
(ii) Autopilot/autothrottle coupled approach to DH/Alert Height and go-around.	X	X	X	X
(iii) Autopilot/autothrottle coupled approach to land and rollout with one engine out.	X	X	X	X
(iv) Autopilot/autothrottle coupled approach to DH/Alert Height and go-around with one engine out.	X	X	X	X
(v) Autopilot/autothrottle coupled approach (to land or to go around).	X	X	X	X
A With generator failure	X	X	X	X
B With 10 knot tail wind	X	X	X	X
C With 10 knot crosswind	X	X	X	X
(2) Non-precision.				
(a) NDB.	X	X	X	X
(b) VOR, VOR/DME, VOR/TAC.	X	X	X	X
(c) RNAV (GNSS/GPS).	X	X	X	X
(d) ILS LLZ (LOC), LLZ(LOC)/BC.	X	X	X	X
(e) ILS offset localizer.	X	X	X	X
(f) Direction finding facility (ADF/SDF).	X	X	X	X
(g) Surveillance radar.	X	X	X	X
NOTE 1: If Standard Operating Procedures allow use autopilot for non-precision approaches they should include evaluation using the autopilot. *NOTE 2: Level A simulators are not authorized to credit the landing maneuver.*				
i. Visual Approaches (Visual Segment) And Landings.				
(1) Maneuvering, normal approach and landing, all engines operating with and without visual approach aid guidance.	X	X	X	X
(2) Approach and landing with one or more engines inoperative.	X	X	X	X
(3) Operation of landing gear, flap/slats and speedbrakes (normal and abnormal).	X	X	X	X
(4) Approach and landing with crosswind (max. demonstrated).	X	X	X	X
(5) Approach to land with windshear on approach.	X	X	X	X
(6) 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

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS				
QPS REQUIREMENTS				
	Simulator Level			
Operations Tasks	**A**	**B**	**C**	**D**
(7) Approach and landing with trim malfunctions.	X	X	X	X
(a) Longitudinal trim malfunction.	X	X	X	X
(b) Lateral-directional trim malfunction.	X	X	X	X
(8) Approach and landing with standby (minimum) electrical/hydraulic power.	X	X	X	X
(9) Approach and landing from circling conditions (circling approach).	X	X	X	X
(10) Approach and landing from visual traffic pattern.	X	X	X	X
(11) Approach and landing from non-precision approach.	X	X	X	X
(12) Approach and landing from precision approach.	X	X	X	X
(13) Approach procedures with vertical guidance (APV), e.g., SBAS.	X	X	X	X
NOTE 1: Level A simulators are not authorized to credit the landing maneuver. *NOTE 2: 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.*				
j. Missed Approach.				
(1) All engines.	X	X	X	X
(2) One or more engine(s) out.	X	X	X	X
(3) With flight control system failures, reconfiguration modes, manual reversion and associated handling.	X	X	X	X
k. Surface Operations (Landing roll and taxi**).**				
(1) Spoiler operation.	X	X	X	X
(2) Reverse thrust operation.	X	X	X	X
(3) Directional control and ground handling, both with and without reverse thrust.		X	X	X
(4) Reduction of rudder effectiveness with increased reverse thrust (rear pod-mounted engines).		X	X	X
(5) Brake and anti-skid operation with dry, wet, and icy conditions.			X	X
(6) Brake operation, to include auto-braking system where applicable.	X	X	X	X
l. Any Flight Phase.				
(1) Airplane and powerplant systems operation.				
(a) Air conditioning and pressurization (ECS).	X	X	X	X
(b) De-icing/anti-icing.	X	X	X	X
(c) Auxiliary powerplant/auxiliary power unit (APU).	X	X	X	X
(d) Communications.	X	X	X	X
(e) Electrical.	X	X	X	X
(f) Fire and smoke detection and suppression.	X	X	X	X
(g) Flight controls (primary and secondary).	X	X	X	X
(h) Fuel and oil, hydraulic and pneumatic.	X	X	X	X
(i) Landing gear.	X	X	X	X
(j) Oxygen.	X	X	X	X
(k) Powerplant.	X	X	X	X
(l) Airborne radar.	X	X	X	X
(m) Autopilot and Flight Director.	X	X	X	X

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS				
QPS REQUIREMENTS				
	Simulator Level			
Operations Tasks	A	B	C	D
(n) Collision avoidance systems. [e.g. (E)GPWS,TCAS]	X	X	X	X
(o) Flight control computers including stability and control augmentation.	X	X	X	X
(p) Flight display systems.	X	X	X	X
(q) Flight management computers.	X	X	X	X
(r) Head-up guidance, head-up displays	X	X	X	X
(s) Navigation systems	X	X	X	X
(t) Stall warning/avoidance	X	X	X	X
(u) Wind shear avoidance equipment	X	X	X	X
(v) Automatic landing aids.	X	X	X	X
(2) Airborne procedures.				
(a) Holding.	X	X	X	X
(b) Air hazard avoidance. (Traffic, Weather,...)			X	X
(c) Windshear.			X	X
(d) Effects of airframe ice.			X	X
(3) Engine shutdown and parking.				
(a) Engine and systems operation.	X	X	X	X
(b) Parking brake operation..	X	X	X	X

2. 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 simulator involved.				
(a) Power Switch(es)	X	X	X	X
(b) Airplane conditions. (1) Gross weight, center of gravity, fuel loading and allocation, etc	X	X	X	X
(2) Airplane systems status.	X	X	X	X
(3) Ground crew functions (e.g., ext. power, push back, etc.)	X	X	X	X
(c) Airports. (1) Number and selection.	X	X	X	X
(2) Runway selection.	X	X	X	X
(3) Runway surface condition (e.g., rough, smooth, icy, wet, etc.)			X	X
(4) Preset positions (e.g. ramp, gate, #1 for takeoff, takeoff position, over FAF, etc.)	X	X	X	X
(5) Lighting controls.	X	X	X	X
(d) Environmental controls. (1) Clouds (base and tops).	X	X	X	X
(2) Visibility (statute miles (kilometers)).	X	X	X	X
(3) Runway visual range (in feet (meters)).	X	X	X	X
(4) Temperature.	X	X	X	X
(5) Climate conditions (e.g., ice, snow, rain, etc.).	X	X	X	X
(6) Wind speed and direction.	X	X	X	X
(7) Windshear.			X	X
(e) Airplane system malfunctions. (1) Insertion / deletion.	X	X	X	X
(f) Locks, Freezes, and Repositioning. (1) Problem (all) freeze / release.	X	X	X	X
(2) Position (geographic) freeze / release.	X	X	X	X
(3) Repositioning (locations, freezes, and releases).	X	X	X	X
(4) Ground speed control.	X	X	X	X
(g) Remote IOS.	X	X	X	X
6. Sound Controls. On / off / adjustment	X	X	X	X
7. Motion / Control Loading System.				
(a) On / off / emergency stop.	X	X	X	X
(b) Crosstalk (motion response in a given degree of freedom not perceptible in other degrees of freedom).	X	X	X	X
(c) Smoothness (no perceptible "turn-around bump" as the direction of motion reverses with the simulator being "flown" normally).	X	X	X	X
8. Observer Seats / Stations. Position / Adjustment / Positive restraint system.	X	X	X	X

Attachment 4 to Appendix A to Part 60--

SAMPLE DOCUMENTS

Table of Contents

Title of Sample

ATTACHMENT 4 TO APPENDIX A TO PART 60—
Figure 1 – Sample Letter , Request for Initial, Upgrade, or Reinstatement Evaluation..
INFORMATION

Edward Cook, PhD.
Manager, National Simulator Program
Federal Aviation Administration
P.O. Box 20636 (AFS-205)
Atlanta, GA 30320

Dear Dr. Cook:

RE: Request for Initial [Upgrade / Reinstatement] Evaluation

(Sponsor's name) ___________________ requests your evaluation of our (make, model, series) ________ airplane simulator for Level ______ qualification, located in (City/State) at the (Facility) on (proposed evaluation date). [The proposed evaluation date must not be more than 180 days following the date of this letter.] This simulator [has / has not] been previously qualified by the FAA [and had been issued FAA identification number XXX]. Under separate cover, we have asked our Principal Operations Inspector (POI) (Training Center Program Manager, TCPM), Mr./Ms.__________________(Name), to forward to you a letter concurring with this request.

[The history of this simulator is as follows: ____.]

We agree to provide a Qualification Test Guide (QTG) to your staff not later than 45 days prior to the proposed evaluation date [if tests not run at training site, an additional "1/3 on-site" tests must be provided not later than 14 days prior the proposed evaluation date]. If we are unable to meet the above date for the evaluation, this may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation. With our forwarding the QTG, we acknowledge that the simulator meets all applicable requirements of Title 14 of the Code of Federal Regulation (14 CFR) Part 60; that it meets the requirements of the Airplane Flight Simulator Qualification Performance Standards (QPS); and that appropriate hardware and software configuration control procedures have been established.

We also agree to forward to you, not later than five (5) business days prior to the scheduled evaluation of this simulator, a confirmation statement that will include the following information:

1. That (a) pilot(s) we have designated, who is(are) qualified on the (make, model, series) _______ airplane, has(have) assessed the simulator and found that the performance and flying qualities of the simulator represent the (make, model, series) _______ airplane. This determination will be made after flying all the maneuvers and procedures and exercising the tasks listed in the Table of Functions and Subjective Tests in Attachment 3 to the Airplane Simulator QPS (except for those listed in the attachment to this letter).

2. That (a) pilot(s), or (an)other person(s) we have designated, has(have) found the simulator systems

and sub-systems (including simulated aircraft systems) functionally represent the (make, model, series) ________ airplane. This determination will be made after having exercised the operation of the simulator and the functions available through the Instructor Operating Station.

3. That, for type specific airplanes, (a) pilot(s), or (an)other person(s) we have designated, has(have) found the cockpit configuration represents the configuration of the (make, model, and series) ________ aircraft.

The names of the person(s) providing this information will be available to you upon your request.

[Added comments from Operator/Sponsor, if any]

Please contact (Name and Telephone Number of Sponsor's Contact) to confirm the date for this initial (upgrade / re-instatement) evaluation. We understand a member of your National Simulator Program staff will respond to this request within 14 days.

Sincerely,

(Signature –Management Representative)

ATTACHMENT 4 TO APPENDIX A TO PART 60--

Figure 2 – 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: ____________
Manager, National
Simulator Program, FAA

ATTACHMENT 4 TO APPENDIX A TO PART 60—

Figure 3 – Sample Simulator Information Page

INFORMATION

SPONSOR NAME	
SPONSOR SIMULATOR CODE:	BA-797 #1
AIRPLANE MODEL:	Stratos BA797-320A
AERODYNAMIC DATA REVISION:	BA797-320, CPX-8D, January 1988
ENGINE MODEL(S) AND REVISION:	CPX-8D; RPT-6, January 1988 DRQ-4002, RPT-3, April 1991
FLIGHT CONTROLS DATA REVISION:	BA707-320; May 1988
FLIGHT MANAGEMENT SYSTEM:	Berry XP
SIMULATOR MODEL AND MANUFACTURER:	MTD-797, Tinker Simulators, Inc.
DATE OF SIMULATOR MANUFACTURE:	1988
SIMULATOR COMPUTER:	CIA
VISUAL SYSTEM MODEL, MANUFACTURER, and DISPLAY TYPE:	ClearView, Inc. “Real World T2;” 5 Channel, 6-window CRT display
VISUAL SYSTEM COMPUTER:	LMB-6
MOTION SYSTEM:	Tinker 6 DOF

Information on this page must be updated and kept current with any modifications or changes made to the simulator and reflected on the log of revisions and the list of effective pages.

ATTACHMENT 4 TO APPENDIX A TO PART 60—
Figure 4 – Sample Statement of Qualification

INFORMATION
(subject to change)

Federal Aviation Administration
National Simulator Program

Statement
of
Qualification

This is to certify that representatives of the
National Simulator Program
Completed an evaluation of the

Go-Fast Training Center
Stratos BA-797 Flight Simulator
FAA Identification Number 701

And found it to meet the standards set forth
In the Qualification Performance Standards
For a simulator at

Level C

____________________ (date)

____________________ for the NSPM

Subject to the attached
Configuration List and Restrictions

ATTACHMENT 4 TO APPENDIX A TO PART 60—

Figure 4A – Sample Statement of Qualification; Configuration List

INFORMATION

STATEMENT of QUALIFICATION
CONFIGURATION LIST
Go-Fast Training Center Stratos BA-797-232 -- Level C -- FAA ID# 701

Configuration		Date Qualified
Airplane Model:......................... Re-configurable to:..................	BA-797-232.................................. BA-797-287 (see FAA ID#722)	July 12, 1988
Engine Model -- Revision:...	CPX-8D, RPT-6........................ DRQ-4002, RPT-3....................	July 12, 1988 April 1, 1991
Flight Management System:.......	Berry XP.......................................	July 12, 1988
Visual System / Manufacturer: CRT Installation:...................	Real World T2, Clear View, Inc. 5 Channel, 6 Window....................	 July 12, 1988
Flight Instruments: Electro-Mechanical:................ Heads-Up Display..................	 .... Jones Industries.............................	 July 12, 1988 December 1, 1993
Flight Director: Dual Cue................................	 Sperry...	 July 12, 1988
Engine Instruments: Electro-Mechanical.................		 July 12, 1988
Navigation Type(s): ADF...................................... VOR/ILS.............................. INS......................................		 July 12, 1988 July 12, 1988 October 10, 1991
Weather Radar:	Jones Industries, Inc.	August 3, 1996
Windshear Equipment		July 12, 1988
TCAS		October 9, 2003
	(Continue as Necessary)	

ATTACHMENT 4 TO APPENDIX A TO PART 60—
Figure 4B – Sample Statement of Qualification
Qualified / Non-Qualified Maneuvers, Procedures, Tasks, Functions

INFORMATION

STATEMENT of QUALIFICATION

Qualified / Non-Qualified Maneuvers, Procedures, Tasks, Functions
Go-Fast Training Center
Stratos BA-797 -- Level C -- FAA ID# 701

The FFS is qualified to perform all of the Maneuvers, Procedures, Tasks, and Functions listed in the Table of Functions and Subjective Tests,
Part 60, Appendix A, Attachment 3,
In Effect on [mm/dd/yyyy] except for the following listed Tasks or Functions.

(*Example*)

Non-Qualified Operations Tasks and Functions

1.b.(2) Power Back.
1.b.(3)(g) Other (SMGCS).
1.c.(1) Normal Takeoff, Daylight Conditions.
1.h.(1)(a) Precision Approaches, Precision Approach Radar (PAR)
1.l.(1)(d) Communications (ACARS)
1.l.(1)(l) Airborne Radar (Weather Radar System)
1.l.(1)(r) (Heads-Up Flight Guidance System [HUD]).
1.i.(14) Other (Land and Hold Short Operations [LAHSO])

Non-Qualified Simulator Systems:

6.g. Remote IOS

Additional Qualified Tasks or Functions in addition to those listed in the Table of Functions and Subjective Tests, Part 60, Appendix A, Attachment 3.

(None)

ATTACHMENT 4 TO APPENDIX A TO PART 60

Figure 5 – Sample Continuing Qualification Evaluation Requirements Page Information

Recurrent Evaluation Requirements
Completed at conclusion of Initial Evaluation

Recurrent Evaluations to be conducted each

_(fill in)__ months

Allotting ______ hours of FTD time.

Recurrent evaluations are due as follows:

_(month)__ and __(month)_ and __(month)_
(enter or strike out, as appropriate)

Signed: ________________________________
NSPM / Evaluation Team Leader

____
Date

Revision:

Based on (enter reasoning):

Recurrent Evaluations are to be conducted each

_(fill in)__ months. Allotting ______ hours.

Recurrent evaluations are due as follows:

_(month)__ and __(month)_ and __(month)_
(enter or strike out, as appropriate)

Signed: ________________________________
NSPM Evaluation Team Leader

____
Date

Revision:

Based on (enter reasoning):

Recurrent Evaluations are to be conducted each

_(fill in)__ months. Allotting ______ hours.

Recurrent evaluations are due as follows:

_(month)__ and __(month)_ and __(month)_
(enter or strike out, as appropriate)

Signed: ________________________________
NSPM Evaluation Team Leader

____
Date

(Repeat as Necessary)

ATTACHMENT 4 TO APPENDIX A TO PART 60—

Figure 6 – Sample MQTG Index of Effective FSTD Directives.

INFORMATION

Index of Effective FSTD Directives Filed in this Section

Notification Number	Received From: (TPAA/NSPM)	Date of Notification	Date of Modification Completion

Continue as Necessary....

Attachment 5 to Appendix A to Part 60—

SIMULATOR QUALIFICATION REQUIREMENTS

FOR WINDSHEAR TRAINING PROGRAM USE

1. Applicability.

Begin QPS Requirements

This attachment applies to all simulators used to satisfy the training requirements of 14 CFR part 121 that pertain to the sponsor's approved low-altitude windshear flight training program, or the training permitted in accordance with an FAA-approved training program under 14CFR part 121, 135, or 142, that addresses low-altitude windshear encounters.

End QPS Requirements

2. Statement of Compliance and Capability (SOC).

Begin QPS Requirements

a. The sponsor must submit an SOC that confirms that the aerodynamic model is based on flight test data supplied by the airplane manufacturer, or other approved source, and 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 where environmental wind parameters are currently evaluated in the simulator (such as crosswind takeoffs, crosswind approaches, and crosswind landings).

b. For those simulators where windshear warning, caution, or guidance hardware was not provided as original equipment, the SOC must also state that the simulation of the added simulator hardware and/or software, including associated cockpit displays and annunciations, function the same or equivalent to the system(s) installed in the airplane and be accompanied by a block diagram that depicts the input and output signal flow, comparing that signal flow to the equipment installed in the airplane being simulated.

End QPS Requirements

3. Models.

Begin QPS Requirements

The windshear models installed in the simulator software that will be used for the qualification evaluation must do the following:

a. Provide cues necessary for recognition of the onset of a windshear phenomena and potential performance degradation that would require a pilot to initiate recovery procedures. The cues must include all of the following, as may be appropriate for the appropriate 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 $\pm 5^0$.

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 by the cues described above, and that when the pilot applies 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 parameters that fall within the dispatch limitations of the airplane.

c. Be available for use in the FAA-approved windshear flight training program.

End QPS Requirements

---

4. Demonstrations.

Begin QPS Requirements

a. The sponsor must identify two of the required, survivable training windshear models – one takeoff and one approach. The sponsor must identify the wind components of the two models selected and present this information in graphical format so that all components of the windshear are shown, including initiation point, variance in magnitude, and either time or distance correlation as may be appropriate. The simulator must be operated at the same gross weight, airplane configuration, and initial airspeed in all of the following situations:

(1) Takeoff – through calm air.

(2) Takeoff – through the first selected survivable windshear.

(3) Approach – through calm air.

(4) Approach – through the second selected survivable windshear.

b. In each of these four situations, at an "initiation point" (that point being where the onset of windshear conditions is, or would have been recognized, depending on the test being run), 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 the presence of 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.

End QPS Requirements

---

5. Recording Parameters.

Begin QPS Requirements

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, N_1 , or throttle position).

(8) Wind magnitudes (simple windshear model assumed).

b. These recordings shall be initiated at least 10 seconds prior to the initiation point and continued until recovery is complete or ground contact is made.

End QPS Requirements

---

6. Equipment Installation and Operation.

Begin QPS Requirements

All windshear warning, caution, or guidance hardware installed in the simulator must operate as it operates in the airplane being simulated. For example: if the simulator encounters a rapidly changing wind speed and/or direction that would have resulted in a windshear warning in the airplane were the same conditions encountered, the simulator must respond equivalently, without instructor/evaluator intervention.

End QPS Requirements

---

7. Qualification Test Guide.

Begin QPS Requirements

a. All QTG material (performance demonstration recordings, etc.) will be forwarded to the NSPM.

b. The simulator will be scheduled for an evaluation in accordance with normal procedures. Use of recurrent 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. QTG's for new (or MQTG's for upgraded) simulators must contain or reference the information described in paragraphs 2, 3, 4, and 5 of this attachment.

End QPS Requirements

---

8. Subjective Evaluation.

Begin Information

The NSPM will fly the simulator in at least two of the available windshear scenarios to examine the function of the simulator and the simulated airplane and to evaluate subjectively the performance of the simulator as it encounters the programmed windshear conditions according to the following:

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 discretion of the NSPM.

End Information

---

9. Qualification Basis.

Begin Information

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.

End Information

---

10. Demonstration Repeatability.

Begin Information

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

Appendix B to Part 60—Qualification Performance Standards for Airplane Flight Training Devices

Begin Information

This appendix establishes the standards for Airplane Flight Training Device (FTD) evaluation and qualification at one of the established levels. The Flight Standards Service, National Simulator Program (NSP) staff, under the direction of the NSP Manager (NSPM), is responsible for the development, application, and interpretation of the standards contained within this appendix.

The procedures and criteria specified in this appendix will be used by the NSPM, or a person or persons assigned by the NSPM (e.g., FAA pilots and/or FAA aeronautical engineers, assigned to and trained under the direction of the NSP – referred to as NSP pilots or NSP engineers, other FAA personnel, etc.) when conducting airplane FTD evaluations.

End Information

Table of Contents

1. Introduction

Begin Information

a. This appendix contains background information as well as material that is either directive or informative in nature as described later in this section. Except for this Introduction section, the directive or the informative material is presented in sections that correspond with sections of part 60. This material provides additional requirements and/or provides information regarding that subject. Some sections will have neither additional regulatory or informational material. In these instances the corresponding section in the Table of Contents will show "(No Info)."

b. To assist the reader in determining what areas are directive or required and what areas are guiding or permissive –

(1) The text in this appendix is contained within one of two sections: regulatory requirements that are in addition to the requirements in part 60 but are found only in this appendix, referred to as "QPS Requirements;" and advisory or informative material, referred to as "Information."

(a) The FAA has chosen to place into special QPS Requirements sections those requirements that are more likely to change on a more regular basis for a variety of reasons, e.g., increased knowledge about human factors, analysis of incident/accident data, and/or changes in aircraft or simulation technology. Using this capability, the FAA will be able to use information resulting from these factors to expeditiously modify the regulatory requirements without compromising the timeliness of those changes and without violating the Administrative Procedure Act (APA). In accordance with the APA, the FAA intends to treat all such QPS Requirements changes as Notices of Proposed Rule Making (NPRM), will seek input and suggestions from a representative cross-section of the affected industry through an Aviation Rulemaking Committee, will seek public comment through announcement of any proposed change in the Federal Register, and will review changes before final action on them is complete. The FAA does not expect that many changes to these QPS Requirements will justify the expenditure of time and resources at the highest levels of the agency and will therefore streamline the process for making technical changes to these QPS Requirements by delegating authority for final review and issuance from the Administrator to the Director, Flight Standards Service.

(b) Similarly, the FAA has chosen to place into special Information sections additional material regarding the adjacent regulatory requirements such as acceptable examples of practices and either additional or clarifying information that may be useful to the public in identifying the intent of the FAA.

(2) The text presented between horizontal lines beginning with the heading "Begin QPS Requirements" and ending with the heading "End QPS Requirements," contains the regulatory requirements that are in addition to the requirements in the body of the part 60 language but found only in this appendix.

(3) The text presented between horizontal lines beginning with the heading "Begin Information" and ending with the heading "End Information," is advisory or informative.

(4) The tables in this appendix have rows across the top of each table –

(a) The data presented in columns under the heading "QPS REQUIREMENTS" is regulatory but is found only in this appendix.

(b) The data presented in columns under the heading "INFORMATION" is advisory or informative.

c. Questions regarding the contents of this publication should be sent to: U.S. Department of Transportation, Federal Aviation Administration, Flight Standards Service, National Simulator Program Staff, AFS-205, PO Box 20636, Atlanta, Georgia, 30320. Telephone contact numbers are: phone, 404-305-6100; fax, 404-305-6118. The National Simulator Program Internet Web Site address is: http://www.faa.gov/nsp. On this Web Site you will find an NSP personnel list with contact information, a list of qualified flight simulation devices, advisory circulars, a description of the qualification process, NSP policy, and an NSP "In-Works" section. Also linked from this site are additional information sources, handbook bulletins, frequently asked questions, a listing and text of the Federal Aviation Regulations, Flight Standards Inspector's handbooks, and other FAA links.

d. The NSPM encourages the use of electronic media for communication and the gathering, storage, presentation, or transmission of any record, report, request, test, or statement required by this appendix provided the media used has adequate provision for security and is acceptable to the NSPM. The NSPM recommends inquiries on system compatibility prior to any such activity. Minimum System requirements may be found on the NSP Website.

e. Related Reading References.(1) 14CFR part 60
(2) 14CFR part 61.
(3) 14CFR part 63.
(4) 14CFR part 121.
(5) 14CFR part 125
(6) 14CFR part 135.
(7) 14CFR part 141
(8) 14CFR part 142
(9) Advisory Circular (AC) 120-28C, Criteria for Approval of Category III Landing Weather Minima.
(10) AC 120-29, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.
(11) AC 120-35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.
(12) AC 120-41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.
(13) AC 120-57A, Surface Movement Guidance and Control System (SMGS).
(14) AC 150/5300-13, Airport Design.
(15) AC 150/5340-1G, Standards for Airport Markings.
(16) AC 150/5340-4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.
(17) AC 150/5340-19, Taxiway Centerline Lighting System.
(18) AC 150/5340-24, Runway and Taxiway Edge Lighting System.
(19) AC 150/5345-28D, Precision Approach Path Indicator (PAPI) Systems
(20) International Air Transport Association document, “Flight Simulator Design and Performance Data Requirements," as amended.
(21) AC 25-7, as amended, Flight Test Guide for Certification of Transport Category Airplanes.
(22) AC 23-8A, as amended, Flight Test Guide for Certification of Part 23 Airplanes.
(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 Publication FAA-S-8081 series (Practical Test Standards for Airline Transport Pilot Certificate, Type Ratings, Commercial Pilot, and Instrument Ratings).
(26) The FAA Aeronautical Information Manual (AIM), FAA Handbook XXXXX

f. Background.
(1) The primary objective of flight training continues to be one of providing a means for flightcrew members to acquire the skills and knowledge necessary to perform to a desired safe standard. By the same measure, flight simulation continues to provide the most effective, viable environment for the instruction, demonstration, and practice of the maneuvers and procedures (called training events) pertinent to a particular airplane and crew member position. The complexity, operating costs, and operating environment of modern airplanes, together with the steady technological advances in flight simulation, have continued to encourage, and, in fact, have demanded, the expanded use of flight simulation (both FTDs and simulators) in the training and checking of flightcrew members.
(2) The FAA has traditionally recognized the value of training devices and has awarded credit for their use in the completion of specific training and checking events in both general aviation and air carrier flight training programs and in pilot certification activities. Such credits are delineated in 14CFR Parts 61 and 121; and in other appropriate sources such as handbooks and guidance documents. These CFR sources,

however, have, in the past, referred only to a “training device” or to a "flight training device," with no further descriptive information. Other sources had referred to flight training devices in several categories such as Cockpit Procedures Trainers, Cockpit Systems Simulators, Fixed Base Simulators, and other descriptors. Prior to the advent of the predecessor to this document, these categories and names had no standard definition or design criteria within the industry and no single source guidance document had existed to categorize these devices, to provide qualification standards for each category, or to relate one category to another in terms of capability or technical complexity. As a result, approval of these devices for use in training programs had not always been equitable. This circumstance has changed. The recognizable and understood technical definitions and descriptions in previous documents has provided a foundation. Knowledge of the FAA-authorized uses of FTDs built on this foundation and has significantly influenced the flight training industry to increase the use of FTDs and has garnered support for multiplying that use in the future.

(3). For information purposes, the following is a chronological listing of the documents preceding part 60 that have addressed the qualification criteria for airplane flight training device (FTD) evaluation and qualification by the FAA, including the effective dates of those documents:

AC 120-45	05/11/87 to 02/05/92
AC 120-45A	02/05/92 to (date TBD)

End Information

2. Applicability (§§ 60.1 & 60.2)

There is no additional regulatory or informational material that 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.

4. Definitions (§ 60.3)

Begin Information

See Appendix E of this part for a list of definitions and abbreviations from part 1 and part 60. These definitions are regulatory. Additional definitions and abbreviations used in reading and understanding this appendix are presented within the QPS Requirements section. These definitions are also regulatory but are found only in this appendix.

End Information

4. Qualification Performance Standards (§ 60.4)

There is no additional regulatory or informational material that applies to § 60.4, Qualification Performance Standards.

5. Quality Management System (§ 60.5).

Begin Information

Additional regulatory material and informational material regarding Quality Management Systems for Flight Simulation Training Devices may be found in appendix E of this part.

End Information

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6. Sponsor Qualification Requirements. (§ 60.7).

Begin Information

a. The intent of the language used in § 60.7(b) is to have a specific FTD, identified by the sponsor, used by the sponsor at least once in the sponsor's 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. To assist in avoiding confusion regarding the requirements for use of a qualified FTD the following examples/descriptions are provided to describe acceptable operational practices:

(1) Example One.

a. A sponsor is sponsoring a single, specific FTD for their own use, in their 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:

(i) If the FTD was qualified prior to [insert the effective date of this rule] the 12-month period begins on the date of the first NSPM-conducted continuing qualification after [insert the effective date of this rule] and continues for each subsequent 12-month period;

(ii) If the FTD satisfactorily completes an initial or upgrade evaluation on or after [insert the effective date of this rule] the 12-month period begins on the date of that completed initial or upgrade evaluation and continues for each subsequent 12-month period.

b. There is no minimum number of hours or minimum FTD periods 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 their facility or elsewhere. Each such 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)] 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 in the same manner as in example one);

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)] at least once in each 12-month period in that certificate holder's FAA-approved flight training program for the airplane simulated (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 or minimum FTD periods required.

(3) Example Three.

a. A sponsor (in this example, a Part 142 certificate holder) in "New York" (having at least one FTD used at least once per year in the sponsor's FAA-approved flight training program) establishes a "satellite" training center in "Chicago" and/or a satellite center in "Moscow."

b. The satellite function means that the "Chicago" and/or "Moscow" center(s) 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, etc.).

c. All of the FTDs in the "Chicago" center and/or the "Moscow" center could be dry-leased (i.e., the certificate holder does not have and utilize FAA-approved flight training programs for the simulators in the "Chicago" and/or the "Moscow" center) because –

(i) Each FTD in the "Chicago" center and/or 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" center and/or each FTD in the "Moscow" center represent 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 intent of the language "as soon as practicable" used in §60.9(a) means without unnecessarily disrupting or delaying beyond a reasonable time the training, evaluation, or experience being conducted in the FSTD.

End Information

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8. FTD Use (§ 60.11).

There is no additional regulatory or informational material that applies to § 60.11, Simulator Use.

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9. FTD Objective Data Requirements (§ 60.13).

Begin QPS Requirements

a. The FTD sponsor must 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/or, if appropriate, with the person having supplied the aircraft data package for the FTD in order to facilitate the notification described in this paragraph. The sponsor must immediately notify the NSPM when 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/or 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 notification must also provide technical information about this data to the NSPM relative to the data's significance for training, evaluation, or flight experience activities in the FTD.

b. 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, that contains:
    (a) The required maneuvers and procedures.

(b) For each maneuver or procedure --
  (i) The procedures and control input the flight test pilot and/or engineer are to use.
  (ii) The atmospheric and environmental conditions.
  (iii) The initial flight conditions.
  (iv) The airplane configuration, including weight and center of gravity.
  (v) The data that is to be gathered.
  (vi) Any other appropriate factors.

(2) Appropriately qualified flight test personnel.
(3) An understanding of the accuracy of the data to be gathered.
(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.
(5) Calibration of data acquisition equipment and airplane performance instrumentation must be current and traceable to a recognized standard.

c. 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 of this appendix.
(4) with any necessary guidance information provided; and
(5) without alteration, adjustments, or bias; however the data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation.

d. 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.

End QPS Requirements

Begin Information

e. It is the intent of the NSPM 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 NSPM for approval, a descriptive document (a validation data roadmap) 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 rationale or explanations for cases where data or data parameters are missing, where engineering simulation data are used, where flight test methods require further explanations, etc. and provide a brief narrative describing the cause and effect of any deviation from data requirements. This document may be provided by the aircraft manufacturer.

f. There is no requirement for any flight test data supplier to submit a flight test plan/program prior to gathering flight test data. However, the NSP staff has experience that indicates at least some data gatherers, primarily those that do not have a satisfactory "history" of supplying such data, often provide data that is irrelevant, not properly marked, without adequate justification for selection, without adequate information regarding initial conditions, without adequate information regarding the test maneuver, etc. The NSP staff has been forced to not accept such data submissions as validation data for FTD evaluation. It is for this reason that the NSP staff 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 NSP staff well in advance of commencing the flight tests.

g. The NSPM will consider, on a case-by-case basis, whether or not 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 NSPM determines that special equipment or (a) specifically qualified person(s) will be required for the conduct of any evaluation, the NSPM 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, sound analyzer, etc. Examples of specially qualified personnel would be those specifically qualified to install or use any special equipment when its use is required.

b. Examples of a special evaluation would be an evaluation conducted after the move of an FTD; at the request of the TPAA; as a result of comments received from users of the FTD that, upon analysis and confirmation, might cause a question as to the continued qualification or use of the FTD; etc.

End Information

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11. Initial (and Upgrade) Qualification Requirements (§ 60.15).

Begin QPS Requirement

a. 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 NSPM 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 NSPM via traditional or electronic means.

(3) A qualification test guide (QTG), acceptable to the NSPM, that includes all of the following:

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

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

(iii) The result of FTD performance demonstrations prescribed in the appropriate QPS.

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

b. 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 of this appendix.

c. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, to the NSPM 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 automatically and manually conducted tests;
(3) A means of comparing the FTD's test results to the objective data;
(4) An explanation, or other information as necessary, to assist in the evaluation of the test results;
(5) Other information appropriate to the qualification level of the FTD.

d. 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 2, for a sample QTG cover page).
(2) A continuing qualification evaluation schedule requirements page – to be used by the NSPM to establish and record the frequency with which continuing qualification evaluations must be conducted and any subsequent changes that may be determined by the NSPM. See Attachment 4, Figure 4, for a sample Continuing Qualification Evaluation Schedule Requirements page.
(3) An FTD information page that provides the information listed in this paragraph (see Attachment 4, Figure 3, for a sample FTD information page). For convertible FTDs, a separate page is submitted 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 engine model(s) and its data revision number or reference.
(e) The flight control data revision number or reference.
(f) The flight management system identification and revision level.
(g) The FTD model and manufacturer.

(h) The date of FTD manufacture.
(i) The FTD computer identification.
(j) The visual system model and manufacturer, including display type.
(k) 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's) with certain requirements. SOC's must provide references to the sources of information for showing the capability of the FTD to comply with the requirement, a rationale explaining how the referenced material is used, mathematical equations and parameter values used, and the conclusions reached; i.e. that the FTD complies with the requirement. Refer to the "Additional Details" column in attachment 1, "FTD Standards," or in the "Test Details" column in attachment 2, "FTD Objective Tests," to see when SOC's are required.
(9) Recording procedures or equipment required to accomplish the objective tests.
(10) The following information for each objective test designated in attachment 2, 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 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) 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. Form and manner of presentation of objective test results in the QTG:
(1) The sponsor's FTD test results must be recorded in a manner, acceptable to the NSPM, that will allow easy comparison of the FTD test results to the validation data (e.g., use of a multi-channel recorder, line printer, cross plotting, overlays, transparencies, etc.).
(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 of this appendix.
(5) For 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. Over-plots must not obscure the reference data.

g. The sponsor may elect to complete the QTG objective tests at the manufacturer's facility. Tests performed at this location must be conducted after assembly of the FTD has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate FTD performance at the sponsor's training facility by repeating a representative sampling of all the objective tests in the QTG and submitting these repeated test results to the NSPM. This sample must consist of at least one-third of the QTG objective tests. The QTG must be clearly annotated to indicate when and where each test was accomplished.

h. While the subjective tests are normally accomplished at the sponsor's training facility, the sponsor may elect to complete the subjective tests at the manufacturer's facility. Tests performed at this location will be conducted after assembly of the FTD has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate FTD performance at the sponsor's training facility by having the pilot(s) who performed these tests originally (or similarly qualified pilot(s)), repeat a representative sampling of these subjective tests (need not take more than one normal FTD period – e.g., 4 hours) and submit a statement to the NSPM that the FTD has not changed from the original determination. This statement must clearly indicate when and where these repeated tests were completed.

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 [insert 6 years after effective date of this rule] 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 general FTD performance or demonstration results (reformatted or digitized) prescribed in this appendix, and a description of the equipment necessary to perform the evaluation for initial qualification and the continuing qualification evaluations for continuing qualification. This 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. An eMQTG must be provided to the NSPM.

k. All other FTDs (not covered in subparagraph "j") must have an electronic copy of the MQTG by and after [insert 6 years after effective date of this rule], a copy of which must be provided to the NSPM. This may be provided by an electronic scan presented in a Portable Document File (PDF), or similar format, acceptable to the NSPM.

End QPS Requirements

Begin Information

l. Only those FTDs that are sponsored by a certificate holder (as defined for use in part 60 and this QPS appendix) will be evaluated by the NSPM. 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.

m. 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 and performance demonstrations in attachment 1, the objective tests listed in attachment 2, and the subjective tests listed in attachment 3 of this appendix. The evaluation(s) described herein will include, but not necessarily be limited to the following, as appropriate, for the qualification level of the FTD:
(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 NSPM in the areas of ground operations, takeoff, climb, cruise, descent, approach, and landing as well as abnormal and emergency operations (see paragraph [check reference] and attachment 2 of this appendix);
(3) Control checks (see attachment 1 and attachment 2 of this appendix);
(4) Cockpit 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 complexity of the FTD 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.

n. The NSPM administers the objective and subjective tests, which includes an examination of functions. The tests include a qualitative assessment of the simulator by an NSP pilot. The NSP 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 simulator 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.

o. The tolerances for the test parameters listed in attachment 2 of this appendix are the maximum acceptable to the NSPM 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 NSPM 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.

p. In addition to the scheduled continuing qualification evaluation (see paragraph [check reference]), each FTD is subject to evaluations conducted by the NSPM at any time with no 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 flightcrew member 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.

q. Problems with objective test results are handled according to the following:
(1) If a problem with an objective test result is detected by the NSP evaluation team during an evaluation, the test may be repeated and/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 NSPM may qualify the FTD at that lower level. For example, if a Level 6 evaluation is requested and the FTD fails to meet the Level 6 Spiral Stability test tolerances but does meet the Level 5 tolerances, it could be qualified at Level 5.

r. After the NSPM issues a statement of qualification to the sponsor when an FTD is successfully evaluated, the FTD is recommended to the TPAA, who will exercise authority on behalf of the Administrator in approving the FTD in the appropriate airplane flight training program.

s. Under normal circumstances, the NSPM establishes a date for the initial or upgrade evaluation within 10 working days after determining that a complete QTG is acceptable. Unusual circumstances may warrant establishing an evaluation date before this determination is made; however, once a schedule is agreed to, any slippage of the evaluation date at the sponsor's request may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation. A sponsor may commit to an initial evaluation date under this early process, in coordination with and the agreement of the NSPM, but the request must be in writing and must include an acknowledgment of the potential schedule impact if the sponsor slips the evaluation from this early-committed date. See Attachment 4, figure 5, of the appendix, Sample Request for Initial Evaluation Date.

t. A convertible FTD is addressed as a separate FTD for each model and series airplane or set of airplanes to which it will be converted and for the FAA qualification level sought. An NSP evaluation is required for each configuration. For example, if a sponsor seeks qualification for two models of an airplane type using a convertible FTD, two QTG's, or a supplemented QTG, and two evaluations are required.

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, FTD Objective Tests.

v. If additional information is needed regarding the preferred qualifications of pilots used to meet the requirements of §60.15(e), the reader should contact the NSPM or visit the NSPM website.

w. Examples of the exclusions for which the FTD might not have been subjectively tested by the sponsor or the NSPM and for which qualification might not be sought or granted, as described in §60.15(h)(6), include windshear training, circling approaches, etc.

End Information

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12. Additional Qualifications for Currently Qualified FTD's (§ 60.16).

There is no additional regulatory or informational material that applies to § 60.16, Additional Qualifications for a Currently Qualified Simulator.

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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 prolonged periods, the following procedures will apply:
(1) The NSPM must be advised in writing and the advisement must include an estimate of the period that the FTD will be inactive;
(2) Continuing Qualification evaluations would not be scheduled during the inactive period;
(3) The NSPM will remove the FTD from the list of qualified FSTD’s 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 may be restored to qualified status, it will require an evaluation by the NSPM. The evaluation content and time required for accomplishment will be based on the number of continuing qualification evaluations and sponsor-conducted 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;

(5) The sponsor must notify the NSPM of any changes to the original scheduled time out of service;
(6) The FTD will normally be re-qualified 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 a review of the qualification basis and will likely result in the re-qualification to be against the standards in effect and current at the time of re-qualification.

End QPS Requirements

Begin Information

b. Other certificate holders or persons desiring to use an FTD may contract with FTD sponsors to use those FTDs already qualified at a particular level for an airplane type or set of airplanes 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 paragraph 12 of this appendix.

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

d. The intent of the requirement listed in § 60.17(b), for each FTD to have a Statement of Qualification 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.

e. Downgrading of a FTD is a permanent change in qualification level. If a temporary restriction is placed on a FTD because of a missing, malfunctioning, or inoperative component or some repair is in progress, the restriction is not a permanent change in qualification level and such a temporary restriction can, and is, removed when the reason for the restriction has been resolved. It would be inappropriate to permanently downgrade an FTD and, at some undetermined time in the future, allow that FTD to be returned to its original status (i.e., accomplish an "upgrade") using the original qualification standards.

End Information

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14. Inspection, Maintenance, and Recurrent Evaluation 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 will be developed by the sponsor and will be acceptable to the NSPM.

b. The description of what constitutes the functional preflight inspection will 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.

End QPS Requirements

Begin Information

d. In determining the acceptability of the sponsor's test sequence and the content of each quarterly inspection required in § 60.19(a)(1), the NSPM looks for a balance and a mix from the performance demonstrations and 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.

e. If the NSP evaluator plans to accomplish specific tests during a normal continuing qqualification 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. These tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests.

f. The continuing qualification evaluations described in § 60.19(b), normally will require 4 hours of FTD time. Flexibility is necessary to address those situations that are not normal or those that involve aircraft with additional levels of complexity (e.g. computer controlled aircraft) and may require additional time. The continuing qualification evaluations will consist of the following:

(1) Review of the results of the objective tests and all the designated FTD performance demonstrations (quarterly inspections) conducted by the sponsor since the last scheduled continuing qualification evaluation.

(2) At the discretion of the evaluator, a selection of approximately 8 to 15 objective tests from the MQTG, that will, in the opinion of the evaluator, provide an adequate opportunity to evaluate, first hand, the performance of the FTD. The tests chosen will be performed either automatically or manually, at the discretion of the evaluator 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, selected at the discretion of the evaluator. 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, to include, but not necessarily limited to, the motion system, visual system, sound system as applicable, the instructor operating station, and the normal functions and simulated malfunctions of the simulated airplane systems. This examination is normally accomplished simultaneously with the subjective evaluation requirements noted in subparagraph d(3).

g. The requirement established in § 60.19(b)(4) regarding the frequency of NSPM-conducted continuing qualification evaluations for each FTD is typically 12 months. However, the establishment and satisfactory operation of an approved quality management system for a sponsor will provide a basis for adjusting the interval between evaluations on some FTDs at a given sponsor's location to exceed this 12-month interval.

End Information

15.Logging FTD Discrepancies (§ 60.20).

There is no additional regulatory or informational material that applies to § 60.20. Logging Simulator Discrepancies.

16. [Reserved].

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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:

(i) All the applicable objective tests that have been run with the modification incorporated, including any necessary updates to the MQTG must be acceptable to the NSPM; and

(ii) The sponsor must provide the NSPM with a statement signed by the MR that the factors cited in § 60.15(b) are addressed by the appropriate personnel as described in that section.

End QPS Requirements

Begin Information

c. See Attachment 4 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. Once the sponsor fairly and accurately advises the user of an FTD's current status, including any missing, malfunctioning, or inoperative (MMI) component(s), the sponsor's responsibility with respect to § 60.25(a) will have been satisfied.

b. 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 intent of the FAA is to automatically extend the deadline until the next business day.

c. In accordance with the authorization described in § 60.25(b)**,** the NSPM may find as acceptable a discrepancy prioritizing system wherein the length of time authorized to repair or replace any given MMI component is based on the level of impact on the capability of the FTD to provide the required training, evaluation, or flight experience, with the larger impact on this capability associated with 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 is to 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, etc.) there is a greater likelihood of being able to determine the amount of testing that would be required for re-qualification.

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 is to 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, etc.) there is a greater likelihood of being able to determine the amount of testing that would be required for re-qualification.

End Information

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21. Recordkeeping and Reporting (§ 60.31).

Begin QPS Requirements

a. The minimally acceptable record of programming changes, as described in § 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 illegal or 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).

There are no additional QPS requirements or informational material that apply to § 60.33, Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements.

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23. (Reserved).

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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 device that may have an open, airplane-specific, flight deck area, or an enclosed, airplane-specific cockpit; at least one operating system; and possessing at least air/ground logic (no aerodynamic programming required).

(2) Level 5. A device that may have an open, airplane-specific, flight deck area, or an enclosed, airplane-specific cockpit, with a generic aerodynamic program; at least one operating system; and control loading that as a minimum is representative of the simulated airplane only at an approach speed.

(3) Level 6. A device that has an enclosed, airplane-specific cockpit and aerodynamic program; all airplane systems operating; control loading that is representative of the simulated airplane throughout it's ground and flight envelope; and significant sound representation.

b. Non-visual simulators have been placed into Level 6 for reference purposes. The placement of these unique simulators into this level has not affected the standards or criteria of Level 6 FTDs, nor will these FTDs affect the standards or criteria of these simulators.

End Information

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25. [Reserved]

Attachment 1 to Appendix B to Part 60--

General FTD REQUIREMENTS

Begin QPS Requirements

1. Requirements

Certain FTD requirements included in this appendix must be supported with a Statement of Compliance and Capability (SOC) and/or, in some designated cases, an Objective Test. The SOC will describe how the requirement was met. The test results must show that the requirement has been attained. Other requirements are satisfied by either an Objective Test or a Subjective Test. In the following tabular listing, requirements for SOCs and tests are indicated in the "Additional Details" column.

End QPS Requirements

Begin Information

2. Discussion

a.This attachment describes the minimum general requirements for qualifying Level 2 through Level 6 flight training devices (information regarding Level 1 FTDs is found in paragraph 24 in the body of this QPS). To determine the complete requirements for a specific level FTD, the objective tests in attachment 2 and the subjective tests listed in attachment 3 for this QPS must also be consulted.

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

(1) General Cockpit Configuration.

(2) Programming.

(3) Equipment Operation.

(4) Instructor or Evaluator Facilities.

(5) Motion System.

(6) Visual System

(7) Sound System

End Information

TABLE OF MINIMUM FTD REQUIREMENTS

QPS REQUIREMENTS					INFORMATION
General FTD Requirements	FTD Level			Additional Details	
	4	5	6		
1. General Cockpit Configuration.					
a. The FTD must have a cockpit that is a full-scale replica of the airplane, or set of airplanes, simulated with controls, equipment, observable cockpit indicators, circuit breakers, and bulkheads properly located, functionally accurate and replicating the airplane or set of airplanes. The direction of movement of controls and switches must be identical to that in the airplane or set of airplanes.			**X**	Level 3 must be representative of a single set of airplanes, and must have navigation controls, displays, and instrumentation as set out in 14CFR Part 91, §91.33 for operation in accordance with instrument flight rules (IFR). Crewmember seats must afford the capability for the occupant to be able to achieve the design “eye position” for specific airplanes, or to approximate such a position for a generic set of airplanes.	For FTD purposes, the cockpit 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 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 or extinguishers, spare light bulbs, aircraft documents pouches etc., are not considered essential and may be omitted.
b. The FTD must have equipment (i.e., instruments, panels, systems, 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 cockpit or an open flight deck area. Actuation of this equipment must replicate the appropriate function in the airplane.	**X**	**X**		Level 2 must be representative of a single set of airplanes.	
c. Circuit breakers must function accurately when they are involved in operating procedures or malfunctions requiring or involving flight crew response.		**X**	**X**	Level 6 devices must have installed circuit breakers properly located in the FTD cockpit.	
2. Programming.					
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 airplane attitude, thrust, drag, altitude, temperature, and configuration.		**X**	**X**	Levels 3 and 6 additionally require the effects of change in gross weight and center of gravity. Levels 2, 3, and 5 require only generic aerodynamic programming.	

TABLE OF MINIMUM FTD REQUIREMENTS

QPS REQUIREMENTS						INFORMATION
General FTD Requirements	FTD Level			Additional Details		
	4	5	6			
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.	X	X	X			
c. The FTD hardware and programming must be updated within 6 months of any airplane modifications or data releases (or any such modification or data releases applicable to the set of airplanes) unless, with prior coordination, the NSPM authorizes otherwise.	X	X	X			
d. Relative responses of the cockpit instruments (and the visual and motion systems, if installed and training, testing, or checking credits are being sought) must be coupled closely to provide integrated sensory cues. The instruments (and the visual and motion systems, if installed, and training, testing, or checking credits are being sought) must respond to abrupt input at the pilot's position within the allotted time, but not before the time, when the airplane or set of airplanes would respond under the same conditions. If a visual system is installed and training, testing, or checking credits are sought, the visual scene changes from steady state disturbance must occur within the appropriate system dynamic response limit but not before the instrument response (and not before the motion system onset if a motion system is installed). (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 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, above, 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	A demonstration is required and must simultaneously record: the output from the pilot's controller(s); and the output signal to the pilot's attitude indicator. These recordings must be compared to airplane response data in the following configurations: takeoff, cruise, and approach or landing. The results must be recorded in the QTG. Additionally, if a visual system is installed and training, testing, or checking credits are sought, the output signal to the visual system display (including visual system analog delays must be recorded); and if a motion system is installed and training, testing, or checking credits are sought, the output from an accelerometer attached to the motion system platform located at an acceptable location near the pilots' seats is also required.		Latency: The intent is to verify that the FTD provides instrument, and if applicable, 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. FTD Latency is measured from the start of a control input to the appropriate perceivable change in flight instrument indication; visual system response; or motion system response (this does not include airplane response time as per the manufacturer's data). Transport Delay: The transport delay is the time between the control input and the individual hardware (i.e., instruments, motion system, visual system) responses. If Transport Delay is the chosen method to demonstrate relative responses, it is expected that, when reviewing those existing tests where latency

TABLE OF MINIMUM FTD REQUIREMENTS					
QPS REQUIREMENTS					INFORMATION
General FTD Requirements	FTD Level			Additional Details	
	4	5	6		
					can be identified (e.g., short period, roll response, rudder response, etc.) the sponsor and the NSPM will apply additional scrutiny to ensure proper FTD response.
3. Equipment Operation.					
a. All relevant instrument indications involved in the simulation of the airplane (or set of airplanes) must automatically respond to control movement or external disturbances to the simulated airplane or set of airplanes; e.g., turbulence or winds.		X	X		
b. Navigation equipment must be installed and operate within the tolerances applicable for the airplane or set of airplanes.		X	X	Level 5 need have only that navigation equipment necessary to fly an instrument approach. Levels 6 must also include communication equipment (inter-phone and air/ground) like that in the airplane, or set of airplanes, and, if appropriate to the operation being conducted, an oxygen mask microphone system.	
c. Installed systems must simulate the applicable airplane (or set of airplanes) system operation, both on the ground and in flight. At least one airplane 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.	X	X	X	Level 6 must simulate all applicable airplane flight, navigation, and systems operation. Level 5 must have functional flight and navigational controls, displays, and instrumentation.	
d. The lighting environment for panels and instruments must be sufficient for the operation being conducted.	X	X	X		
e. The FTD must provide control forces and control travel that correspond to the replicated airplane, or set of airplanes. Control forces must react in the same manner as in the airplane, or set of airplanes, under the same flight conditions.			X		

TABLE OF MINIMUM FTD REQUIREMENTS

QPS REQUIREMENTS					INFORMATION
General FTD Requirements	**FTD Level**			**Additional Details**	
	4	**5**	**6**		
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 airplane, or set of airplanes, under the same flight conditions.		**X**			
4. Instructor or Evaluator Facilities.					
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**		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.
b. The FTD must have instructor controls that permit activation of normal, abnormal, and emergency conditions, as may be 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**		
5. Motion System.					
a. The FTD may have a motion system; if desired, although it is not required.	**X**	**X**	**X**	If installed, the motion system operation may not be distracting. The motion system standards set out in part 60, Appendix A for at least Level A simulators is acceptable.	
6. Visual System.					
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: (1) Single channel, uncollimated display is acceptable. (2) Minimum field of view: 18° vertical / 24° horizontal for the pilot flying. (3) Maximum paralax error: 10° per pilot. (4) Scene content may not be distracting. (5) 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. (6) Minimum resolution of 5 arc-min. for both computed and displayed pixel size.	**X**	**X**	**X**	A statement of capability is required. A demonstration of latency or through-put is required. Visual system standards set out in part 60, Appendix A, for at least Level A simulators is acceptable. However, if additional authorizations (training, testing, or checking credits) are sought that require the use of a visual system, these standards apply.	.

TABLE OF MINIMUM FTD REQUIREMENTS

QPS REQUIREMENTS						INFORMATION
General FTD Requirements	**FTD Level**			**Additional Details**		
	4	**5**	**6**			
(7) Maximum latency or through-put must not exceed 300 milliseconds.						
7. Sound System.						
a. The FTD must simulate significant cockpit sounds resulting from pilot actions that correspond to those heard in the airplane.			**X**			

Attachment 2 to Appendix B to Part 60--
FLIGHT TRAINING DEVICE (FTD) OBJECTIVE EVALUATION

1. General

Begin QPS Requirements

a. Test Requirements.

(1) The ground and flight tests required for qualification are listed in the following Table of Objective Tests. Computer generated FTD test results must be provided for each test except where specifically authorized an alternate means by the NSPM. If a flight condition or operating condition is required for the test but which does not apply to the airplane being simulated or to the qualification level sought, it may be disregarded (for example: an engine out missed approach for a single-engine airplane; a maneuver using reverse thrust for an airplane without reverse thrust capability; etc.). Each test result is compared against the validation data described in §60.13, and Paragraph 9 in the main body of this appendix. (See paragraph 1.b. of this attachment for additional information.) Although use of a driver program designed to automatically accomplish the tests is encouraged, 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 NSPM 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 the Table of Objective Tests. All results must be labeled using the tolerances and units given.

(2) The Table of Objective Tests 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/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.

(3) Certain tests included in this attachment must be supported with a Statement of Compliance and Capability (SOC). In the following tabular listing of FTD tests, requirements for SOC's are indicated in the “Test Details” column.

(4) 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 airplane data throughout a time history, differences must be justified by providing a comparison of other related variables for the condition being assessed.

(5) It is not sufficient, nor is it acceptable, to program the FTD so that the mathematical modeling is correct only at the validation test points. Unless noted otherwise, tests must represent airplane performance and handling qualities at normal operating weights and centers of gravity (CG). 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 Levels 3 and 6 are expected to be indicative of the device's performance and handling qualities throughout the following:

- (a) the airplane weight and CG envelope;
- (b) the operational envelope; and
- (c) varying atmospheric ambient and environmental conditions – including the extremes authorized for the respective airplane or set of airplanes.

(6) 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 ±5 pounds (2.2 daN) in 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 clearly annotated as to indicated, calibrated, etc., and like values used for comparison.

(7) The QTG provided by the sponsor must describe clearly and distinctly how the FTD will be set up and operated for each test. Overall integrated testing of the FTD must be accomplished to assure that the total FTD system meets the prescribed standards; i.e., it is not acceptable to test only each FTD subsystem independently. A manual test procedure with explicit and detailed steps for completion of each test must also be provided.

(8) 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 from at least 5 seconds prior to, through at least 2 seconds after, the instant of time captured by the “snapshot.”

(9) For previously qualified FTDs, the tests and tolerances of this appendix may be used in subsequent continuing qualification evaluations for any given test providing the sponsor has submitted a proposed MQTG revision to the NSPM and has received NSPM approval.

(10) 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. Where thrust is more than 5% greater or more than 15% less than that of the flight test engine, flight test data from an airplane equipped with the alternative engine is required. However, if the validation data supplier shows that a thrust increase greater than 5% will not significantly change the airplane’s flight characteristics, then flight validation data are not needed. Where the airplane data supplier certifies that the only impact on the FTD model is thrust, and that other variables related to the alternative engine (such as drag and thrust vector) are unchanged or are insignificantly changed, additional FTD tests may be run with the same initial conditions using the thrust from the flight test data as a driven parameter for the alternative engine model.

(11) 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 NSPM on a case-by-case basis.

End QPS Requirements

b. Discussion.

Begin Information

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

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS

TEST	TOLERANCE	FLIGHT CONDITIONS	Flight Training Device LEVEL			TEST DETAILS		Information
			4	5	6			
2. Performance								
a. Takeoff								
(1) Ground Acceleration Time.	±5% Time or ±1 Second	Takeoff			X	Record acceleration time for a minimum of 80% of the total segment from brake release to V_r. Preliminary aircraft certification data may be used.		
b. Climb								
(1) Normal Climb	±3 Kts Airspeed, ±5% or ±100 FPM (0.5 Meters/Sec) Climb Rate	All Engines Operating		X	X	Record results at nominal climb speed and at nominal altitude. Manufacturer's gross climb gradient may be used for flight test data. May be a snapshot test result.		
c. Ground Deceleration								
(1) Deceleration time, using manual application of wheel Brakes; no reverse thrust	±5% time or ±1 Second	Rejected Takeoff Dry Runway			X	Record time for at least 80% of the segment from initiation of the Rejected Takeoff to full stop.		
(2) Deceleration time, using reverse thrust and no wheel brakes.	±5% Time, or ±1 Second	Rejected Takeoff Dry Runway			X	Record time for at least 80% of the segment from initiation of Rejected Takeoff to full stop.		
d. Engines								
(1) Acceleration	±10% Time	Approach or Landing		X	X	Record engine power (N_1, N_2, EPR, Torque, etc.) from idle to go-around power for a rapid (slam) throttle movement. Tolerance of ±1 second authorized for Levels 2, 3, and 5.		

TEST	TOLERANCE	FLIGHT CONDITIONS	Flight Training Device LEVEL			TEST DETAILS		Information
			4	5	6			
(2) Deceleration	±10% Time	Ground/Takeoff		**X**	**X**	Record engine power (N_1, N_2, EPR, Torque, etc.) from Max T/O power to 90% decay of Max T/O power for a rapid (slam) throttle movement. Tolerance of ±1 second authorized for Levels 2, 3, and 5.		
3. Handling Qualities								

Note: For FTDs requiring Static or Dynamic tests at the controls, 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, that show satisfactory agreement. Repeat of the alternative method during the initial or upgrade evaluation would then satisfy this test requirement. Contact the NSPM for clarification of any issue regarding airplanes with reversible controls.

a. Static Control Checks								
(1)(a) Column Position vs. Force and Surface Position Calibration	±2 lbs. (0.9daN) Breakout, ±5 lbs. (2.2 daN) or ±10% Force, ±2° Elevator	Ground			**X**	Record results for an uninterrupted control sweep to the stops. (**CCA:** Position vs. force not required if cockpit controller is installed in the FTD.)		
(1)(b) Column Position vs. Force	±2 lbs. (0.9daN) Breakout, ±5 lbs. (2.2 daN) or ±10% Force	Ground		**X**		Record results for an uninterrupted control sweep to the stops. (**CCA:** Position vs. force not required if cockpit controller is installed in the FTD.)		

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS

TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**Flight Training Device LEVEL**			**TEST DETAILS**		**Information**
			4	**5**	**6**			
(2)(a) Wheel Position vs. Force and Surface Position Calibration	±2 lbs. (0.9daN) Breakout, ±3 lbs. (1.34 daN) or ±10% Force, ±1° Aileron, ±2° Spoiler	Ground			**X**	Record results for an uninterrupted control sweep to the stops. (**CCA:** Position vs. force not required if cockpit controller is installed in the FTD.)		
(2)(b) Wheel Position vs. Force	±2 lbs. (0.9daN) Breakout, ±3 lbs. (1.3 daN) or ±10% Force	Ground		**X**		Record results for an uninterrupted control sweep to the stops. (**CCA:** Position vs. force not required if cockpit controller is installed in the FTD.)		
(3)(a) Pedal Position vs. Force and Surface Position Calibration.	±5 lbs. (2.2 daN) Breakout; ±5 lbs. (2.2 daN) or ±10% Force, ±2° Rudder	Ground			**X**	Record results for an uninterrupted control sweep to the stops.		
(3)(b) Pedal Position vs. Force	±5 lbs. (2.2 daN) Breakout; ±5 lbs. (2.2 daN) or ±10% Force	Ground		**X**		Record results for an uninterrupted control sweep to the stops.		
(4) Nosewheel Steering Force	±2 lbs. (0.9 daN) Breakout; ±3 lbs. (1.3 daN) or ±10% Force	Ground			**X**			
(5) Rudder Pedal Steering Calibration	±2° Nosewheel Angle	Ground			**X**			
(6) Pitch Trim Calibration, Indicator vs. Computed.	±0.5° of Computed Trim Angle	Ground			**X**			

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS

TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**Flight Training Device LEVEL**			**TEST DETAILS**		**Information**
			4	**5**	**6**			
(7) Alignment of Power Lever (or Cross Shaft Angle) vs. Selected Engine Parameter (e.g., EPR, N1, Torque, Manifold Pressure, etc.)	±5° of Power Lever Angle or Cross Shaft Angle or Equivalent	Ground			**X**	Requires recording for all engines. No simulator throttle position may be more than 5° (in either direction) from the airplane throttle position. Also, no simulator throttle position may differ from any other simulator throttle position by more than 5°. Where power levers do not have angular travel, a tolerance of ± 0.8 in (2 cm) applies. In the case of propeller powered airplanes, if a propeller lever is present, it must also be checked. May be a series of snapshot test results.		
(8) Brake Pedal Position vs. Force	±2° Pedal Position, ±5 lbs. (2.2 daN) or 10% Force	Ground			**X**	Two data points are required (zero and maximum deflection). Computer output results may be used to show compliance.		
b. Longitudinal								
(1) Power Change Force	±5 lbs. (2.2 daN) or ±20% Force	Cruise or Approach		**X**	**X**	May be a series of snapshot test results. Power change dynamics will be accepted. (**CCA:** Test in Normal and Non-normal control state.)		
(2) Flap/slat Change Force	±5 lbs. (2.2 daN) or ±20% Force	Takeoff and Approach		**X**	**X**	May be a series of snapshot test results. Flap change dynamics will be accepted. **CCA:** Test in Normal and Non-normal control state.		

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS

TEST	TOLERANCE	FLIGHT CONDITIONS	Flight Training Device LEVEL			TEST DETAILS		Information
			4	**5**	**6**			
(3) Gear Change Force	±5 lbs. (2.2 daN) or ±20% Force	Takeoff and Approach		**X**	**X**	May be a series of snapshot test results. Gear change dynamics will be accepted. (**CCA:** Test in Normal and Non-normal control state.)		
(4) Gear and Flap Operating Times	±3 Seconds or ±10% of Time	Takeoff and Approach		**X**	**X**			
(5) Longitudinal Trim	±1° Pitch Control (Stab and Elevator); ±1° Pitch Angle, ±2% Net Thrust or	Cruise, Approach, Landing		**X**	**X**	May be a series of snapshot test results. Levels 2,3, and 5 may use equivalent stick and trim controllers in lieu of stabilizer and elevator. (**CCA:** Test in Normal and Non-normal control state.)		
(6) Longitudinal Maneuvering Stability (Stick Force/g)	±5 lbs. (2.2 daN) or ±10% Column Force or Equivalent Surface position.	Cruise, Approach, Landing			**X**	May be a series of snapshot test results. Force or surface deflection must be in the correct direction. (**CCA:** Test in Normal and Non-normal control state.)		
(7) Longitudinal Static Stability	±5 lbs. (2.2 daN) or ±10% Column Force or Equivalent Surface position.	Approach		**X**	**X**	May be a series of snapshot test results. Level 5 must exhibit positive static stability, but need not comply with the numerical tolerance. (**CCA:** Test in Normal and Non-normal control state.)		
(8) Stall Warning (actuation of stall warning device)	±3 Kts Airspeed, ±2° Bank	Second Segment Climb and Approach or Landing		**X**	**X**			

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS

TEST	TOLERANCE	FLIGHT CONDITIONS	Flight Training Device LEVEL			TEST DETAILS		Information
			4	5	6			
(9)(a) Phugoid Dynamics	±10% of Period, ±10% of Time to 1/2 Amplitude or ±.02 of Damping Ratio	Cruise			X	Results must include whichever is less of the following: Three (3) full cycles (6 overshoots after the input is completed), or the number of cycles sufficient to determine time to ½ or double amplitude. (**CCA:** Test in Normal and Non-normal control state.)		
(9)(b) Phugoid Dynamics	±10% of Period with Representative Damping	Cruise		X		(**CCA:** Test in Normal and Non-normal control state.)		
(10) Short Period Dynamics	±1.5° Pitch or ± 2°/sec Pitch Rate, ± 0.10g Normal Acceleration.	Cruise			X	(**CCA:** Test in Normal and Non-normal control state.)		
c. Lateral Directional								
(1) Roll Response	±10% or ± 2°/sec Roll Rate	1) Cruise and 2) Approach or Landing		X	X			
(2) Response to Roll Controller Step Input	±10% or ± 2°/sec Roll Rate	Approach or Landing			X	(**CCA:** Test in Normal and Non-normal control state.)		
(3)(a) Spiral Stability	Correct Trend	Cruise		X		(**CCA:** Test in Normal and Non-normal control state.)		
(3)(b) Spiral Stability	Correct Trend, and ±3° of Bank Angle or ±10% at 30 sec.	Cruise			X	Data averaged from multiple tests in same direction may be used. (**CCA:** Test in Normal and Non-normal control state.)		
(4)(a) Rudder Response	±2°/sec, or ±10% Yaw Rate or ±10% Rate of Heading Change for small pitch attitudes.	Approach or Landing			X	(**CCA:** Test in Normal and Non-normal control state.) May be deleted if rudder input and response is shown in Dutch roll test.		

TABLE OF OBJECTIVE TESTS

QPS REQUIREMENTS

TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**Flight Training Device LEVEL**			**TEST DETAILS**		**Information**
			4	**5**	**6**			
(4)(b) Rudder Response	Yaw Rate ±2°/sec, Bank Angle ±3°	Approach or Landing		**X**		May be roll response to a given rudder deflection. (**CCA:** Test in Normal and Non-normal control state.)		
(5)(a) Dutch Roll, Yaw Damper Off.	1) ±10% of Period and 2a) ±10% of Time to 1/2 Amplitude or Double Amplitude, or 2b) ±.02 of Damping Ratio	1) Cruise and 2) Approach or Landing			**X**	Record results for at least 6 cycles with stability augmentation off. (**CCA:** Test in Normal and Non-normal control state.)		
(5)(b) Dutch Roll, Yaw Damper Off.	±10% of Period With Correct Trend and Number of Cycles	1) Cruise and 2) Approach or Landing				(**CCA:** Test in Normal and Non-normal control state.)		
(6) Steady State Sideslip.	For given rudder position; ±2° Bank, ±1° Sideslip, ±10% or ±2° Aileron, ±10% or ±5° Spoiler or Equivalent Wheel Position or Force	Approach or Landing		**X**	**X**	May be a series of snapshot test results. Propeller driven airplanes must test in each direction.		

4. Alternative Objective Data for FTD Level 5.

Begin QPS Requirements

a. This paragraph 5 (including the following tables) is relevant only to FTD Level 5 and is provided due to the fact that this level is required to perform and handle similarly to a set of airplanes having similar performance (normal airspeed/altitude operating envelope), that have similar handling characteristics, and have the same number and type of propulsion systems (engines).

b. The following tables reflect the performance range typical for the stated set of airplanes and may be used without having to acquire flight test data or gather validation data from any other source. However, if the performance of the device does not fall within the established range (according to the following tables) for a specific table entry, and the sponsor has airplane flight test data, acceptable to the NSPM, that matches the performance of the device within the tolerances established in the Table of Objective Tests, this flight test data may be used for that specific table entry requirement. fg

c. The following applies to those wishing to pursue this alternative approach:

(1) The sponsor will submit a complete QTG including the following:

(a) If this alternate source of data method is used, recordings that demonstrate that the performance of the FTD is within the allowable performance range.

(b) Results from the objective tests appropriate to the level of qualification sought.

(2) The QTG test results must include all appropriate parameters for which tolerances are established in the Table of Objective Tests, and 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 would have an impact on the conduct of the test.

(3) One reviewed and accepted by the NSPM, these test results are the validation data against which the initial and all subsequent recurrent evaluations will be compared. These subsequent evaluations will use the tolerances listed in the Table of Objective Tests.

(4) Subjective testing of the device must be performed to determine that the device performs and handles acceptably like an airplane within the appropriate set of airplanes.

End QPS Requirements

Begin Information

d. The alternative source data contained in the following tables have been derived from a consensus of aviation professionals, including simulator and flight training device manufacturers; pilots and instructors familiar with the various sets of airplanes, and airplane manufacturer’s representatives for airplanes fitting the appropriate set of airplanes.

e. The reader is encouraged to consult the Airplane Flight Simulator Evaluation Handbook, Volumes I and II, published by the Royal Aeronautical Society, London, UK, in February 1995 and July 1996, respectively, and FAA Advisory Circulars (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, for references and examples regarding flight testing requirements and techniques.

End Information

Table of Alternative Source Data FTD Level 5. Small, Single Engine (Reciprocating) Airplane	
QPS REQUIREMENT	
Applicable Test and Test Number	**Authorized Performance Range**
2. Performance	
a. Takeoff.	
(1) Ground acceleration time; brake release to liftoff Speed.	20 - 30 Seconds.
b. Climb.	
(1) Normal climb with nominal gross weight, at best rate-of-climb airspeed.	Climb rate = 500 - 1200 fpm (2.5 - 6 m/sec).
c. Ground Deceleration.	
(1) Deceleration time from 60 knots to zero; with a nominal gross weight; using wheel brakes on a dry runway.	5 - 15 Seconds.
d. Engines.	
(1) Acceleration; idle to takeoff power.	2 - 4 Seconds.
(2) Deceleration; takeoff power to idle.	2 - 4 Seconds.
3. Handling Qualities. **a.** Static Control Checks.	
(1)(b) Column position vs. force.	Plot of Column Position vs. Force must fall within the shaded areas shown in Figure 3 of this attachment (Small, Single Engine Airplanes).
(2)(b) Wheel position vs. force.	Plot of Wheel Position vs. Force must fall within the shaded areas shown in Figure 3a of this attachment (Small, Single Engine Airplanes).
(3)(b) Pedal position vs. force.	Plot of Rudder Pedal Position vs. Force must fall within the shaded areas shown in Figure 3b of this attachment (Small, Single Engine Airplanes).
(4) Nosewheel steering force.	Plot of Rudder Pedal Position vs. Force must fall within the shaded areas shown in Figure 3b of this attachment (Small, Single Engine Airplanes).
(5) Rudder pedal steering calibration with full rudder pedal travel.	10 - 30 degrees of nosewheel angle, both sides of neutral.
(8) Brake pedal position vs. force; at maximum pedal deflection.	30 - 100 lbs (13.2 - 44 daN) of force.
b. Longitudinal.	
(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. OR (b) Trim for straight and level flight at 80% 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.	(a) 5 - 15 lbs (2.2 - 6.6 daN) of force (Pull). (b) 5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
(2) Flap/slat change force.	

Table of Alternative Source Data FTD Level 5. Small, Single Engine (Reciprocating) Airplane

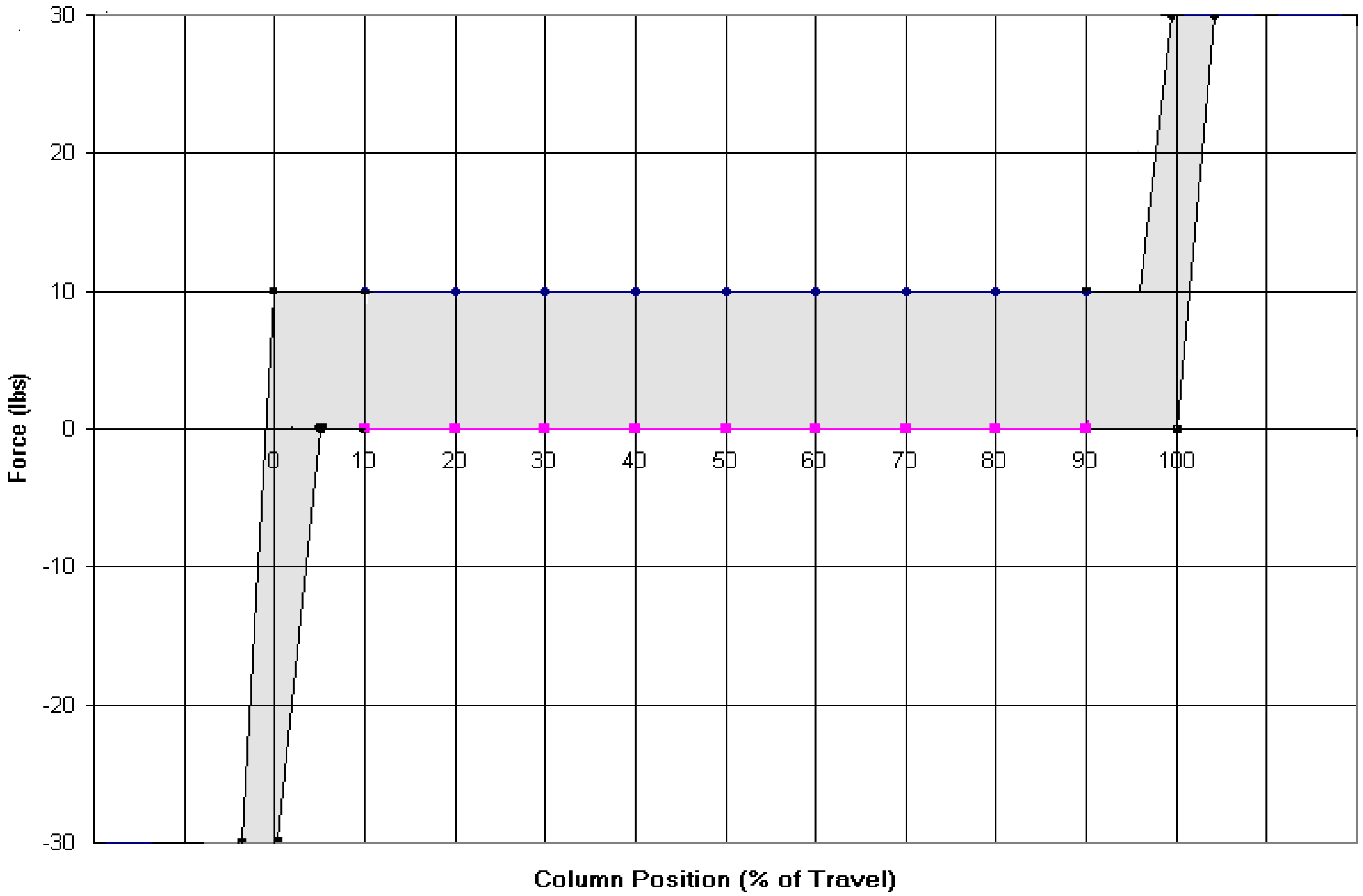
QPS REQUIREMENT

Applicable Test and Test Number	**Authorized Performance Range**
(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% of full flap travel. After stabilized, record stick force necessary to maintain original airspeed. 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.	(a) 5 - 15 lbs (2.2 - 6.6 daN) of force (Pull). (b) 5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
(3) 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. 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.	(a) 2 - 12 lbs (0.88 - 5.3 daN) of force (Pull). (b) 2 - 12 lbs (0.88 - 5.3 daN) of force (Push).
(4) Gear and flap operating times. (a) Extend gear. (b) Retract gear. (c) Extend flaps, zero to 50% travel. (d) Retract flaps, 50% travel to zero.	(a) 2 - 12 seconds. (b) 2 - 12 seconds. (c) 3 - 13 seconds. (d) 3 - 13 seconds
(5) Longitudinal trim.	Must be able to trim longitudinal stick force to “zero” in each of the following configurations: cruise; approach; and landing.
(7) Longitudinal static stability.	Must exhibit positive static stability.
(8) Stall warning (actuation of stall warning device) with nominal gross weight; wings level; and a deceleration rate of approximately one (1) knot per second. (a) Landing configuration: (b) Clean configuration:	(a) 40 - 60 knots; ± 5° of bank. (b) Landing configuration speed + 10 - 20 percent.

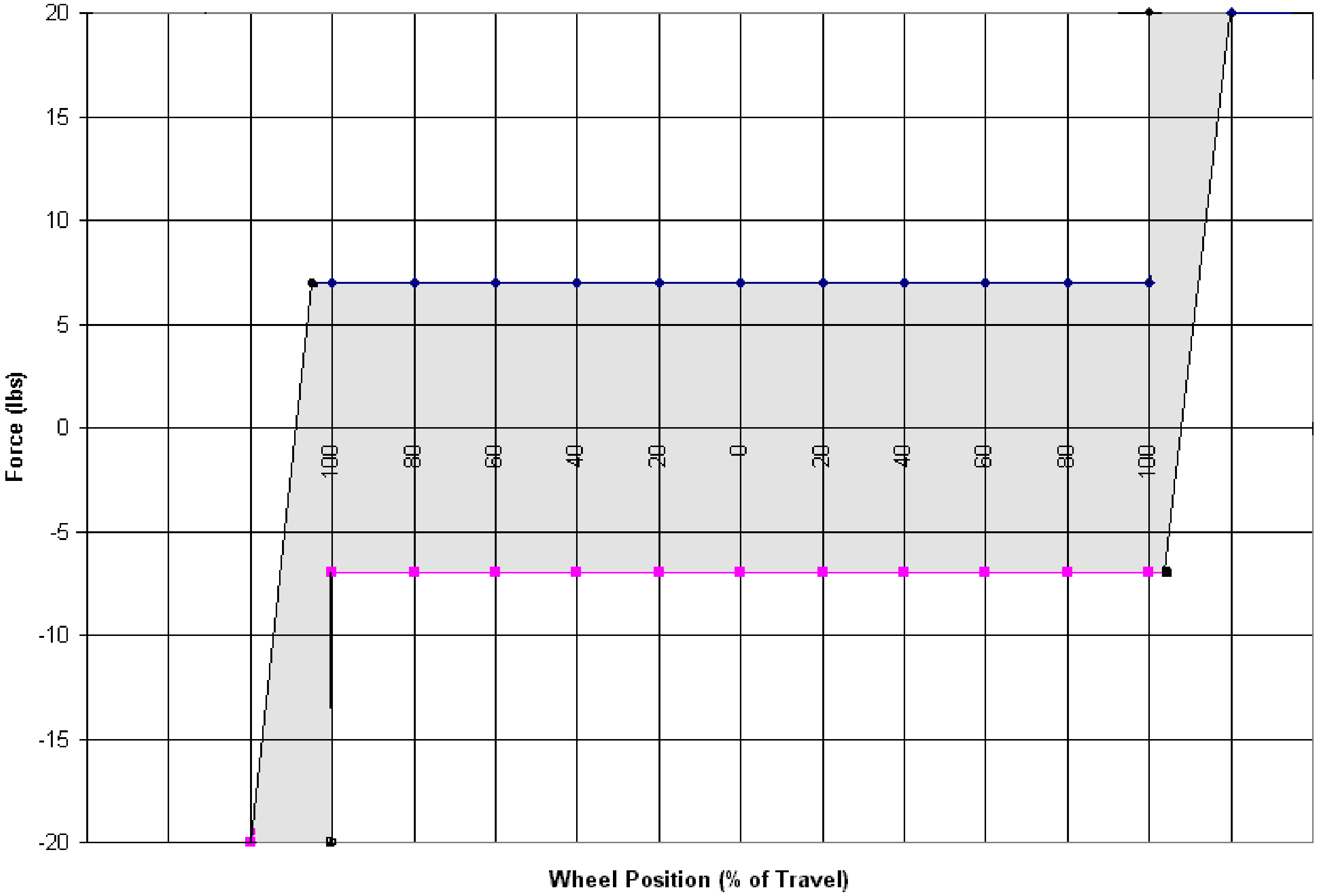
Table of Alternative Source Data FTD Level 5. Small, Single Engine (Reciprocating) Airplane

QPS REQUIREMENT

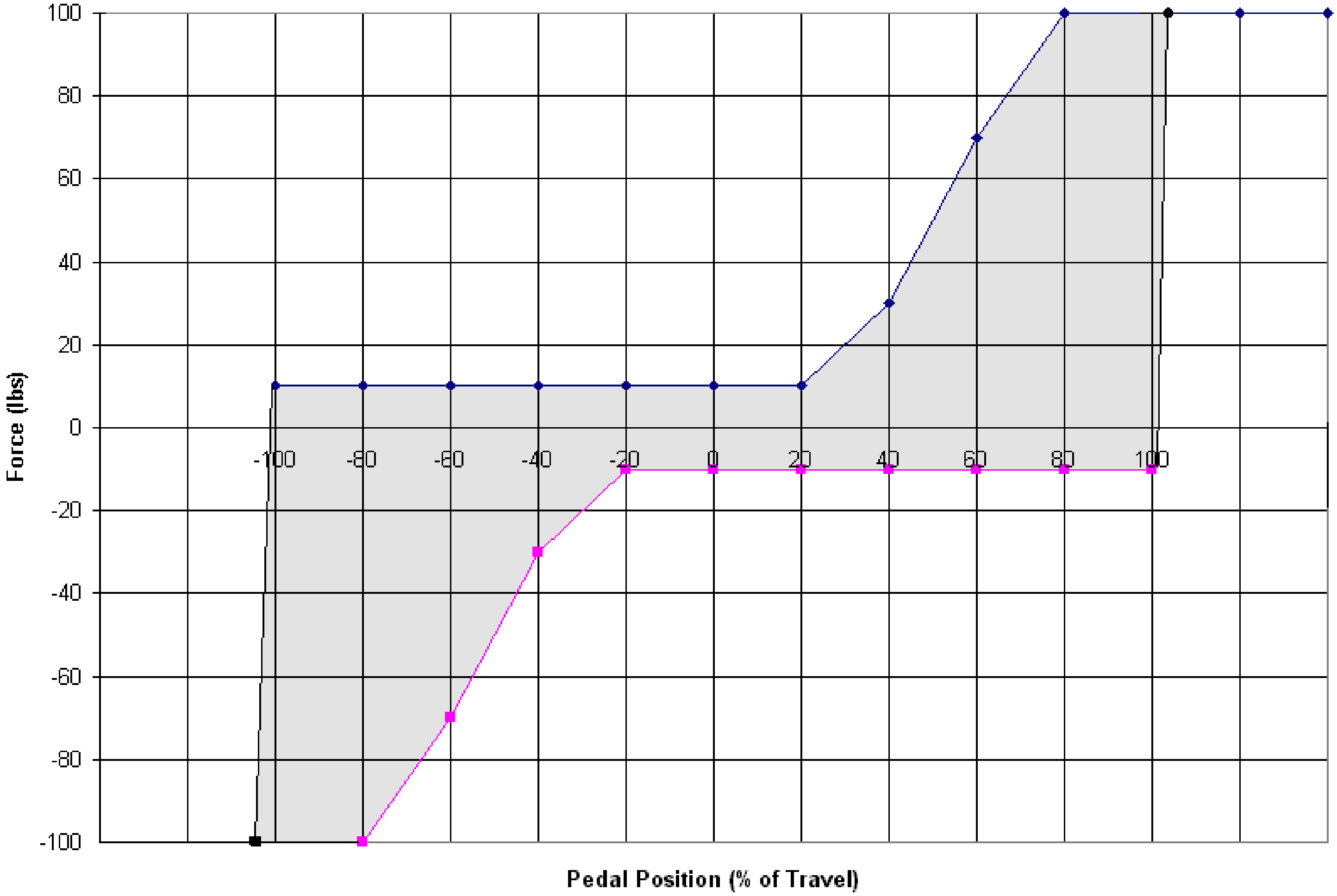
Applicable Test and Test Number	**Authorized Performance Range**
(9)(b) Phugoid dynamics.	Must have a phugoid with a period of 30 - 60 seconds. May not reach ½ or double amplitude in less than 2 cycles.
c. Lateral Directional.	
(1) Roll response. Roll rate must be measured through at least 30 degrees of roll. Aileron control must be deflected 50 percent of maximum travel.	Must have a roll rate of 6 - 40 degrees/second.
(2) Response to roll controller step input. Trim for straight and level flight at nominal gross weight and approach airspeed. Roll into a 30 degree bank turn and stabilize. When ready, input a 50 percent aileron control opposite to the direction of turn. When reaching zero bank angle, rapidly neutralize the aileron control and release. Record the response from at least 2 seconds prior to the initiation of control input opposite to the direction of turn until at least 20 seconds after neutralization of the controls.	Roll rate must decrease to not more than 10 percent of the roll rate achieved, within 1 - 3 seconds of control release.
(3)(a) and (b) Spiral stability. Cruise configuration and normal cruise airspeed. Establish a 20 - 30 degree bank. When stabilized, neutralize the aileron control and release. Must be completed in both directions of turn.	Initial bank angle (± 5 degrees) after 20 seconds.
(4)(b) Rudder response. Use 50 percent of maximum rudder deflection. Applicable to approach or landing configuration	6 - 12 degrees/second yaw rate.
(5)(b) Dutch roll, yaw damper off. Applicable to cruise and approach configurations.	A period of 2 - 5 seconds; and ½ - 2 cycles.
(6) Steady state sideslip. Use 50 percent rudder deflection. Applicable to approach and landing configurations.	2 - 10 degrees of bank; 4 - 10 degrees of sideslip; and 2 -10 degrees of aileron.
4. Cockpit Instrument Response.	
Instrument systems response to an abrupt pilot controller input. One test is required in each axis (pitch, roll, yaw).	300 milliseconds or less.



ATTACHMENT 2 TO APPENDIX B TO PART 60—
FIGURE 3. SMALL SINGLE ENGINE (RECIPROCATING) AIRPLANE
COLUMN POSITION VS. FORCE



ATTACHMENT 2 TO APPENDIX B TO PART 60—
FIGURE 3a. SMALL, SINGLE ENGINE (RECIPROCATING) AIRPLANE
WHEEL POSITION VS. FORCE



ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 3b. SMALL, SINGLE ENGINE (RECIPROCATING) AIRPLANE RUDDER PEDAL POSITION VS. FORCE

Table of Alternative Source Data FTD Level 5. Small, Multi-Engine (Reciprocating) Airplane

QPS REQUIREMENT

Applicable Test and Test Number	**Authorized Performance Range**
2. Performance	
a. Takeoff.	
(1) Ground acceleration time; brake release to liftoff speed.	20 - 30 Seconds.
b. Climb.	
(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).
c. Ground Deceleration.	
(1) Deceleration time from 80 knots to zero; with a nominal gross weight; using wheel brakes on a dry runway.	10 - 20 Seconds.
d. Engines.	
(1) Acceleration; idle to takeoff power.	2 - 5 Seconds.
(2) Deceleration; takeoff power to idle.	2 - 5 Seconds.
3. Handling Qualities. **a.** Static Control Checks.	
(1)(b) Column position vs. force.	Plot of Column Position vs. Force must fall within the shaded areas shown in Figure 4, page 29 (Small, Multi-Engine Airplanes).
(2)(b) Wheel position vs. force.	Plot of Wheel Position vs. Force must fall within the shaded areas shown in Figure 5, page 30 (Small, Multi-Engine Airplanes).
(3)(b) Pedal position vs. force.	Plot of Rudder Pedal Position vs. Force must fall within the shaded areas shown in Figure 6, page 31 (Small, Multi-Engine Airplanes).
(4) Nosewheel steering force.	Plot of Rudder Pedal Position vs. Force must fall within the shaded areas shown in Figure 6, page 31 (Small, Multi-Engine Airplanes).
(5) Rudder pedal steering calibration with full rudder pedal travel.	10 - 30 degrees of nosewheel angle, both sides of neutral.
(8) Brake pedal position vs. force; at maximum pedal deflection.	50 - 150 lbs (22 - 66 daN) of force;
b. Longitudinal.	
(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. OR (b) Trim for straight and level flight at 80% 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.	(a) 10 - 25 lbs (2.2 - 6.6 daN) of force (Pull). (b) 5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
(2) Flap/slat change force.	

Table of Alternative Source Data FTD Level 5. Small, Multi-Engine (Reciprocating) Airplane

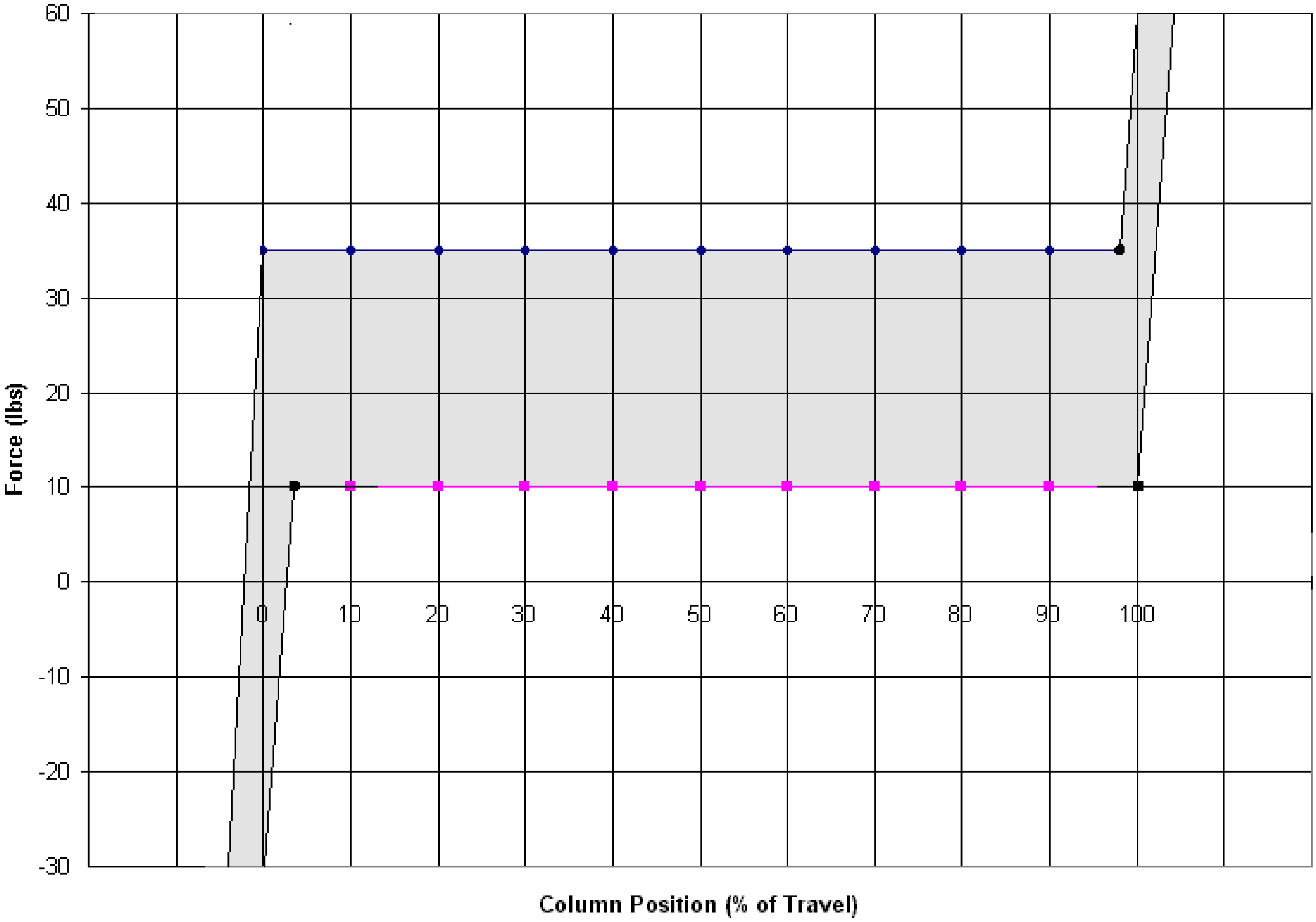
QPS REQUIREMENT

Applicable Test and Test Number	**Authorized Performance Range**
(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% of full flap travel. After stabilized, record stick force necessary to maintain original airspeed. 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 (fully retracted). After stabilized, record stick force necessary to maintain original airspeed.	(a) 5 - 15 lbs (2.2 - 6.6 daN) of force (Pull). (b) 5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
(3) 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. 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.	(a) 2 - 12 lbs (0.88 - 5.3 daN) of force (Pull). (b) 2 - 12 lbs (0.88 - 5.3 daN) of force (Push).
(4) Gear and flap operating times. (a) Extend gear. (b) Retract gear. (c) Extend flaps, zero to 50% travel. (d) Retract flaps, 50% travel to zero.	(a) 2 - 12 seconds. (b) 2 - 12 seconds. (c) 3 - 13 seconds. (d) 3 - 13 seconds.
(5) Longitudinal trim.	Must be able to trim longitudinal stick force to "zero" in each of the following configurations: (a) cruise; (b) approach; and (c) landing.
(7) Longitudinal static stability.	Must exhibit positive static stability.
(8) Stall warning (actuation of stall warning device) with nominal gross weight; wings level; clean configuration, and a deceleration	

Table of Alternative Source Data FTD Level 5. Small, Multi-Engine (Reciprocating) Airplane

QPS REQUIREMENT

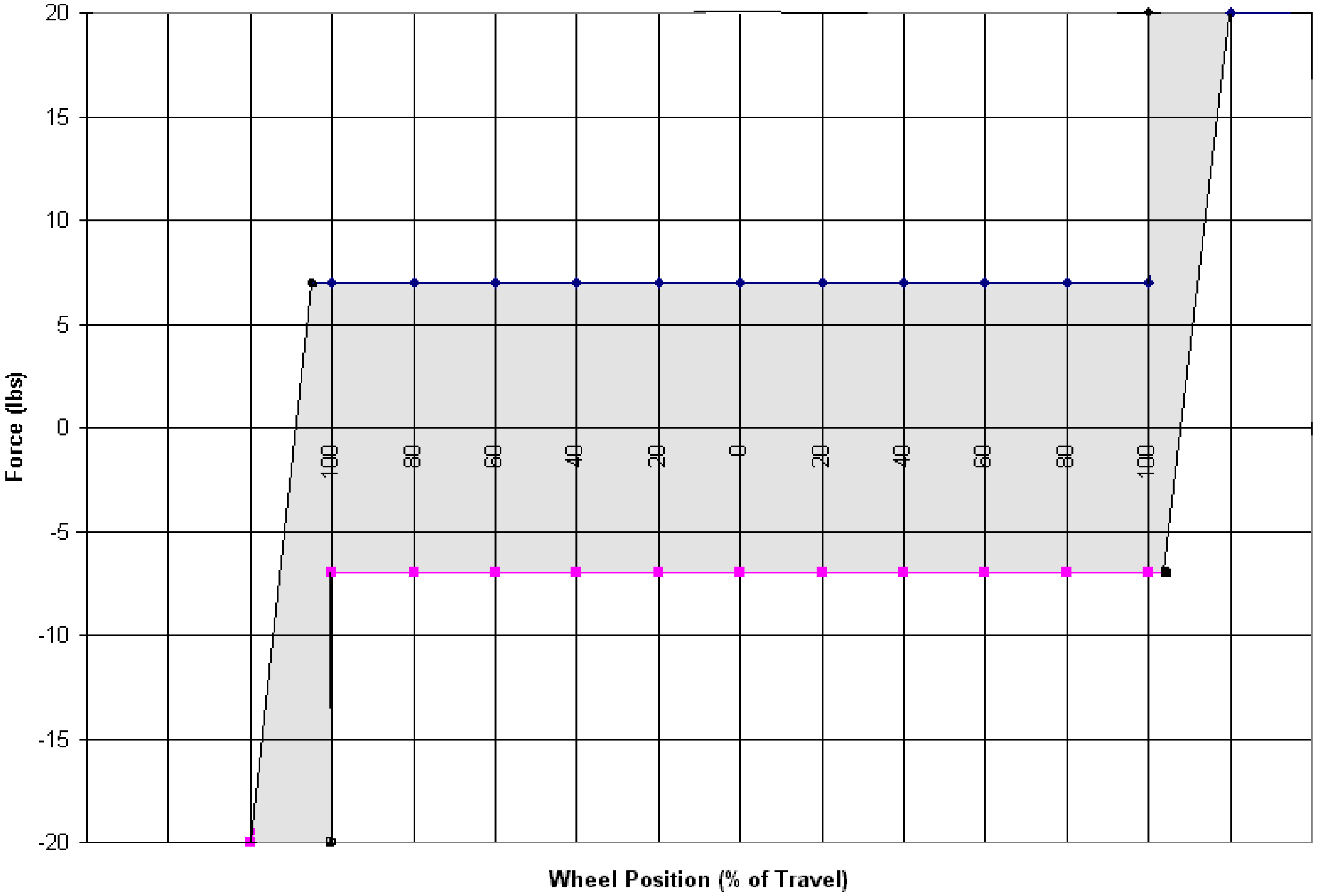
Applicable Test and Test Number	Authorized Performance Range
rate of approximately one (1) knot per second. (a) Landing configuration: (b) Clean configuration:	 (a) 60 - 90 knots; ± 5 degrees of bank. (b) Landing configuration speed, + 10 - 20 percent.
(9)(b) Phugoid dynamics.	(a) Must have a phugoid with a period of 30 - 60 seconds. (b) May not reach ½ or double amplitude in less than 2 cycles.
c. Lateral Directional.	
(1) Roll response. Roll rate must be measured through at least 30 degrees of roll. Aileron control must be deflected 50 percent of maximum travel.	Must have a roll rate of 6 - 40 degrees/second.
(2) Response to roll controller step input. Trim for straight and level flight at nominal gross weight and approach airspeed. Roll into a 30 degree bank turn and stabilize. When ready, input a 50 percent aileron control opposite to the direction of turn. When reaching zero bank angle, rapidly neutralize the aileron control and release. Record the response from at least 2 seconds prior to the initiation of control input opposite to the direction of turn until at least 20 seconds after neutralization of the controls.	Roll rate must decrease to not more than 10 percent of the roll rate achieved, within 1 - 3 seconds of control release.
(3)(a) and (b) Spiral stability. Cruise configuration and normal cruise airspeed. Establish a 20 - 30 degree bank. When stabilized, neutralize the aileron control and release. Must be completed in both directions of turn.	Initial bank angle (± 5 degrees) after 20 seconds.
(4)(b) Rudder response. Use 50 percent of maximum rudder deflection. Applicable to approach or landing configuration	6 - 12 degrees/second yaw rate.
(5)(b) Dutch roll, yaw damper off. Applicable to cruise and approach configurations.	(a) A period of 2 - 5 seconds; and ½ - 2 cycles.
(6) Steady state sideslip. Use 50 percent rudder deflection; Applicable to approach and landing configurations.	2 - 10 degrees of bank; 4 - 10 degrees of sideslip; and 2 -10 degrees of aileron.
3. Cockpit Instrument Response.	
Instrument systems response to an abrupt pilot controller input. One test is required in each axis (pitch, roll, yaw).	300 milliseconds or less.



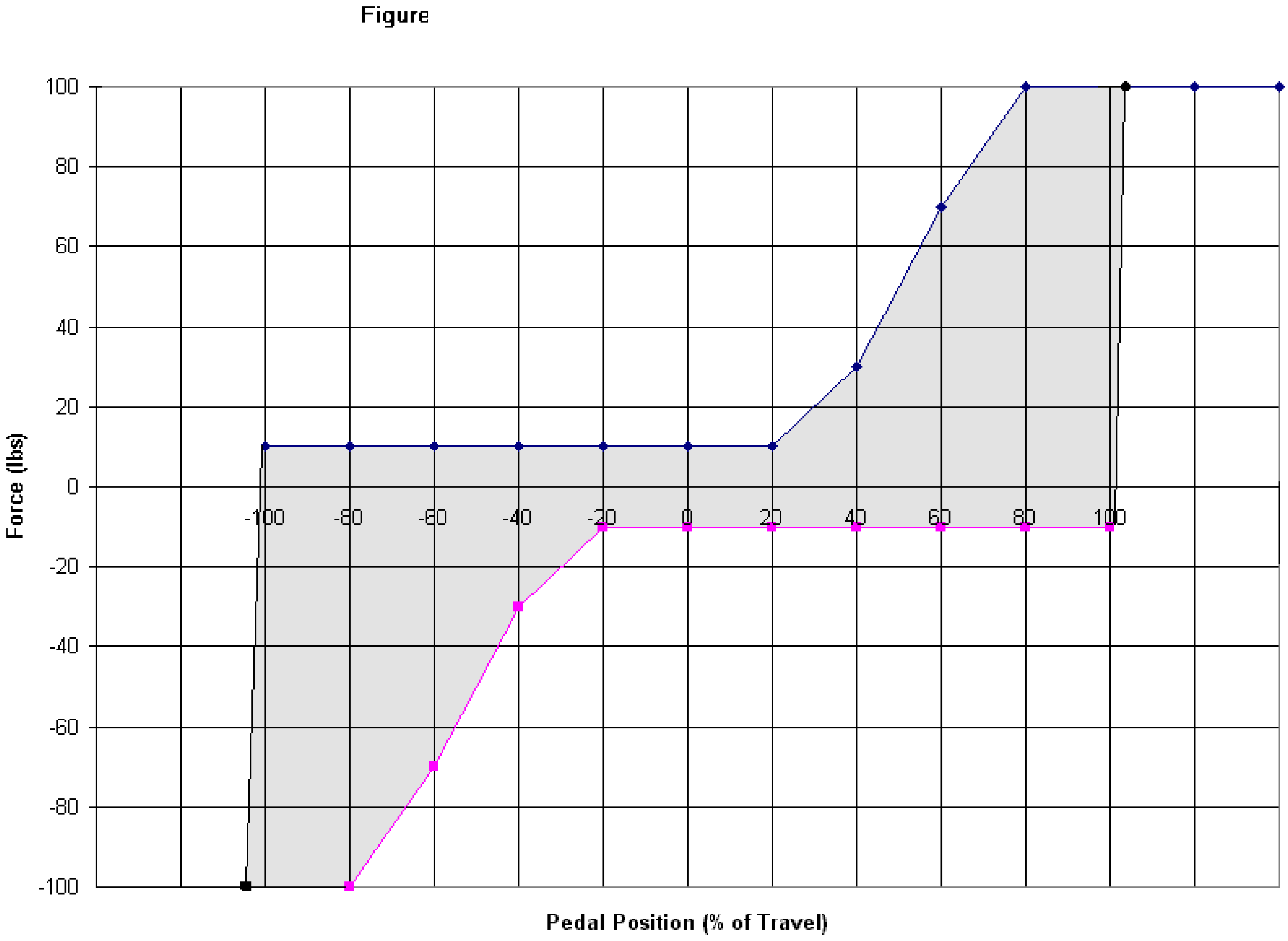
ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 4. SMALL, MULTI-ENGINE (RECIPROCATING) AIRPLANE

COLUMN POSITION VS. FORCE



ATTACHMENT 2 TO APPENDIX B TO PART 60—
FIGURE 5. SMALL, MULTI-ENGINE (RECIPROCATING) AIRPLANE
WHEEL POSITION VS. FORCE



ATTACHMENT 2 TO APPENDIX B TO PART 60—
FIGURE 6. SMALL, MULTI-ENGINE (RECIPROCATING) AIRPLANE RUDDER PEDAL POSITION VS. FORCE

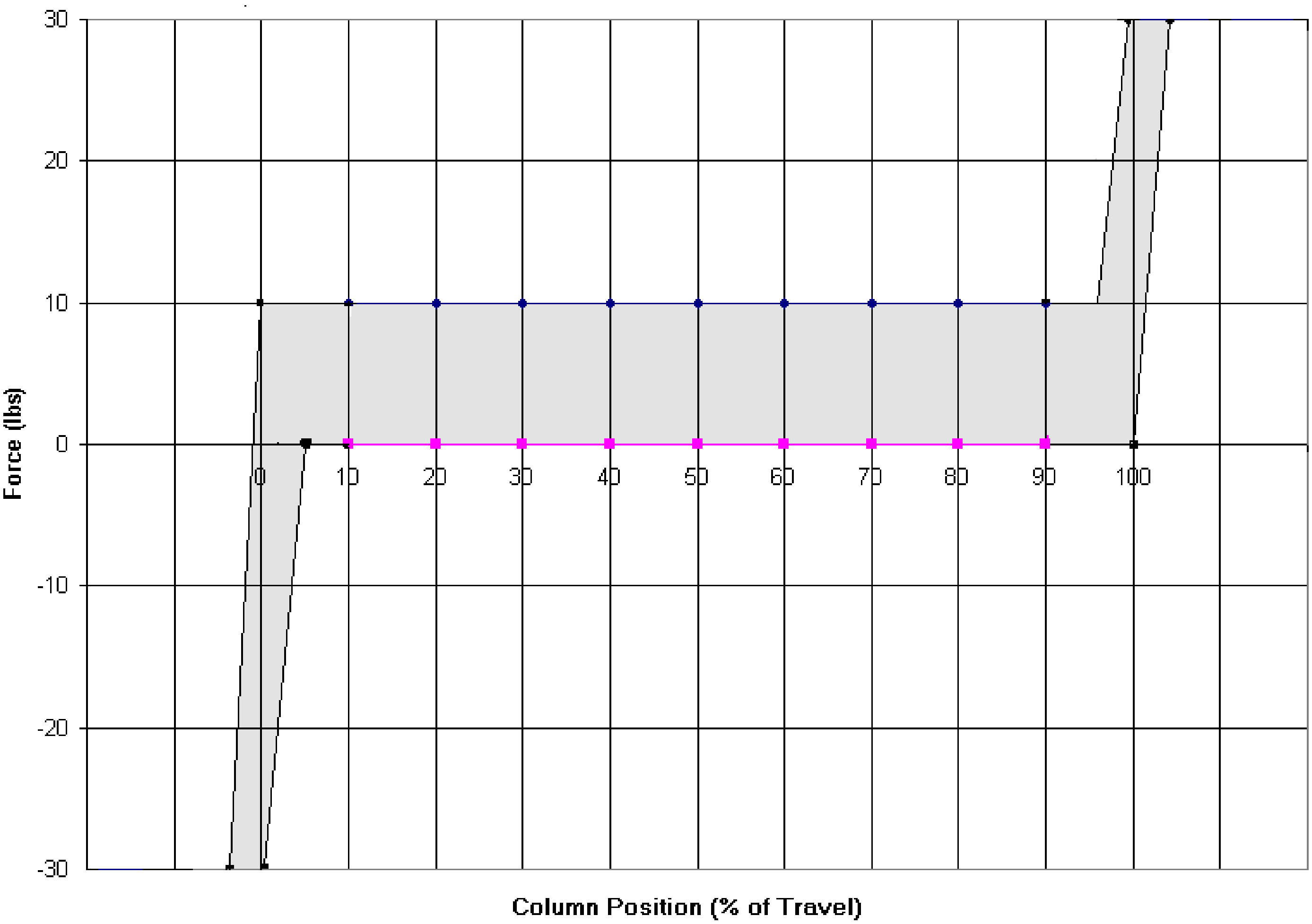
Table of Alternative Source Data FTD Level 5. Single Engine (Turbo-Propeller) Airplane	
QPS REQUIREMENT	
Applicable Test and Test Number	**Authorized Performance Range**
2. Performance	
a. Takeoff.	
(1) Ground acceleration time; brake release to liftoff speed.	20 - 30 Seconds.
b. Climb.	
(1) Normal climb with nominal gross weight, at best rate-of-climb airspeed.	Climb airspeed = 95 -115 knots. Climb rate = 800 - 1800 fpm (4 – 9 m/sec).
c. Ground Deceleration.	
(1) Deceleration time from 80 knots to zero; with a nominal gross weight; using wheel brakes on a dry runway.	20 - 35 Seconds.
d. Engines.	
(1) Acceleration; idle to takeoff power.	4 - 8 Seconds.
(2) Deceleration; takeoff power to idle.	3 - 7 Seconds.
3. Handling Qualities. **a.** Static Control Checks.	
(1)(b) Column position vs. force.	Plot of Column Position vs. Force must fall within the shaded areas shown in Figure 7 of this appendix (Single Engine [Turbo-Propeller] Airplanes).
(2)(b) Wheel position vs. force.	Plot of Wheel Position vs. Force must fall within the shaded areas shown in Figure 8 of this appendix (Single Engine [Turbo-Propeller] Airplanes)
(3)(b) Pedal position vs. force.	Plot of Rudder Pedal Position vs. Force must fall within the shaded areas shown in Figure 9 of this appendix (Single Engine [Turbo-Propeller] Airplanes)
(4) Nosewheel steering force.	Plot of Rudder Pedal Position vs. Force must fall within the shaded areas shown in Figure 9 of this appendix (Single Engine [Turbo-Propeller] Airplanes)
(5) Rudder pedal steering calibration with full rudder pedal travel.	10 - 30 degrees of nosewheel angle, both sides of neutral.
(8) Brake pedal position vs. force; at maximum pedal deflection.	50 - 100 lbs (22 - 44 daN) of force;
b. Longitudinal.	
(2) 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. OR (b) Trim for straight and level flight at 80% 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.	(a) 8 lbs (3.5 daN) of Push force to 8 lbs (3.5 daN) of Pull force. (b) 12-22 lbs (5.3 – 9.7 daN) of force (Push).
(3) 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	(a) 5 - 15 lbs (2.2 - 6.6 daN) of force (Pull).

QPS REQUIREMENT	
Applicable Test and Test Number	**Authorized Performance Range**
not adjust trim or power. Extend the flaps to 50% of full flap travel. After stabilized, record stick force necessary to maintain original airspeed. 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 (fully retracted). After stabilized, record stick force necessary to maintain original airspeed.	(b) 5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
(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. 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.	(a) 2 - 12 lbs (0.88 - 5.3 daN) of force (Pull). (b) 2 - 12 lbs (0.88 - 5.3 daN) of force (Push).
(5) Gear and flap operating times. (a) Extend gear. (e) Retract gear. (f) Extend flaps, zero to 50% travel. (g) Retract flaps, 50% travel to zero.	(a) 2 - 12 seconds. (b) 2 - 12 seconds. (c) 3 - 13 seconds. (d) 3 - 13 seconds.
(6) Longitudinal trim.	Must be able to trim longitudinal stick force to "zero" in each of the following configurations: (d) cruise; (e) approach; and (f) landing.
(7) Longitudinal static stability.	Must exhibit positive static stability.
(9) Stall warning (actuation of stall warning device) with nominal gross weight; wings level; clean configuration, and a deceleration rate of approximately one (1) knot per second. (c) Landing configuration: (d) Clean configuration:	(c) 60 - 90 knots; ± 5 degrees of bank. (d) Landing configuration speed, + 10 - 20 percent.

Table of Alternative Source Data FTD Level 5. Single Engine (Turbo-Propeller) Airplane

QPS REQUIREMENT

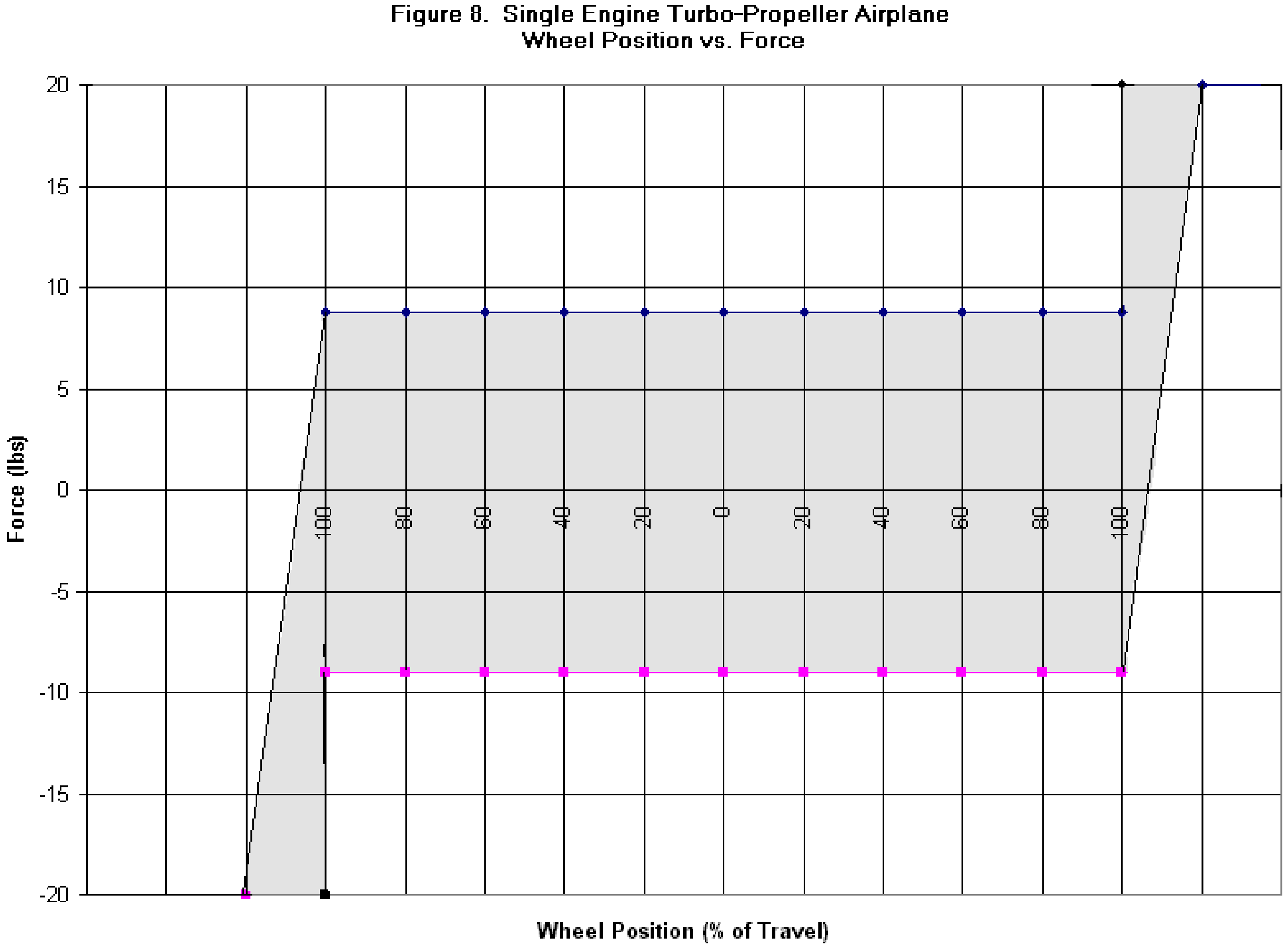
Applicable Test and Test Number	**Authorized Performance Range**
(9)(b) Phugoid dynamics.	(a) Must have a phugoid with a period of 30 - 60 seconds. (b) May not reach ½ or double amplitude in less than 2 cycles.
c. Lateral Directional.	
(2) Roll response. Roll rate must be measured through at least 30 degrees of roll. Aileron control must be deflected 50 percent of maximum travel.	Must have a roll rate of 6 - 40 degrees/second.
(2) Response to roll controller step input. Trim for straight and level flight at nominal gross weight and approach airspeed. Roll into a 30 degree bank turn and stabilize. When ready, input a 50 percent aileron control opposite to the direction of turn. When reaching zero bank angle, rapidly neutralize the aileron control and release. Record the response from at least 2 seconds prior to the initiation of control input opposite to the direction of turn until at least 20 seconds after neutralization of the controls.	Roll rate must decrease to not more than 10 percent of the roll rate achieved, within 1 - 3 seconds of control release.
(3)(a) and (b) Spiral stability. Cruise configuration and normal cruise airspeed. Establish a 20 - 30 degree bank. When stabilized, neutralize the aileron control and release. Must be completed in both directions of turn.	Initial bank angle (± 5 degrees) after 20 seconds.
(4)(b) Rudder response. Use 50 percent of maximum rudder deflection. Applicable to approach or landing configuration	6 - 12 degrees/second yaw rate.
(5)(b) Dutch roll, yaw damper off. Applicable to cruise and approach configurations.	A period of 2 - 5 seconds; and ½ - 3 cycles.
(7) Steady state sideslip. Use 50 percent rudder deflection; Applicable to approach and landing configurations.	2 - 10 degrees of bank; 4 - 10 degrees of sideslip; and 2 -10 degrees of aileron.
4. Cockpit Instrument Response.	
Instrument systems response to an abrupt pilot controller input. One test is required in each axis (pitch, roll, and yaw).	300 milliseconds or less.



ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 7. SINGLE ENGINE TURBO-PROPELLER AIRPLANE

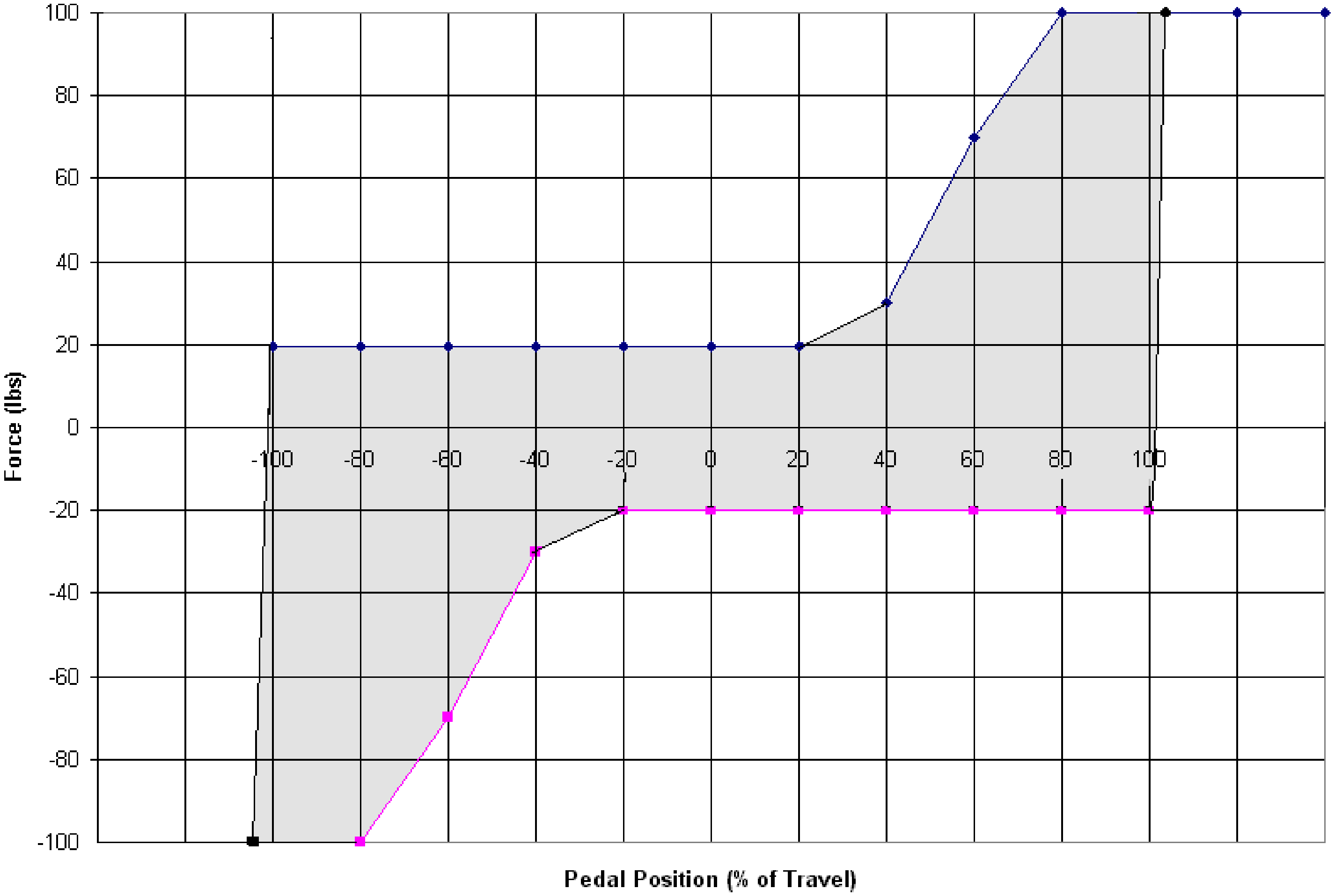
COLUMN POSITION VS. FORCE



ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 8. SINGLE ENGINE TURBO-PROPELLER AIRPLANE

WHEEL POSITION VS. FORCE



ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 9. SINGLE ENGINE TURBO-PROPELLER AIRPLANE RUDDER PEDAL POSITION VS. FORCE

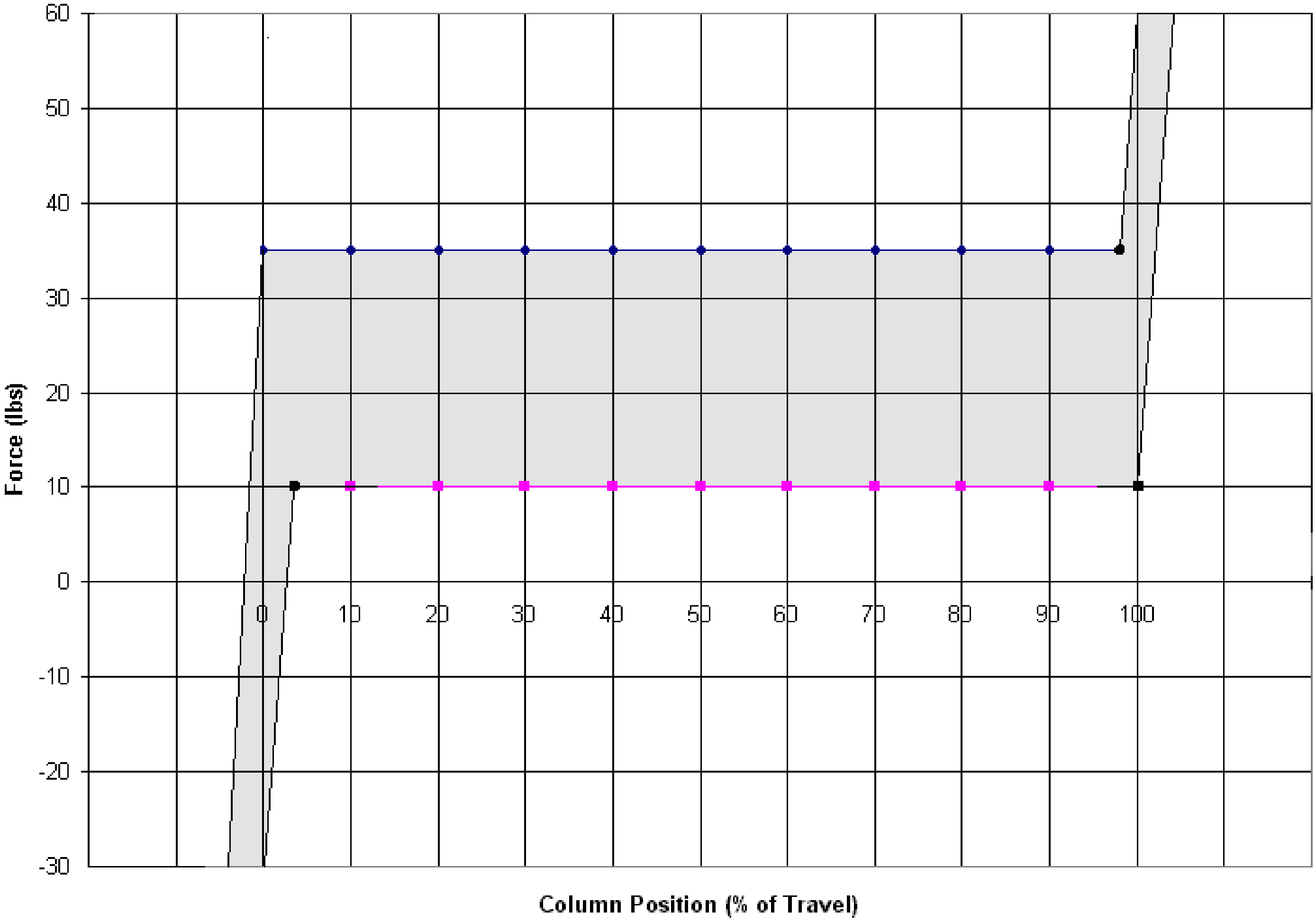
Table of Alternative Source Data FTD Level 5.	**Multi Engine (Turbo-Propeller) Airplanes ≤ 19,000 Pounds**
QPS	**REQUIREMENT**
Applicable Test and Test Number	**Authorized Performance Range**
2. Performance	
a. Takeoff.	
(1) Ground acceleration time; brake release to liftoff speed.	20 - 30 Seconds.
b. Climb.	
(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)
c. Ground Deceleration.	
(1) Deceleration time from 90 knots to zero; with a nominal gross weight; using wheel brakes on a dry runway.	20 - 35 Seconds.
d. Engines.	
(1) Acceleration; idle to takeoff power.	2 - 6 Seconds.
(2) Deceleration; takeoff power to idle.	1 - 5 Seconds.
3. Handling Qualities. **a.** Static Control Checks.	
(1)(b) Column position vs. force.	Plot of Column Position vs. Force must fall within the shaded areas shown in Figure 10 of this appendix (Multi-Engine Turbo-Propeller Airplanes).
(2)(b) Wheel position vs. force.	Plot of Wheel Position vs. Force must fall within the shaded areas shown in Figure 11 of this appendix (Multi-Engine Turbo-Propeller Airplanes).
(3)(b) Pedal position vs. force.	Plot of Rudder Pedal Position vs. Force must fall within the shaded areas shown in Figure 12 of this appendix (Multi-Engine Turbo-Propeller Airplanes).
(4) Nosewheel steering force.	Plot of Rudder Pedal Position vs. Force must fall within the shaded areas shown in Figure 12 of this appendix (Multi-Engine Turbo-Propeller Airplanes).
(5) Rudder pedal steering calibration with full rudder pedal travel.	10 - 30 degrees of nosewheel angle, both sides of neutral.
(8) Brake pedal position vs. force; at maximum pedal deflection.	50 - 150 lbs (22 - 66 daN) of force.
b. Longitudinal.	
(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. OR (b) Trim for straight and level flight at 80% 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.	(a) 8 lbs (3.5 daN) of Push force to 8 lbs (3.5 daN) of Pull force. (b) 12 - 22 lbs (5.3 - 9.7 daN) of force (Push).
(2) Flap/slat change force. (a) Trim for straight and level flight with flaps fully retracted at a	(a) 5 - 15 lbs (2.2 - 6.6 daN) of force (Pull).

Table of Alternative Source Data FTD Level 5. Multi Engine (Turbo-Propeller) Airplanes ≤ 19,000 Pounds	
QPS REQUIREMENT	
Applicable Test and Test Number	**Authorized Performance Range**
constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Extend the flaps to 50% of full flap travel. After stabilized, record stick force necessary to maintain original airspeed. 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 (fully retracted). After stabilized, record stick force necessary to maintain original airspeed.	(b) 5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
(3) 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. 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.	(a) 2 - 12 lbs (0.88 - 5.3 daN) of force (Pull). (b) 2 - 12 lbs (0.88 - 5.3 daN) of force (Push).
(4) Gear and flap operating times. (a) Extend gear. (b) Retract gear. (c) Extend flaps, zero to 50% travel. (d) Retract flaps, 50% travel to zero.	(a) 2 - 12 seconds. (b) 2 - 12 seconds. (c) 3 - 13 seconds. (d) 3 - 13 seconds.
(5) Longitudinal trim.	Must be able to trim longitudinal stick force to “zero” in each of the following configurations: (a) cruise; (b) approach; and (c) landing.
(7) Longitudinal static stability.	Must exhibit positive static stability.
(8) Stall warning (actuation of stall warning device) with nominal gross weight; wings level; clean configuration, and a deceleration rate of approximately one (1) knot per second. (a) Landing configuration:	

Table of Alternative Source Data FTD Level 5. Multi Engine (Turbo-Propeller) Airplanes ≤ 19,000 Pounds

QPS REQUIREMENT

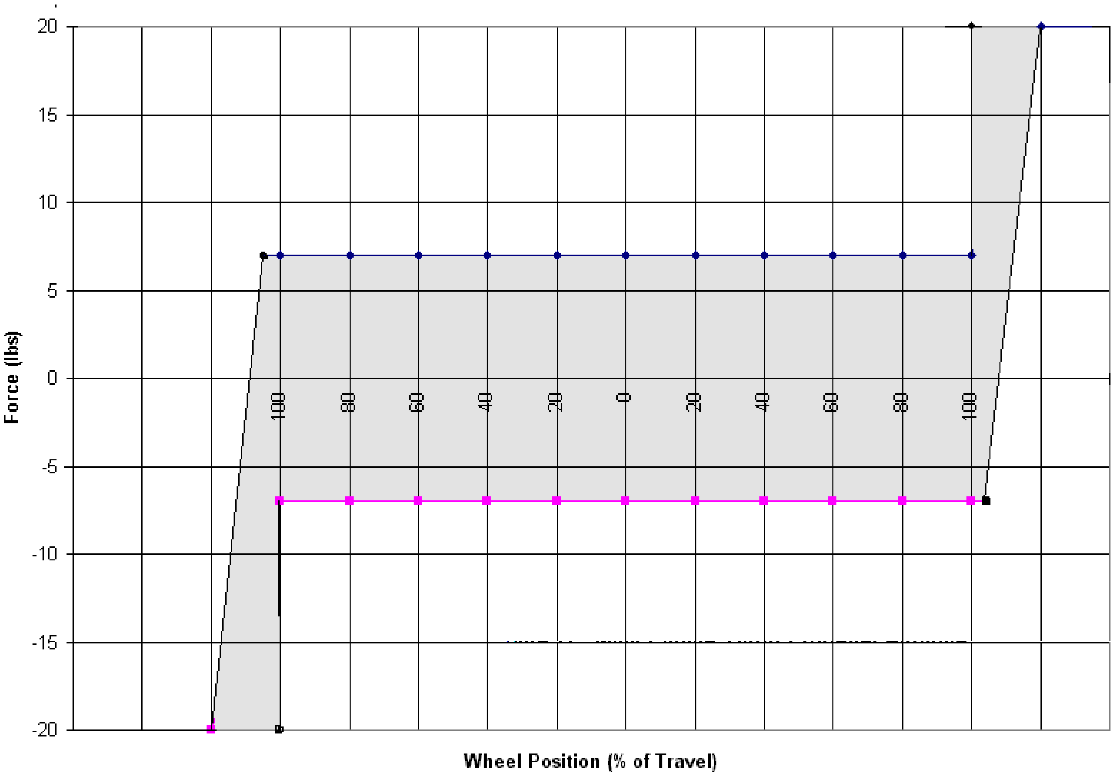
Applicable Test and Test Number	**Authorized Performance Range**
(b) Clean configuration:	(a) 80 - 100 knots; ± 5 degrees of bank. (b) Landing configuration speed + 10 -20 percent.
(9)(b) Phugoid dynamics.	(a) Must have a phugoid with a period of 30 - 60 seconds. (b) May not reach ½ or double amplitude in less than 2 cycles.
c. Lateral Directional.	
(1) Roll response. (a) Roll rate must be measured through at least 30 degrees of roll. Aileron control must be deflected 50 percent of maximum travel.	Must have a roll rate of 6 - 40 degrees/second.
(2) Response to roll controller step input. Trim for straight and level flight at nominal gross weight at approach airspeed. Roll into a 30 degree band turn and stabilize. When ready, input a 50 percent aileron control opposite the direction of turn. When reaching zero bank angle, rapidly neutralize the aileron control and release. Record the response from at least 2 seconds prior to initiation of control input at least 20 seconds after neutralization of the controls.	Roll rate must decrease to not more than 10 percent of the roll rate achieved, and must do so within 1 -3 seconds.
(3)(a) and (b) Spiral stability. Cruise configuration and normal cruise airspeed. Establish a 20 - 30 degree bank. When stabilized, neutralize the aileron control and release. (Must be completed in both directions of turn)	Initial bank angle (± 5 degrees) after 20 seconds.
(4)(b) Rudder response. Use 50 percent of maximum rudder deflection. Applicable to approach or landing configuration.	6 - 12 degrees/second yaw rate.
(5)(b) Dutch roll, yaw damper off. Applicable to cruise and approach configurations.	(a) A period of 2 - 5 seconds; and (b) ½ - 3 cycles.
(6) Steady state sideslip. Use 50 percent rudder deflection. Applicable to approach and landing configurations.	(a) 2 - 10 degrees of bank; (b) 4 - 10 degrees of sideslip; and (c) 2 -10 degrees of aileron.
4. Cockpit Instrument Response.	
Instrument systems response to an abrupt pilot controller input. One test is required in each axis (pitch, roll, yaw).	300 milliseconds or less.



ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 10. MULTI-ENGINE TURBO-PROPELLER AIRPLANE

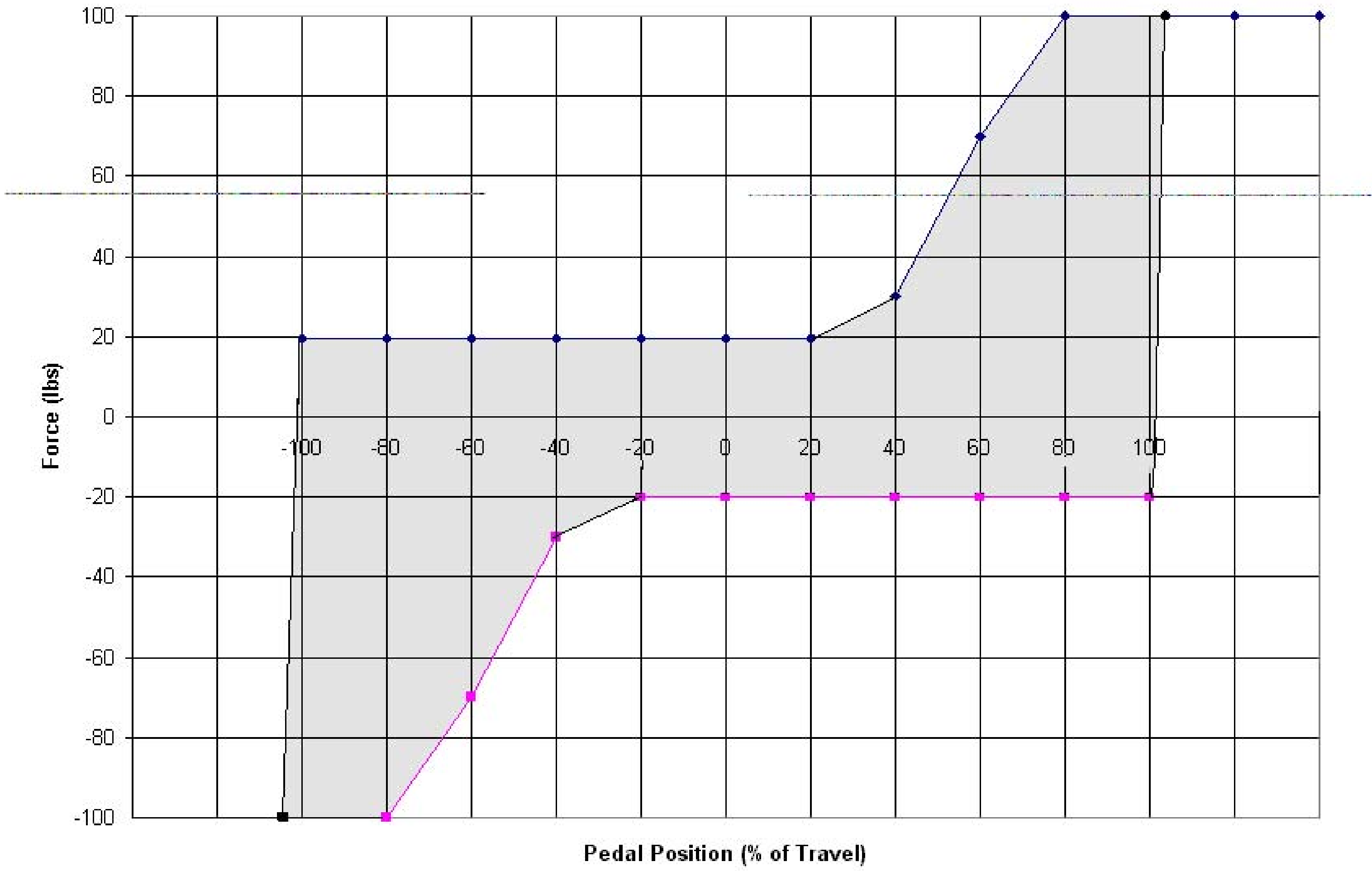
COLUMN POSITION VS. FORCE



ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 11. MULTI-ENGINE TURBO-PROPELLER AIRPLANE

WHEEL POSITION VS. FORCE



ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 12. MULTI-ENGINE TURBO-PROPELLER AIRPLANE

RUDDER PEDAL POSITION VS. FORCE

6. Alternative Data Sources, Procedures, and Instrumentation: Level 6 FTD Only

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Begin Information

a. In recent years, considerable progress has been made by highly experienced aircraft and FTD manufacturers in improvement of aerodynamic modeling techniques. In conjunction with increased accessibility to very high powered computer technology, these techniques have become quite sophisticated. Additionally, those who have demonstrated success in combining these modeling techniques with minimal flight testing have incorporated the use of highly mature flight controls models and have had extensive experience in comparing the output of their effort with actual flight test data - and they have been able to do so on an iterative basis over a period of years.

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 NSPM 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 as an acceptable alternative to the procedures and instrumentation found in the traditionally accepted flight test methods used to gather such modeling and validation data.

(1) Alternative data sources which 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 NSPM recommends that use of the alternative instrumentation noted in the following Table be coordinated with the NSPM prior to employment in a flight test or data gathering effort.

e. The NSPM 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) While the 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. Any of the FTD 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.

(2) 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, will be used. Such a model does not require control surface position measurements in the flight test objective data in these limited applications.

(3) The authorized uses of Level 6 FTDs (as listed in the appropriate Commercial, Instrument, or Airline Transport Pilot and/or Type Rating Practical Test Standards) for “initial,” “transition,” or “upgrade” training, still requires additional flight training and/or flight testing/checking in the airplane or in a Level C or Level D simulator.

f. The sponsor is urged to contact the NSPM for clarification of any issue regarding airplanes with reversible control systems. This table is not applicable to Computer Controlled Aircraft flight 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 simulators.

End Information

Table of Alternative Data Sources, Procedures, and Instrumentation: Level 6 FTD Only

QPS REQUIREMENT (if this source used)		
Applicable Test and Test Number	**Alternative Data Sources, Procedures, and Instrumentation**	**Notes, Reminders, and Information**
2.a.(1) Performance. Takeoff. Minimum Radius turn	TIR, AFM, or Design data may be used.	
2.b.(1) Performance. Climb. Normal Climb	Data may be acquired with a synchronized video of: calibrated airplane instruments and engine power throughout the climb range.	
2.c.(1) Performance. In-Flight. 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.
2.d.(1) Performance. Ground. Deceleration Time, using manual application of wheel brakes and no reverse thrust.	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.	
2.d.(2) Performance. Ground. Deceleration Time, using reverse thrust and no wheel brakes.	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.	
2.e.(1) Performance. Engines. Acceleration	Data may be acquired with a synchronized video recording of engine instruments and throttle position.	
2.e.(2) Performance. Engines. Deceleration	Data may be acquired with a synchronized video recording of engine instruments and throttle position.	
3.a.(1)(b) Handling Qualities. Static Control Checks. Column Position vs. Force	Force data may be acquired by using a hand held force gauge at selected, significant column positions (encompassing significant column position data points) acceptable to the NSPM.	
3.a.(2)(b) Handling Qualities. Static Control Checks. Wheel Position vs. Force	Force data may be acquired by using a hand held force gauge at selected, significant wheel positions (encompassing significant wheel position data points) acceptable to the NSPM.	
3.a.(3)(b) Handling Qualities. Static Control Checks. Rudder Pedal Position vs. Force	Force data may be acquired by using a hand held force gauge at selected, significant wheel positions (encompassing significant wheel position data points) acceptable to the NSPM.	
3.a.(4) Handling Qualities. Static Control Checks. 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.	
3.a.(5) Handling Qualities. Static Control Checks.	Data may be acquired through the use of force pads on the rudder pedals and a pedal position measurement device, together with	

Table of Alternative Data Sources, Procedures, and Instrumentation: Level 6 FTD Only		
QPS REQUIREMENT (if this source used)		
Applicable Test and Test Number	**Alternative Data Sources, Procedures, and Instrumentation**	**Notes, Reminders, and Information**
Rudder Pedal Steering Calibration	design data for nose wheel position.	
3.a.(6) Handling Qualities. Static Control Checks. Pitch Trim Calibration (Indicator vs. Computed).	Data may be acquired through calculations.	
3.a.(7) Handling Qualities. Static Control Checks. Alignment of Power Lever Angle vs. Selected Engine Parameter (e.g., EPR, N_1, Torque, etc.)	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.	
3.a.(8) Handling Qualities. Static Control Checks. Brake Pedal Position vs. Force	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.	
3.b.(1) Handling Qualities. Longitudinal. 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 cockpit controls.	
3.b.(2) Handling Qualities. Longitudinal. 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 cockpit controls.	
3.c.(4) Handling Qualities. Longitudinal. 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 cockpit controls.	
3.b.(4) Handling Qualities. Longitudinal. Landing Gear and Flap/Slat Operating Times.	May use design data, production flight test schedule, or maintenance specification, together with an SOC.	
3.b.(5) Handling Qualities. Longitudinal. Longitudinal Trim	Data may be acquired through use of an inertial measurement system and a synchronized video of: the cockpit controls position (previously calibrated to show related surface position) and the engine instrument readings.	
3.b.(6) Handling Qualities. Longitudinal. 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.	
3.b.(7) Handling Qualities. Longitudinal.	Data may be acquired through the use of a synchronized video of the airplane flight	

Table of Alternative Data Sources, Procedures, and Instrumentation: Level 6 FTD Only

QPS REQUIREMENT (if this source used)		
Applicable Test and Test Number	**Alternative Data Sources, Procedures, and Instrumentation**	**Notes, Reminders, and Information**
Longitudinal Static Stability	instruments and a hand held force gauge.	
3.b.(8)(b) Handling Qualities. Longitudinal. 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 cockpit controls.	
3.c.(1) Handling Qualities. Lateral Directional. Roll Response (Rate)		
3.c.(2) Handling Qualities. Lateral Directional. **(a)** Roll Overshoot OR **(b)** Roll Response to Cockpit 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 cockpit lateral controls.	
3.c.(4)(b) Handling Qualities. Lateral Directional. 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 cockpit controls; and a stop watch.	
3.c.(5)(a) Handling Qualities. Lateral Directional. 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.	
3.c.(6)(a) Handling Qualities. Lateral Directional. 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 cockpit controls.	
3.c.(7) Handling Qualities. Lateral Directional. 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 cockpit controls. Ground track and wind corrected heading may be used for sideslip angle.	

Table of Alternative Data Sources, Procedures, and Instrumentation: Level 6 FTD Only		
QPS REQUIREMENT (if this source used)		
Applicable Test and Test Number	**Alternative Data Sources, Procedures, and Instrumentation**	**Notes, Reminders, and Information**

Attachment 3 to Appendix B to Part 60--

FLIGHT TRAINING DEVICE (FTD) SUBJECTIVE EVALUATION

1. DISCUSSION.

Begin Information

a. The subjective tests provide a basis for evaluating the capability of the FTD to perform over a typical utilization period; determining that the FTD competently simulates each required maneuver, procedure, or task; and verifying correct operation of the FTD controls, instruments, and systems. The items listed in the Table of Functions and Subjective Tests 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 described on the Statement of Qualification or as may be approved by the TPAA. All items in the following paragraphs are subject to an examination.

b. The Table of Functions and Subjective Tests in this attachment addresses pilot functions, including maneuvers and procedures (called flight tasks), and is divided by flight phases. The performance of these tasks by the NSPM includes an operational examination of special effects and any installed visual system. 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 Table of Functions and Subjective Tests in this attachment addresses the overall function and control of the FTD including the various simulated environmental conditions; simulated airplane system operation (normal, abnormal, and emergency); and visual system displays and special effects (if either are applicable) that are used to meet flightcrew 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 NSP pilot will include in his report to the TPAA, the effect of the system operation and any system limitation.

e. At the request of the TPAA, the NSP 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 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

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1. Operations: Tasks in the Operations Table are subject to evaluation if appropriate for the airplane simulated as indicated in the SOQ Configuration List and/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.			
a. Preparation For Flight Preflight. Accomplish a functions check of all installed switches, indicators, systems, and equipment at all crewmembers' and instructors' stations, and determine that the cockpit (or flight deck area) design and functions replicate the appropriate airplane or set of airplanes.	**X**	**X**	**X**
b. Surface Operations (Pre-Take-Off)			
(1) Engine Start			
(a) Normal start.	**X**	**X**	**X**
(b) Alternate start procedures.	**X**	**X**	**X**
(c) Abnormal starts and shutdowns (hot / hung start, etc.).	**X**	**X**	**X**
(2) Pushback/Powerback (as applicable, powerback requires visual system).	**X**	**X**	**X**
(3) Taxi			
(a) Thrust response.	**X**	**X**	**X**
(b) Power lever friction.	**X**	**X**	**X**
(c) Ground handling.	**X**	**X**	**X**
(d) Nose wheel scuffing.	**X**	**X**	**X**
(e) Brake operation (normal and alternate/emergency).	**X**	**X**	**X**
(f) Ground Hazard (if applicable) requires visual system.	**X**	**X**	**X**
(g) Surface Movement and Guidance System (if applicable) requires visual system.	**X**	**X**	**X**
c. Take-Off (1) Normal			
(a) Propulsion system checks (e.g., engine parameter relationships; propeller and mixture controls).	**X**	**X**	**X**
(b) Airplane acceleration characteristics.	**X**	**X**	**X**
(c) Nose wheel and rudder steering.	**X**	**X**	**X**
(d) Crosswind (maximum demonstrated).	**X**	**X**	**X**
(e) Special performance.	**X**	**X**	**X**
(f) Instrument.	**X**	**X**	**X**
(g) Landing gear, wing flap, leading edge device operation.	**X**	**X**	**X**
(2) Abnormal/emergency.	**X**		
(a) Rejected, with brake fade (if applicable) due to rising brake temperature.	**X**	**X**	**X**
(b) Rejected special performance.	**X**	**X**	**X**
(c) Flight control system failure modes.	**X**	**X**	**X**
d. Inflight Operations			
(1). Climb (a) Normal.	**X**	**X**	**X**
(2) Cruise.			

(a) Performance characteristics (speed vs. power).	X	X	X
(b) Normal turns and turns with/without spoilers (speed brake) deployed.	X	X	X
(c) High altitude handling.	X	X	X
(d) High indicated airspeed handling, overspeed warning	X	X	X
(e) Mach effects on control and trim.	X	X	X
(f) Naormal and steep turns	X	X	X
(g) Performance turns	X	X	X
(h) Approach to stalls in the following configurations: (i) cruise; (ii) takeoff or approach; and (iii) landing.	X	X	X
(i) High angle of attack maneuvers in the following configurations: (i) cruise; (ii) takeoff or approach; and (iii) landing.	X	X	X
(j) Inflight engine shutdown (as applicable, procedures only).	X	X	X
(k) Inflight engine restart (as applicable, procedures only).	X	X	X
(l) Maneuvering with one or more engines inoperative (as applicable, procedures only)..	X	X	X
(m) Slow flight.	X	X	X
(n) Specific flight characteristics.	X	X	X
(o) Manual flight control reversion (i.e., loss of all flight control power).	X	X	X
(p) Other flight control system failure modes.	X	X	X
(q) Holding.	X	X	X
(r) Airborne hazard (if applicable, requires visual system).	X	X	X
(s) Operations during icing conditions.	X	X	X
(t) Traffic alert and collision avoidance.	X	X	X
(u) Effects of airframe icing.	X	X	X
(3) Descent.			
(a) Normal.	X	X	X
(b) Maximum rate (clean,with speedbrake extended, etc) and recovery.	X	X	X
(c) Flight control system failure modes (e.g., manual flight control reversion, split controls, etc.).	X	X	X
(d) High rate of sink and recovery.	X	X	X
e. Approaches *Those instrument approach and landing tests relevant to the simulated airplane type should be selected from the following list. Some tests should be made with limiting wind velocities, under windshear conditions, and with relevant system failures, including the failure of the Flight Director.* **(1) Instrument Approach Maneuvers.**			
(a) Non-precision:	X	X	X
(i) Non-Directional Beacon (NDB).	X	X	X
(ii) VHF Omni-Range (VOR), Area Navigation (RNAV), Tactical Air Navigation (TACAN).	X	X	X
(iii) Distance Measuring Equipment, Arc (DME ARC).	X	X	X
(iv) ILS Localizer Back Course (LOC/BC).	X	X	X
(v) Localizer Directional Aid (LDA), ILS Front Course Localizer (LOC), Simplified Direction Facility (SDF).	X	X	X
(vi) Airport Surveillance Radar (ASR).	X	X	X

(vii) Global Positioning System (GPS).	X	X	X
(viii) Missed approach.	X	X	X
(b) Precision:	X	X	X
(i) Instrument Landing System (ILS).	X	X	X
A. Category I published.	X	X	X
(i) Manually controlled with and without flight director to 100 feet below published decision height.	X	X	X
(ii) With maximum demonstrated crosswind..	X	X	X
(iii) B. Category II published – with and without use of autopilot, autothrottle, and autoland, as applicable.	X	X	X
C. Category III published:	X	X	X
(i) With minimum/standby electrical power.	X	X	X
(ii) With generator/alternator failure (transient).	X	X	X
(iii) With 10 knot tail wind.	X	X	X
(iv) With 10 knot crosswind.	X	X	X
D. Missed approach.	X	X	X
(ii) Precision Approach Radar (PAR)	X	X	X
A. Normal.	X	X	X
B. With crosswind.	X	X	X
C. Missed approach.	X	X	X
(iii) Digital Global Positioning System (DGPS).	X	X	X
A. Normal.	X	X	X
B. With crosswind.	X	X	X
C. Missed approach.	X	X	X
(iv) Microwave Landing System (MLS).	X	X	X
A. Normal.	X	X	X
B. With crosswind.	X	X	X
C. Missed approach.	X	X	X
(v) Steep Glide Path.	X	X	X
A. Normal.	X	X	X
B. With crosswind.	X	X	X
C. Missed approach.	X	X	X
(2) Visual Approach Maneuvers (if applicable, requires visual system).			
(a) Abnormal wing flaps/slats.	X	X	X
(b) Without glide slope guidance or visual vertical flightpath aid.	X	X	X
(3) Abnormal/emergency.	X	X	X
(a) With standby (or minimum) electric/hydraulic power.	X	X	X
(b) With longitudinal trim malfunction.) Approach to land with windshear on approach.	X	X	X
(c) With jammed or mis-trimmed horizontal stabilizer.	X	X	X
(d) With lateral-directional trim malfunction.	X	X	X
(e) With worst case failure of flight control system (most significant degradation of the computer controlled airplane which is not extremely improbable).	X	X	X
(f) Other flight control system failure modes as dictated by training program	X	X	X
(g) Land and hold short operations.	X	X	X

f. Missed Approach.			
(1) Manual.	X	X	X
(2) Automatic (if applicable).	X	X	X
g. Any Flight Phase.			
(1) Air conditioning.	X	X	X
(2) Anti-icing/deicing.	X	X	X
(3) Auxiliary powerplant.	X	X	X
(4) Communications.	X	X	X
(5) Electrical.	X	X	X
(6) Fire detection and suppression.	X	X	X
(7) Flaps.	X	X	X
(8) Flight controls (including spoiler/speedbrake).	X	X	X
(9) Fuel and oil.	X	X	X
(10) Hydraulic.	X	X	X
(11) Landing gear.	X	X	X
(12) Oxygen.	X	X	X
(13) Pneumatic.	X	X	X
(14) Propulsion System.	X	X	X
(15) Pressurization.	X	X	X
(16) Flight management and guidance systems.	X	X	X
(17) Automatic landing aids.	X	X	X
(18) Automatic pilot.	X	X	X
(19) Thrust management/auto-throttle.	X	X	X
(20) Flight data displays.	X	X	X
(21) Flight management computers.	X	X	X
(22) Flight director/system displays.	X	X	X
(23) Flight instruments.	X	X	X
(24) Heads-up flight guidance system.	X	X	X
(25) Navigation systems.	X	X	X
(26) Weather radar system.	X	X	X
(27) Stall warning/avoidance.	X	X	X
(28) Stability and control augmentation.	X	X	X
(29) ACARS.	X	X	X
h. Engine Shutdown and Parking.			
(1) Systems operation.	X	X	X
(2) Parking brake operation..	X	X	X
i. 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.			
(1) Power Switch(es)	X	X	X
(2) Airplane conditions.			
(a) Gross weight, center of gravity, fuel loading and allocation, etc	X	X	X
(b) Airplane systems status.	X	X	X
(c) Ground crew functions (e.g., ext. power, push back, etc.)	X	X	X
(3) Airports.			
(a) Selection.	X	X	X

(b) Runway selection.	**X**	**X**	**X**
(c) Preset positions (e.g. ramp, over FAF, etc.)	**X**	**X**	**X**
(4) Environmental controls.			
(a) Temperature.	**X**	**X**	**X**
(b) Climate conditions (e.g., ice, rain, etc.).	**X**	**X**	**X**
(c) Wind speed and direction.	**X**	**X**	**X**
(5) Airplane system malfunctions.			
(a) Insertion / deletion.	**X**	**X**	**X**
(b) Problem clear.	**X**	**X**	**X**
(6) Locks, Freezes, and Repositioning.			
(a) Problem (all) freeze / release.	**X**	**X**	**X**
(b) Position (geographic) freeze / release.	**X**	**X**	**X**
(c) Repositioning (locations, freezes, and releases).	**X**	**X**	**X**
(d) Ground speed control.	**X**	**X**	**X**
(7) Remote IOS.	**X**	**X**	**X**
j. Sound Controls. On / off / adjustment	**X**	**X**	**X**
k. Control Loading System (as applicable).			
(a) On / off / emergency stop.	**X**	**X**	**X**
l. Observer Stations.			
(1) Position.	**X**	**X**	**X**
(2) Adjustments.	**X**	**X**	**X**

End QPS Requirements

Attachment 4 to Appendix B to Part 60--

SAMPLE DOCUMENTS

Begin Information

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Title of Sample

Attachment 4 to Appendix B to Part 60—

Figure 1 – Sample Letter , Request for Initial, Upgrade, or Reinstatement Evaluation..

INFORMATION

Edward Cook, PhD.
Manager, National Simulator Program
Federal Aviation Administration
P.O. Box 20636 (AFS-205)
Atlanta, GA 30320

Dear Dr. Cook:

RE: Request for Initial [Upgrade / Reinstatement] Evaluation

(Sponsor's name) ___________________ requests your evaluation of our (make, model, series) ________ airplane FTD for Level ______ qualification, located in (City/State) at the (Facility) on (proposed evaluation date). [The proposed evaluation date must not be more than 180 days following the date of this letter.] This FTD [has / has not] been previously qualified by the FAA [and had been issued FAA identification number XXX]. Under separate cover, we have asked our Principal Operations Inspector (POI) (Training Center Program Manager, TCPM), Mr./Ms.__________________(Name), to forward to you a letter concurring with this request.

[The history of this FTD is as follows: ____.]

We agree to provide a Qualification Test Guide (QTG) to your staff not later than 45 days prior to the proposed evaluation date [if tests not run at training site, an additional "1/3 on-site" tests must be provided not later than 14 days prior the proposed evaluation date]. If we are unable to meet the above date for the evaluation, this may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation. With our forwarding the QTG, we acknowledge that the FTD meets all applicable requirements of Title 14 of the Code of Federal Regulation (14 CFR) Part 60; that it meets the requirements of the Airplane Flight Training Device Qualification Performance Standards (QPS); and that appropriate hardware and software configuration control procedures have been established.

We also agree to forward to you, not later than five (5) business days prior to the scheduled evaluation of this FTD, a confirmation statement that will include the following information:

1. That (a) pilot(s) we have designated, who is(are) qualified on the (make, model, series) _______ airplane, has(have) assessed the FTD and found that the performance and flying qualities of the FTD represent the (make, model, series) _______ airplane. This determination will be made after flying all the maneuvers and procedures and exercising the tasks listed in the Table of Functions and Subjective Tests in Attachment 3 to the Airplane FTD QPS (except for those listed in the attachment to this letter).

2. That (a) pilot(s), or (an)other person(s) we have designated, has(have) found the FTD systems and sub-systems (including simulated aircraft systems) functionally represent the (make, model, series) ________ airplane. This determination will be made after having exercised the operation of the FTD

and the functions available through the Instructor Operating Station.

3. That, for type specific airplanes, (a) pilot(s), or (an)other person(s) we have designated, has(have) found the cockpit configuration represents the configuration of the (make, model, and series) ________ aircraft.

The names of the person(s) providing this information will be available to you upon your request.

[Added comments from Operator/Sponsor, if any]

Please contact (Name and Telephone Number of Sponsor's Contact) to confirm the date for this initial (upgrade / re-instatement) evaluation. We understand a member of your National Simulator Program staff will respond to this request within 14 days.

Sincerely,

(Signature –Management Representative)

Attachment 4 to Appendix B to Part 60—

Figure 2 – 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: ___________
Manager, National
Simulator Program, FAA

Attachment 4 to Appendix B to Part 60—
Figure 3 – Sample Simulator Information Page
INFORMATION

SPONSOR NAME	
SPONSOR SIMULATOR CODE:	BA-797 #1
AIRPLANE MODEL:	Stratos BA797-320A
AERODYNAMIC DATA REVISION:	BA797-320, CPX-8D, January 1988
ENGINE MODEL(S) AND REVISION:	CPX-8D; RPT-6, January 1988 DRQ-4002, RPT-3, April 1991
FLIGHT CONTROLS DATA REVISION:	BA707-320; May 1988
FLIGHT MANAGEMENT SYSTEM:	Berry XP
FTD MODEL AND MANUFACTURER:	MTD-797, Tinker Simulators, Inc.
DATE OF FTD MANUFACTURE:	1988
FTD COMPUTER:	CIA
VISUAL SYSTEM MODEL, MANUFACTURER, and DISPLAY TYPE:	ClearView, Inc. "Real World T2;" 5 Channel, 6-window CRT display
VISUAL SYSTEM COMPUTER:	LMB-6
MOTION SYSTEM:	N/A

Information on this page must be updated and kept current with any modifications or changes made to the simulator and reflected on the log of revisions and the list of effective pages.

Attachment 4 to Appendix B to Part 60—
Figure 4 – Sample Statement of Qualification

Federal Aviation Administration
National Simulator Program

Statement
of
Qualification

This is to certify that representatives of the
National Simulator Program
Completed an evaluation of the

Go-Fast Training Center
Stratos BA-797 Flight Training Device

FAA Identification Number 721

And found it to meet the standards set forth
In the Qualification Performance Standards
For a Flight Training Device at

Level 6

________________________ (date)

________________________ for the NSPM

Subject to the attached
Configuration List and Restrictions

Attachment 4 to Appendix B to Part 60—

Figure 4A – Sample Statement of Qualification; Configuration List

INFORMATION

STATEMENT of QUALIFICATION
CONFIGURATION LIST
Go-Fast Training Center Stratos BA-797-232 -- Level C -- FAA ID# 701

Configuration		Date Qualified
Airplane Model:.......................... Re-configurable to:..................	BA-797-232................................... BA-797-287 (see FAA ID#722)	July 12, 1988
Engine Model -- **Revision:**...	CPX-8D, RPT-6........................ DRQ-4002, RPT-3....................	July 12, 1988 April 1, 1991
Flight Management System:.......	Berry XP..	July 12, 1988
Visual System / Manufacturer: CRT Installation:...................	Real World T2, Clear View, Inc. 5 Channel, 6 Window....................	 July 12, 1988
Flight Instruments: Electro-Mechanical:................ Heads-Up Display..................	 .... Jones Industries..............................	 July 12, 1988 December 1, 1993
Flight Director: Dual Cue................................	 Sperry..	 July 12, 1988
Engine Instruments: Electro-Mechanical.................		 July 12, 1988
Navigation Type(s): ADF....................................... VOR/ILS............................... INS.......................................		 July 12, 1988 July 12, 1988 October 10, 1991
Weather Radar:	Jones Industries, Inc.	August 3, 1996
Windshear Equipment		July 12, 1988
TCAS		October 9, 2003
	(Continue as Necessary)	

Attachment 4 to Appendix B to Part 60—
Figure 4B – Sample Statement of Qualification
Qualified / Non-Qualified Maneuvers, Procedures, Tasks, Functions

INFORMATION

STATEMENT of QUALIFICATION

Qualified / Non-Qualified Maneuvers, Procedures, Tasks, Functions
Go-Fast Training Center
Stratos BA-797 -- Level 6 -- FAA ID# 721

The FTD is qualified to perform all of the Maneuvers, Procedures, Tasks, and Functions listed in the Table of Functions and Subjective Tests,
Part 60, Appendix B, Attachment 3,
In Effect on [mm/dd/yyyy] except for the following listed Tasks or Functions.

(*Example*)

Non-Qualified Operations Tasks and Functions

1.b.(2) Power Back.
1.b.(3)(g) Other (SMGCS).
1.c.(1) Normal Takeoff, Daylight Conditions.
1.g.(7) Flaps

Non-Qualified Simulator Systems:

6.g. Remote IOS

Additional Qualified Tasks or Functions in addition to those listed in the Table of Functions and Subjective Tests, Part 60, Appendix B, Attachment 3.

(None)

Attachment 4 to Appendix B to Part 60—
Figure 5 – Sample Continuing Qualification Evaluation Requirements Page Information

Recurrent Evaluation Requirements

Completed at conclusion of Initial Evaluation

Recurrent Evaluations to be conducted each _(fill in)__ months Allotting ______ hours of FTD time. Signed: ___________________________________ NSPM / Evaluation Team Leader	Recurrent evaluations are due as follows: _(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate) _______________________ Date

Revision:

Based on (enter reasoning):

Recurrent Evaluations are to be conducted each _(fill in)__ months. Allotting ______ hours. Signed: ___________________________________ NSPM Evaluation Team Leader	Recurrent evaluations are due as follows: _(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate) _______________________ Date

Revision:

Based on (enter reasoning):

Recurrent Evaluations are to be conducted each _(fill in)__ months. Allotting ______ hours. Signed: ___________________________________ NSPM Evaluation Team Leader	Recurrent evaluations are due as follows: _(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate) _______________________ Date

(Repeat as Necessary)

Attachment 4 to Appendix B to Part 60—
Figure 6 – Sample MQTG Index of Effective FSTD Directives.

INFORMATION

Index of Effective FSTD Directives
Filed in this Section

Notification Number	**Received From: (TPAA/NSPM)**	**Date of Notification**	**Date of Modification Completion**

Continue as Necessary....

Appendix C to Part 60--Qualification Performance Standards for Helicopter Flight Simulators

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Begin Information

This appendix establishes the standards for Helicopter Flight Simulator evaluation and qualification. The Flight Standards Service, National Simulator Program (NSP) staff, under the direction of the NSP Manager (NSPM), is responsible for the development, application, and interpretation of the standards contained within this appendix. The procedures and criteria specified in this document will be used by the NSPM, or a person or persons assigned by the NSPM (e.g., FAA pilots and/or FAA aeronautical engineers, assigned to and trained under the direction of the NSP--referred to as NSP pilots or NSP engineers, other FAA personnel, etc.) when conducting helicopter flight simulator evaluations.

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6. Sponsor Qualification Requirements (§ 60.7).
7. Additional Responsibilities of the Sponsor (§ 60.9).
8. Simulator Use (§ 60.11).
9. Simulator Objective Data Requirements (§ 60.13).
10. Special Equipment and Personnel Requirements for Qualification of the Simulator (§ 60.14).
11. Initial (and Upgrade) Qualification Requirements (§ 60.15).
12. Additional Qualifications for a Currently Qualified Simulator (§ 60.16).
13. Previously Qualified Simulators (§ 60.17).
14. Special Equipment and Personnel Requirements for Qualification of the Simulator (§ 60.14).
15. Logging Simulator Discrepancies (§ 60.20).
16. Interim Qualification of Simulators for New Helicopter Types or Models (§ 60.21).
17. Modifications to Simulators (§ 60.23).
18. Operation with Missing, Malfunctioning, or Inoperative Components (§ 60.25).
19. Automatic Loss of Qualification and Procedures for Restoration of Qualification (§ 60.27).
20. Other Losses of Qualification and Procedures for Restoration of Qualification (§ 60.29).
21. Recordkeeping and Reporting (§ 60.31).
22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements (§ 60.33).
23. [Reserved].
24. [Reserved].

1. Introduction

Begin Information

a. This appendix contains background information as well as material that is either directive or informative in nature as described later in this section. Except for this Introduction section, the directive or the informative material is presented in sections that correspond with sections of part 60. This material provides additional requirements and/or provides information regarding that subject. Some sections will have neither additional regulatory or informational material. In these instances the corresponding section in the Table of Contents will show "(No Info)."

b. To assist the reader in determining what areas are directive
or required and what areas are guiding or permissive—

(1) The text in this appendix is contained within one of two sections: regulatory requirements that are in addition to the requirements in part 60 but are found only in this appendix, referred to as “QPS Requirements;” and advisory or informative material, referred to as “Information.”

(2) The text presented between horizontal lines beginning with the heading “Begin QPS Requirements” and ending with the heading “End QPS Requirements,” contains the regulatory requirements that are in addition to the requirements in the body of the part 60 language but found only in this appendix.

(3) The text presented between horizontal lines beginning with the heading “Begin Information” and ending with the heading “End Information,” is advisory or informative.

(4) The tables in this appendix have rows across the top of each table--

(a) The data presented in columns under the heading ``QPS REQUIREMENTS'' is regulatory but is found only in this appendix.

(b) The data presented in columns under the heading ``INFORMATION'' is advisory or informative.

c. Questions regarding the contents of this publication should be sent to: U.S. Department of Transportation, Federal Aviation

Administration, Flight Standards Service, National Simulator Program Staff, AFS-205, PO Box 20636 Atlanta, Georgia 30320. Telephone contact numbers are: phone, 404-305-6100; fax, 404-305-6118. The National Simulator Program Internet Web Site address is: http://frwebgate.access.gpo.gov/cgi-bin/leaving.cgi?from=leavingFR.html&log=linklog&to=http://www.faa.gov/nsp. On this Web Site you will find an NSP personnel list with contact information, a list of qualified flight simulation devices, advisory circulars, a description of the qualification process, NSP policy, and an NSP ``In-Works'' section. Also linked from this site are additional information sources, handbook bulletins, frequently asked questions, a listing and text of the Federal Aviation Regulations, Flight Standards Inspector's handbooks, and other FAA links.

d. The NSPM encourages the use of electronic media for communication and the gathering, storage, presentation, or transmission of any record, report, request, test, or statement required by this QPS provided the media used has adequate provision for security and is acceptable to the NSPM. The NSPM recommends inquiries on system compatibility prior to any such activity. Minimum System requirements may be found on the NSP Web site.

e. Related Reading References

(1) 14CFR part 60

(2) 14CFR part 61.

(3) 14CFR part 63.

(4) 14CFR part 119

(5) 14CFR part 121.

(6) 14CFR part 125

(7) 14CFR part 135.

(8) 14CFR part 141

(9) 14CFR part 142

(10) Advisory Circular (AC) 120-28C, Criteria for Approval of Category III Landing Weather Minima.

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

(12) AC 120-35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.

(13) AC 120-41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.

(14) AC 120-57A, Surface Movement Guidance and Control System (SMGS).

(15) AC 150/5300-13, Airport Design.

(16) AC 150/5340-1G, Standards for Airport Markings.

(17) AC 150/5340-4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.

(18) AC 150/5340-19, Taxiway Centerline Lighting System.

(19) AC 150/5340-24, Runway and Taxiway Edge Lighting System.

(20) AC 150/5345-28D, Precision Approach Path Indicator (PAPI) Systems

(21) International Air Transport Association document, “Flight Simulator Design and Performance Data Requirements," as amended

(22) AC 29-2B, Flight Test Guide for Certification of Transport Category Rotorcraft.

(23) AC 27-1A, Flight Test Guide for Certification of Normal Category Rotorcraft.

(24) International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, as amended.

(25) Airplane Flight Simulator Evaluation Handbook, Volume I, as amended and Volume II, as amended, The Royal Aeronautical Society, London, UK.

(26) FAA Publication FAA-S-8081 series (Practical Test Standards for Airline Transport Pilot Certificate, Type Ratings, Commercial Pilot, and Instrument Ratings).

(27) The FAA Aeronautical Information Manual (AIM), FAA Handbook XXXXX

f. Background

(1) The FAA has been involved in flight simulator evaluation and approval for well over three decades. As far back as 1954, air carriers were allowed to perform limited proficiency check maneuvers in airplane simulators. Credit for the use of these devices was hampered by the state of the technology available in early simulator development. More recently, however, rapid technological advances have permitted and encouraged the expanded use of flight simulators in the training and checking of flightcrew members. In addition, the complexity, operating costs, and operating environment of modern aircraft have lead to the increasing use of advancing simulator technology. Extensive experience has proven that modern simulators can provide more in-depth training than can be accomplished in the aircraft as well as provide a very high transfer of learning and behavior from the simulator to the aircraft. Additionally, their use, in lieu of aircraft, results in safer flight training and cost reductions for the operators, while achieving fuel conservation and a significant reduction in environmental impact.

(2) In recognition of expanding flight simulator capabilities, as technology has progressed, regulatory revisions have been developed to permit the increased use of airplane simulators in approved training programs. However, the helicopter simulators in use today, in large part, have been evaluated and approved on a case-by-case basis. Previously, those persons using helicopter simulators had received credit for training or checking only through exemption to the regulations. While this situation is changing, the regulations regarding the use of helicopter simulators have not kept pace with their airplane counterparts--and has resulted in rather limited use of helicopter simulators to meet regulatory required training, testing, or checking activities.

(3) The same factors that have led to the widespread use and acceptance of airplane simulators, such as technological advancements, aircraft complexity, operating cost, operating environment, enhanced training, safety, environmental impact, etc. have recently spurred a dramatic increase in interest in helicopter simulators. The FAA anticipates that the use of helicopter simulators will expand rapidly and that applicable regulations will be amended to extend formal credit to the use of these simulators in FAA-approved flight training programs.

(4) For information purposes, the following is a chronological listing of the documents preceding this document that have addressed the qualification criteria for helicopter simulator evaluation and qualification by the FAA, including the effective dates of those documents:

AC 120-63--10/11/94 to (date TBD)

End Information

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2. Applicability (§§ 60.1 & 60.2)

There is no additional regulatory or informational material that 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.

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3. Definitions (§ 60.3)

Begin Information

See Appendix F 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)

There is no additional regulatory or informational material that applies to § 60.4, Qualification Performance Standards.

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5. Quality Management System (§ 60.5).

Begin Information

Additional regulatory material and informational material regarding Quality Management Systems for Flight Simulation Training Devices may be found in appendix E of this part.

End Information

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6. Sponsor Qualification Requirements (§ 60.7).

Begin Information

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

b. To assist in avoiding confusion regarding the requirements for use of a qualified simulator the following examples/descriptions are provided to describe acceptable operational practices:

(1) Example One.

a. A sponsor is sponsoring a single, specific simulator for their own use, in their own facility or elsewhere – this single simulator forms the basis for the sponsorship. The sponsor uses that simulator 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:

(i) If the simulator was qualified prior to [insert the effective date of this rule] the 12-month period begins on the date of the first NSPM-conducted continuing qualification after [insert the effective date of this rule] and continues for each subsequent 12-month period;

(ii) If the simulator satisfactorily completes an initial or upgrade evaluation on or after [insert the effective date of this rule] the 12-month period begins on the date of that completed initial or upgrade evaluation and continues for each subsequent 12-month period.

b. There is no minimum number of hours or minimum simulator periods required.

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

(2) Example Two.

a. A sponsor sponsors an additional number of simulators, in their facility or elsewhere. Each such additionally sponsored simulator 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)] 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 in the same manner as in example one);

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)] at least once in each 12-month period in that certificate holder's FAA-approved flight training program for the helicopter simulated (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 simulator or another simulator, during the preceding 12-month period) stating that the subject simulator'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 or minimum simulator periods required.

(3) Example Three.

a. A sponsor (in this example, a Part 142 certificate holder) in "New York" (having at least one simulator used at least once per year in the sponsor's FAA-approved flight training program) establishes a "satellite" training center in "Chicago" and/or a satellite center in "Moscow."

b. The satellite function means that the "Chicago" and/or "Moscow" center(s) 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, etc.).

c. All of the simulators in the "Chicago" center and/or the "Moscow" center could be dry-leased (i.e., the certificate holder does not have and utilize FAA-approved flight training programs for the simulators in the "Chicago" and/or the "Moscow" center) because –

(i) Each simulator in the "Chicago" center and/or each simulator 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 simulator or another simulator during the preceding 12-month period) stating that the performance and handling qualities of each simulator in the "Chicago" center and/or each simulator in the "Moscow" center represent the helicopter [as described in § 60.7(d)(2)].

End Information

7. Additional Responsibilities of the Sponsor (§ 60.9).

Begin Information

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

End Information

8. Simulator Use (§ 60.11).

There is no additional regulatory or informational material that applies to § 60.11, Simulator Use.

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9. Simulator Objective Data Requirements

Begin QPS Requirements

a. The simulator sponsor must 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/or, if appropriate, with the person having supplied the aircraft data package for the simulator in order to facilitate the notification described in this paragraph. The sponsor must immediately notify the NSPM when 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/or operate a qualified simulator. 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 notification must also provide technical information about this data to the NSPM relative to the data's significance for training, evaluation, or flight experience activities in the simulator.

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

(1) A flight test plan, that contains:

(a) The required maneuvers and procedures.

(b) For each maneuver or procedure --

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

(ii) The atmospheric and environmental conditions.

(iii) The initial flight conditions.

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

(v) The data that is to be gathered.

(vi) Any other appropriate factors.

(2) Appropriately qualified flight test personnel.

(3) An understanding of the accuracy of the data to be gathered.

(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.

(5) Calibration of data acquisition equipment and helicopter performance instrumentation must be current and traceable to a recognized standard.

c. The data, regardless of source, must be presented:

(1) in a format that supports the flight simulator 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 of this appendix.

(4) with any necessary guidance information provided; and

(5) without alteration, adjustments, or bias; however the data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation.

d. 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 simulator at the level requested.

End QPS Requirements

Begin Information

e. It is the intent of the NSPM 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 NSPM for approval, a descriptive document (a validation data roadmap) 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 rationale or explanations for cases where data or data parameters are missing, where engineering simulation data are used, where flight test methods require further explanations, etc. and provide a brief narrative describing the cause and effect of any deviation from data requirements. This document may be provided by the aircraft manufacturer.

f. There is no requirement for any flight test data supplier to submit a flight test plan/program prior to gathering flight test data. However, the NSP staff has experience that indicates at least some data gatherers, primarily those that do not have a satisfactory "history" of supplying such data, often provide data that is irrelevant, not properly marked, without adequate justification for selection, without adequate information regarding initial conditions, without adequate information regarding the test maneuver, etc. The NSP staff has been forced to not accept such data submissions as validation data for simulator evaluation. It is for this reason that the NSP staff recommends that any data supplier not previously experienced in this area review the data necessary for programming and for validating the performance of the simulator and discuss the flight test plan anticipated for acquiring such data with the NSP staff well in advance of commencing the flight tests.

g. The NSPM will consider, on a case-by-case basis, whether or not 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 Simulator (§ 60.14).

Begin Information

a. In the event that the NSPM determines that special equipment or (a) specifically qualified person(s) will be required for the conduct of any evaluation, the NSPM 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, sound analyzer, etc. Examples of specially qualified personnel would be those specifically qualified to install or use any special equipment when its use is required.

b. Examples of a special evaluation would be an evaluation conducted after the move of a simulator; at the request of the TPAA; as a result of comments received from users of the simulator that, upon analysis and confirmation, might cause a question as to the continued qualification or use of the simulator; etc.

End Information

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11. Initial (and Upgrade) Qualification Requirements (§ 60.15).

Begin QPS Requirements

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

(1) A statement that the FSTD 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 NSPM 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 NSPM via traditional or electronic means.

(3) A qualification test guide (QTG), acceptable to the NSPM, that includes all of the following:

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

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

(iii) The result of FSTD performance demonstrations prescribed in the appropriate QPS.

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

b. 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 of this appendix.

c. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, to the NSPM 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 automatically and manually conducted tests;

(3) A means of comparing the simulator's test results to the objective data;

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

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

d. 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 2, for a sample QTG cover page).

(2) A continuing qualification evaluation schedule requirements page – to be used by the NSPM to establish and record the frequency with which continuing qualification evaluations must be conducted and any subsequent changes that may be determined by the NSPM. See Attachment 4, Figure 4, for a sample Continuing Qualification Evaluation Schedule Requirements page.

(3) A simulator information page that provides the information listed in this paragraph (see Attachment 4, Figure 3, for a sample simulator information page). For convertible simulators, a separate page is submitted for each configuration of the simulator.

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

(b) The helicopter model and series being simulated.

(c) The aerodynamic data revision number or reference.

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

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

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

(g) The simulator model and manufacturer.

(h) The date of simulator manufacture.

(i) The simulator computer identification.

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

(k) 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's) with certain requirements. SOC's must provide references to the sources of information for showing the capability of the simulator to comply with the requirement, a rationale explaining how the referenced material is used, mathematical equations and parameter values used, and the conclusions reached; i.e. that the simulator complies with the requirement. Refer to the "Additional Details" column in attachment 1, "Simulator Standards," or in the “Test Details” column in attachment 2, “Simulator Objective Tests,” to see when SOC's are required.

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

(10) The following information for each objective test designated in attachment 2, 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 simulator 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.

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

(1) The sponsor's simulator test results must be recorded in a manner, acceptable to the NSPM, that will allow easy comparison of the simulator test results to the validation data (e.g., use of a multi-channel recorder, line printer, cross plotting, overlays, transparencies, etc.).

(2) Simulator 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 of this appendix.

(5) For tests involving time histories, data sheets (or transparencies thereof) and simulator test results must be clearly marked with appropriate reference points to ensure an accurate comparison between simulator 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 must not obscure the reference data.

f. The sponsor may elect to complete the QTG objective tests at the manufacturer’s facility. Tests performed at this location must be conducted after assembly of the simulator has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate simulator performance at the sponsor's training facility by repeating a representative sampling of all the objective tests in the QTG and submitting these repeated test results to the NSPM. This sample must consist of at least one-third of the QTG objective tests. The QTG must be clearly annotated to indicate when and where each test was accomplished.

g. While the subjective tests are normally accomplished at the sponsor's training facility, the sponsor may elect to complete the subjective tests at the manufacturer's facility. Tests performed at this location will be conducted after assembly of the simulator has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate simulator performance at the sponsor's training facility by having the pilot(s) who performed these tests originally (or similarly qualified pilot(s)), repeat a representative sampling of these subjective tests (need not take more than one normal simulator period – e.g., 4 hours) and submit a statement to the NSPM that the simulator has not changed from the original determination. This statement must clearly indicate when and where these repeated tests were completed.

h. The sponsor must maintain a copy of the MQTG at the simulator location. j. All simulators for which the initial qualification is conducted after [insert 6 years after effective date of this rule] 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 simulator (reformatted or digitized) as prescribed in this appendix, the general simulator performance or demonstration results (reformatted or digitized) prescribed in this appendix, and a description of the equipment necessary to perform the evaluation for initial qualification and the continuing qualification evaluations for continuing qualification. This eMQTG must include the original validation data used to validate simulator 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. An eMQTG must be provided to the NSPM.

i. All other simulators (not covered in subparagraph “i”) must have an electronic copy of the MQTG by and after [insert 6 years after effective date of this rule], a copy of which must be provided to the NSPM. This may be provided by an electronic scan presented in a Portable Document File (PDF), or similar format, acceptable to the NSPM.

End QPS Requirements

Begin Information

j. Only those simulators that are sponsored by a certificate holder (as defined for use in part 60 and this QPS appendix) will be evaluated by the NSPM. However, other simulator evaluations may be conducted on a case-by-case basis as the Administrator deems appropriate, but only in accordance with applicable agreements.

k. Each simulator must be evaluated as completely as possible. To ensure a thorough and uniform evaluation, each simulator is subjected to the general simulator requirements and performance demonstrations in attachment 1, the objective tests listed in attachment 2, and the subjective tests listed in attachment 3 of this appendix. The evaluation(s) described herein will include, but not necessarily be limited to the following, as appropriate, for the qualification level of the simulator:

(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 NSPM in the areas of ground operations, takeoff, climb, cruise, descent, approach, and landing as well as abnormal and emergency operations (see paragraph [check reference] and attachment 2 of this appendix);

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

(4) Cockpit 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) Simulator 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 complexity of the simulator 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.

l. The NSPM administers the objective and subjective tests, which includes an examination of functions. The tests include a qualitative assessment of the simulator by an NSP pilot. The NSP 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 simulator performance and determining compliance with the requirements of this part.

(2) Subjective tests provide a basis for:

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

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

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

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

m. The tolerances for the test parameters listed in attachment 2 of this appendix are the maximum acceptable to the NSPM for simulator validation and are not to be confused with design tolerances specified for simulator manufacture. In making decisions regarding tests and test results, the NSPM 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.

n. In addition to the scheduled continuing qualification evaluation (see paragraph [check reference]), each simulator is subject to evaluations conducted by the NSPM at any time with no prior notification to the sponsor. Such evaluations would be accomplished in a normal manner (i.e., requiring exclusive use of the simulator for the conduct of objective and subjective tests and an examination of functions) if the simulator is not being used for flightcrew member training, testing, or checking. However, if the simulator were being used, the evaluation would be conducted in a non-exclusive manner. This non-exclusive evaluation will be conducted by the simulator evaluator accompanying the check airman, instructor, Aircrew Program Designee (APD), or FAA inspector aboard the simulator along with the student(s) and observing the operation of the simulator during the training, testing, or checking activities.

o. Problems with objective test results are handled according to the following:

(1) If a problem with an objective test result is detected by the NSP evaluation team during an evaluation, the test may be repeated and/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 NSPM may qualify the simulator at that lower level. For example, if a Level D evaluation is requested and the simulator fails to meet sound test tolerances, it could be qualified at Level C.

p. After the NSPM issues a statement of qualification to the sponsor when a simulator is successfully evaluated, the simulator is recommended to the TPAA, who will exercise authority on behalf of the Administrator in approving the simulator in the appropriate helicopter flight training program.

q. Under normal circumstances, the NSPM 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; however, once a schedule is agreed to, any slippage of the evaluation date at the sponsor's request may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation. A sponsor may commit to an initial evaluation date under this early process, in coordination with and the agreement of the NSPM, but the request must be in writing and must include an acknowledgment of the potential schedule impact if the sponsor slips the evaluation from this early-committed date. See Attachment 4, figure 5, Sample Request for Initial Evaluation Date.

r. A convertible simulator is addressed as a separate simulator for each model and series helicopter to which it will be converted and for the FAA qualification level sought. An NSP evaluation is required for each configuration. For example, if a sponsor seeks qualification for two models of a helicopter type using a convertible simulator, two QTG's, or a supplemented QTG, and two evaluations are required.

s. The numbering system used for objective test results in the QTG should closely follow the numbering system set out in attachment 2, Simulator Objective Tests.

t. If additional information is needed regarding the preferred qualifications of pilots used to meet the requirements of §60.15(e), the reader should contact the NSPM or visit the NSPM website.

u. Examples of the exclusions for which the simulator might not have been subjectively tested by the sponsor or the NSPM and for which qualification might not be sought or granted, as described in §60.15(h)(6), include windshear training, circling approaches, etc.

End Information

12. Additional Qualifications for a Currently Qualified Simulator (§ 60.16).

There is no additional regulatory or informational material that applies to § 60.16, Additional Qualifications for a Currently Qualified Simulator.

13. Previously Qualified Simulators (§ 60.17).

Begin QPS Requirements

a. In instances where a sponsor plans to remove a simulator from active status for prolonged periods, the following procedures will apply:

(1) The NSPM must be advised in writing and the advisement must include an estimate of the period that the simulator will be inactive;

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

(3) The NSPM will remove the simulator from the list of qualified FSTD's 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 simulator may be restored to qualified status, it will require an evaluation by the NSPM. The evaluation content and time required for accomplishment will be based on the number of continuing qualification evaluations and sponsor-conducted quarterly inspections missed during the period of inactivity. For example, if the simulator 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;

(5) The sponsor must notify the NSPM of any changes to the original scheduled time out of service;

(6) The simulator will normally be re-qualified 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 a review of the qualification basis and will likely result in the re-qualification to be against the standards in effect and current at the time of re-qualification.

End QPS Requirements

Begin Information

b. Other certificate holders or persons desiring to use a flight simulator may contract with simulator sponsors to use those simulators already qualified at a particular level for a helicopter type and approved for use within an FAA-approved flight training program. Such simulators are not required to undergo an additional qualification process, except as described in paragraph 17 of this appendix.

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

d. The intent of the requirement listed in § 60.17(b), for each simulator to have a Statement of Qualification 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 simulator 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 simulator.

e. Downgrading of a simulator is a permanent change in qualification level. If a temporary restriction is placed on a simulator because of a missing, malfunctioning, or inoperative component or some repair is in progress, the restriction is not a permanent change in qualification level and such a temporary restriction can, and is, removed when the reason for the restriction has been resolved. It would be inappropriate to permanently downgrade a simulator and, at some undetermined time in the future, allow that simulator to be returned to its original status (i.e., accomplish an "upgrade") using the original qualification standards.

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 in this sequence will be developed by the sponsor and will be acceptable to the NSPM.

b. The description of what constitutes the functional preflight inspection will be contained in the sponsor's QMS.

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

End QPS Requirements

Begin Information

d. In determining the acceptability of the sponsor's test sequence and the content of each quarterly inspection required in § 60.19(a)(1), the NSPM looks for a balance and a mix from the performance demonstrations and 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 simulator systems.

e. If the NSP 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. These tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests.

f. The continuing qualification evaluations, described in § 60.19(b), normally will require 4 hours of simulator time. Flexibility is necessary to address those situations that are not normal or those that involve aircraft with additional levels of complexity (e.g. computer controlled aircraft) and may require additional time. The continuing qualification evaluations will consist of the following:

(1) Review of the results of the objective tests and all the designated simulator performance demonstrations (quarterly inspections) conducted by the sponsor since the last scheduled continuing qualification evaluation.

(2) At the discretion of the evaluator, a selection of approximately 8 to 15 objective tests from the MQTG, that will, in the opinion of the evaluator, provide an adequate opportunity to evaluate, first hand, the performance of the simulator. The tests chosen will be performed either automatically or manually, at the discretion of the evaluator and should be able to be conducted within approximately one-third (1/3) of the allotted simulator time.

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

(4) An examination of the functions of the simulator, to include, but not necessarily limited to, 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 noted in subparagraph d(3).

g. The requirement established in § 60.19(b)(4) regarding the frequency of NSPM-conducted continuing qualification evaluations for each simulator is typically 12 months. However, the establishment and satisfactory operation of an approved quality management system for a sponsor will provide a basis for adjusting the interval between evaluations on some simulators at a given sponsor's location to exceed this 12-month interval.

End Information

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15. Logging Simulator Discrepancies (§ 60.20).

There is no additional regulatory or informational material that applies to § 60.20. Logging Simulator Discrepancies.

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16. Interim Qualification of Simulators for New Helicopter Types or Models (§ 60.21).

There is no additional regulatory or informational material that applies to § 60.21, Interim Qualification of Simulators for New Helicopter Types or Models.

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17. Modifications to Simulators (§ 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:

(i) All the applicable objective tests that have been run with the modification incorporated, including any necessary updates to the MQTG must be acceptable to the NSPM; and

(ii) The sponsor must provide the NSPM with a statement signed by the MR that the factors cited in § 60.15(b) are addressed by the appropriate personnel as described in that section.

End QPS Requirements

Begin Information

c. See Attachment 4 for a sample Index of Effective FSTD Directives.

End Information

18. Operation with Missing, Malfunctioning, or Inoperative Components (§ 60.25).

Begin Information

a. Once the sponsor fairly and accurately advises the user of a simulator's current status, including any missing, malfunctioning, or inoperative (MMI) component(s), the sponsor's responsibility with respect to § 60.25(a) will have been satisfied.

b. 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 intent of the FAA is to automatically extend the deadline until the next business day.

c. In accordance with the authorization described in § 60.25(b)**,** the NSPM may find as acceptable a discrepancy prioritizing system wherein the length of time authorized to repair or replace any given MMI component is based on the level of impact on the capability of the simulator to provide the required training, evaluation, or flight experience, with the larger impact on this capability associated with a higher priority for repair or replacement.

End Information

19. Automatic Loss of Qualification and Procedures for Restoration of Qualification (§ 60.27).

Begin Information

If the sponsor provides a plan for how the simulator is to 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 simulator is to be maintained, etc.) there is a greater likelihood of being able to determine the amount of testing that would be required for re-qualification.

End Information

20. Other Losses of Qualification and Procedures for Restoration of Qualification (§ 60.29)

Begin Information

If the sponsor provides a plan for how the simulator is to 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 simulator is to be maintained, etc.) there is a greater likelihood of being able to determine the amount of testing that would be required for re-qualification.

End Information

21. Recordkeeping and Reporting (§ 60.31).

Begin QPS Requirements

a. The minimally acceptable record of programming changes, as described in § 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 illegal or inappropriate alteration of such records after the fact.

End QPS Requirements

22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements (§ 60.33).

There are no additional QPS requirements or informational material that apply to § 60.33, Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements.

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23. [Reserved].

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24. [Reserved].

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25. Simulator Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA) (§ 60.37).

There are no additional QPS requirements or informational material that apply to § 60.37, Simulator Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA).

Attachment 1 to Appendix C to Part 60--

GENERAL SIMULATOR REQUIREMENTS

Begin QPS Requirements

1. Requirements.

Certain requirements included in this appendix must be supported with a Statement of Compliance and Capability (SOC) and/or, in some designated cases, an Objective Test. The SOC will describe how the requirement was met, such as gear modeling approach, coefficient of friction sources, etc. The test results must show that the requirement has been attained. Other requirements are satisfied by either a Subjective Test or a Subjective Test. In the following tabular listing, requirements for SOCs and tests are indicated in the "Additional Details" column.

End QPS Requirements

Begin Information

2. Discussion.

a. This attachment describes the minimum general simulator requirements for qualifying helicopter full flight simulators (FFS). To determine the complete requirements for a specific level simulator the objective tests in attachment 2 and the examination of functions and subjective tests listed in attachment 3 must also be consulted.

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

(1) General cockpit configuration.

(2) Simulator programming.

(3) Equipment operation.

(4) Equipment and facilities for instructor/evaluator functions.

(5) Motion system.

(6) Visual system.

(7) Sound system.

End Information

Begin QPS Requirements

TABLE OF MINIMUM SIMULATOR REQUIREMENTS

QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	Simulator Levels				Additional Details		
	A	B	C	D			
1. General Cockpit Configuration.							
a. The simulator must have a cockpit that is a full-scale replica of the helicopter simulated with controls, equipment, observable cockpit 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.		X	X	X	An SOC is required. 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 cockpit windows and doors must be included, but they need not be operable. Fire axes, extinguishers, spare light bulbs, etc., must be available in the flight simulator 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.		For simulator purposes, the cockpit 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 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 or extinguishers, spare light bulbs, aircraft documents pouches etc., are not considered essential and may be omitted.
b. Those circuit breakers that affect procedures and/or result in observable cockpit indications must be properly located and functionally accurate.		X	X	X	An SOC is required.		
2. Programming.							
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 helicopter attitude, thrust, drag, altitude, temperature, gross weight, moments of inertia, center of gravity location, and configuration.		X	X	X	An SOC is required.		
b. The simulator must have the computer capacity, accuracy, resolution, and dynamic response needed to meet the qualification level sought.		X	X	X	An SOC is required.		

TABLE OF MINIMUM SIMULATOR REQUIREMENTS							
QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	**Simulator Levels**				**Additional Details**		
	A	**B**	**C**	**D**			
c. Ground handling and aerodynamic programming must include the following:					An SOC is required. Level B does not require hover programming.		
(1) Ground effect.		X	X	X	Flare and touch down from a running landing as well as for in-ground-effect (IGE) hover.		
(2) Ground reaction.		X	X	X	Data is required to identify the flight condition and helicopter configuration		Reaction of the helicopter upon contact with the landing surface during landing, (e.g., strut deflection, tire or skid friction, side forces, etc.) and may differ with changes in gross weight, airspeed, rate of descent on touchdown, etc.
(3) Ground handling characteristics.		X	X	X	Control inputs required during operations in crosswind, during braking and deceleration, and for turning radius.		
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.			X	X	An SOC is required.		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.
e. Relative responses of the motion system, visual system, and cockpit		X			Response must be within 150 milliseconds of the helicopter response. Objective Tests are required.		
instruments must be coupled closely to provide integrated sensory cues.			X	X	Response must be within 100 milliseconds of the helicopter response. Objective Tests are required.		
Visual change may start before motion response, but motion acceleration must be initiated before					Visual scene changes from steady state disturbance (i.e., the start of the scan of the		

TABLE OF MINIMUM SIMULATOR REQUIREMENTS

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completion of the visual scan of the first video field containing different information.					first video field containing different information) and motion system onset must occur within the system dynamic response limit of 100/150 milliseconds.		
(1) Latency: These systems must respond to abrupt input at the pilot's position. The response must not be prior to that time when the helicopter responds and may respond up to 100/150 milliseconds after that time under the same conditions.					Simultaneously record: 1) the output from the pilot's controller(s); 2) the output from an accelerometer attached to the motion system platform located at an acceptable location near the pilots' seats; 3) the output signal to the visual system display (including visual system analog delays); and 4) the output signal to the pilot's attitude indicator or an equivalent test approved by the Administrator. Simulator performance must be recorded and the results must be compared to helicopter response data in the hover (for levels C and D only), climb, cruise, and autorotation. The results must be recorded in the QTG.		The intent is to verify that the simulator provides instrument, motion, and visual cues that are, within the stated time delays, like the helicopter responses. For helicopter response, acceleration in the appropriate, corresponding rotational axis is preferred. Simulator Latency is measured from the start of a control input to the appropriate perceivable change in flight instrument indication; visual system response; or motion system response (this does not include helicopter response time as per the manufacturer's data).
(2) Transport Delay: (As an alternative to the Latency requirement, above, a transport delay objective test may be used to demonstrate that the simulator 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 the control loading electronics and interfacing through all the simulation software modules in the correct order, using a handshaking protocol, finally through the normal output interfaces to the					An SOC is required. A recordable start time for the test must be provided with the pilot flight control input. The migration of the signal must permit normal computation time to be consumed and must not alter the flow of information through the hardware/software system. While transport delay need only be measured once in each axis, independent of flight condition,		The transport delay is the time between the control input and the individual hardware (i.e., instruments, motion system, visual system) responses. If Transport Delay is the chosen method to demonstrate relative responses, it is expected that, when reviewing those existing tests where latency

TABLE OF MINIMUM SIMULATOR REQUIREMENTS							
QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	Simulator Levels				Additional Details		
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instrument displays, the motion system, and the visual system.)					if this method is chosen, the sponsor must also demonstrate the latency of the simulator with respect to that of the helicopter with at least one demonstration in pitch, in roll, and in yaw as described above. Simulator performance must be recorded and the results must be recorded in the QTG.		can be identified the sponsor and the NSPM will apply additional scrutiny to ensure proper simulator response.
f. The simulator must accurately reproduce the stopping and directional control forces for at least, the following landing surface conditions for a running landing: (1) Dry; (2) Wet; (3) Icy; (4) Patchy Wet. (5) Patchy Icy.			X	X	An SOC is required. Objective tests are required only for dry, wet, and icy runway conditions; see Attachment 2.		
g. The simulator must accurately simulate: 1) brake and tire failure dynamics (including antiskid failure). 2) decreased brake efficiency due to high brake temperatures, if applicable.			X	X	An SOC is required.		Simulator pitch, side loading, and directional control characteristics should be representative of the helicopter.
h. The modeling in the simulator must include: (1) Ground effect, (2) Effects of airframe icing (if applicable), (3) Aerodynamic interference effects between the rotor wake and fuselage, (4) Influence of the rotor on control and stabilization systems, and (5) Representations of nonlinearities due to			X	X	An SOC is required and must include references to computations of aeroelastic representations and of nonlinearities due to sideslip. An SOC and a demonstration of icing effects (if applicable) are required.		See Attachment 2, paragraph 4, for further information on ground effect.

TABLE OF MINIMUM SIMULATOR REQUIREMENTS							
QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	Simulator Levels				Additional Details		
	A	B	C	D			
sideslip.							
i. 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.		X	X	X	An SOC is required and must include a range of tabulated target values to enable a subjective test of the mass properties model to be conducted from the instructor's station.		
							.
3. Equipment Operation.							
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.		X	X	X	Numerical values must be presented in the appropriate units. A subjective test is required.		
b. Communications, navigation, caution, and warning equipment must be installed and operate within the tolerances applicable for the helicopter.		X	X	X	A subjective test is required.		See Attachment 3, paragraph 1d for further information regarding long-range navigation equipment.
c. Simulator systems must operate as the helicopter systems would operate under normal, abnormal, and emergency operating conditions on the ground and in flight.		X	X	X	A subjective test is required.		
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 in the helicopter under the same flight conditions.		X	X	X	An objective test is required.		
4. Instructor or Evaluator Facilities.							
a. In addition to the flight crew member 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.		X	X	X	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. A subjective test is required.		The NSPM will consider alternatives to this standard for additional seats based on unique cockpit configurations.
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		X	X	X	A subjective test is required.		

TABLE OF MINIMUM SIMULATOR REQUIREMENTS

QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	**Simulator Levels**				**Additional Details**		
	A	**B**	**C**	**D**			
systems as described in the sponsor’s FAA-approved training program; or as described in the relevant operating manual as appropriate.							
c. The simulator must have instructor controls for environmental conditions including wind speed and direction.		X	X	X	A subjective test is required.		
d. The simulator must provide the instructor or evaluator the ability to present ground and air hazards.			X	X	A subjective test is required.		For example, another aircraft crossing the active runway and converging airborne traffic; etc.
5. Motion System.							
a. The simulator must have motion (force) cues perceptible to the pilot that are representative of the motion in an helicopter.		X	X	X	A subjective test is required.		For example, touchdown cues should be a function of the rate of descent (RoD) of the simulated helicopter.
b. The simulator must have a motion (force cueing) system with a minimum of three degrees of freedom (at least pitch, roll, and heave).		X			An SOC is required.		
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).			X	X	An SOC is required.		
d. The simulator must provide for the recording of the motion system response time.		X	X	X	An SOC is required.		
e. The simulator must provide motion effects programing to include: (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		X	X	X	A subjective test is required.		

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QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	Simulator Levels				Additional Details		
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stall.. (5) Buffet due to settling with power.. (6) Representative cues resulting from touchdown.. (7) Rotor vibrations.							
(8) Tire failure dynamics. (9) Engine malfunction and engine damage. (10) Airframe (e.g., tail, flap, engine pod) ground strike.			X	X	A subjective test is required.		
(11) Motion vibrations that result from atmospheric disturbances.				X	For air turbulence, general purpose disturbance models that approximate demonstrable flight test data are acceptable.		
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 cockpit.				X	An objective test is required.		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.							
a. The simulator must have a visual system providing an out-of-the-cockpit view.		X	X	X	A subjective test is required.		
b. The simulator must provide a continuous minimum collimated field of view of 75° horizontally and 30° vertically per pilot seat. Both pilot seat visual systems must be operable simultaneously.		X			An SOC is required.		
c. The simulator must provide a continuous minimum collimated visual field of view of 150° horizontally and 40° vertically per pilot seat. Both pilot seat visual systems must be operable			X		An SOC is required. Horizontal field of view is centered on the zero degree azimuth line relative to the aircraft fuselage.		Optimization of the vertical field of view may be considered with

TABLE OF MINIMUM SIMULATOR REQUIREMENTS							
QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	Simulator Levels				Additional Details		
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simultaneously.							respect to the specific helicopter cockpit cut-off angle.
d. The simulator must provide a continuous minimum collimated visual field of view of 180° horizontally and 60° vertically for each pilot. Both pilot seat visual systems must be operable simultaneously.				X	An SOC and an Objective Test is required. Horizontal field of view is centered on the zero degree azimuth line relative to the aircraft fuselage.		Optimization of the vertical field of view may be considered with respect to the specific helicopter cockpit cut-off angle.
e. The visual system must be free from optical discontinuities and artifacts that create non-realistic cues.		X	X	X	A subjective test is required.		Non-realistic 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.
f. The simulator must have operational landing lights for night scenes.		X	X	X	A subjective test is required Where used, dusk (or twilight) scenes require operational landing lights.		
g. The simulator must have instructor controls for the following: (1) Cloudbase. (2) Visibility in statute miles (km) and runway visual range (RVR) in ft. (m). (3) Airport or landing area selection. (4) Airport or landing area lighting.		X	X	X	A subjective test is required.		
h. Each airport scene displayed must include the following: (1) Airport runways and taxiways. (2) Runway definition. (i) Runway surface and markings. (ii) Lighting for the runway in use, including runway threshold, edge, centerline, touchdown zone, VASI (or PAPI), and approach lighting of		X	X	X	A subjective test is required.		

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QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	Simulator Levels				Additional Details		
	A	B	C	D			
appropriate colors, as appropriate. (iii) Taxiway lights.							
i. The distances at which runway features are visible, as measured from runway threshold to an helicopter aligned with the runway on an extended 3° glide slope must not be less than listed below: (1) Runway definition, strobe lights, approach lights, runway edge white lights and Visual Approach Slope Indicator (VASI) or Precision Approach Path Indicator (PAPI) system lights from 5 statute miles (8 kilometers (km)) of the runway threshold. (2) Runway centerline lights and taxiway definition from 3 statute miles (4.8 km). (3) Threshold lights and touchdown zone lights from 2 statute miles (3.2 km). (4) Runway markings within range of landing lights for night scenes and as required by three (3) arc-minutes resolution on day scenes.		X	X	X	A funtional test is required.		
j. The simulator must provide visual system compatibility with dynamic response programming.		X	X	X	A Subjective Test is required.		
k. The simulator must be verified for visual ground segment and visual scene content for the helicopter in landing configuration and a main wheel (or landing skid) height of 100 feet (30 meters) above the touchdown zone. Data submitted must include at least the following: (1) Static helicopter dimensions as follows: (i) Horizontal and vertical distance from main landing gear (MLG) or landing skids to glideslope reception antenna. (ii) Horizontal and vertical distance from MLG or skids to pilot's eyepoint. (iii) Static cockpit cutoff angle.		X	X	X	An SOC is required. The QTG must contain appropriate calculations and a drawing showing the pertinent data used to establish the helicopter location and the segment of the ground that is visible considering the helicopter attitude (cockpit cut-off angle) and a runway visual range of 1,200 feet or 350 meters. Simulator performance must be measured against the QTG calculations. Sponsors must provide this data for each simulator (regardless of previous qualification standards) to qualify the simulator for all precision instrument approaches.		The test should be conducted in the 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). This will show the modeling accuracy of RVR, glideslope, and localizer for a given weight, configuration and speed within the helicopter's operational envelope for a

TABLE OF MINIMUM SIMULATOR REQUIREMENTS							
QPS REQUIREMENTS							**INFORMATION**
General Simulator Requirements	**Simulator Levels**				**Additional Details**		
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(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.					At the near end of the visual ground segment, lights and ground objects computed to be visible from the helicopter cockpit must be visible in the flight simulator. The far end of the visual ground segment must be at the computed end of the segment ±20% of the computed visible segment distance.		normal approach and landing. If non-homogenous fog is used, the vertical variation in horizontal visibility should be described and be included in the slant range visibility calculation used in the computations.
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 takeoffs and landings.		X			A subjective test is required.		
m. The simulator must have night and dusk (or twilight) visual scene capability, including general terrain characteristics and significant landmarks, free from apparent quantization.			X	X	A subjective test is required. Dusk (or twilight) scene must enable identification of a visible horizon and general terrain characteristics.		Examples of general terrain characteristics are fields, roads, and bodies of water.
n. 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	A subjective test is required.		
o. The simulator must provide for (2) Accurate portrayal of the environment relating to the simulator attitude.		X	X	X	A subjective test is required.		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.
(2) Quick confirmation of visual system color, RVR, focus, and intensity.			X	X	An SOC is required. A subjective test is required.		
p. The simulator must provide a minimum of three			X	X	A subjective test is required.		

TABLE OF MINIMUM SIMULATOR REQUIREMENTS							
QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	Simulator Levels				Additional Details		
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airport (or landing area) scenes including: (1) Surfaces on landing areas. (2) Lighting of appropriate color for all landing surfaces, including, for runways, runway threshold, edge, centerline, VASI (or PAPI), and approach lighting for the runway in use. (3) Airport taxiway lighting. (4) Terrain, including ramps and buildings that correspond to the sponsor's Line Oriented scenarios, as appropriate.							
q. The simulator must be capable of producing at least 10 levels of occulting.			X	X	A subjective test is required.		
r. The simulator must be able to provide weather representations including the following: (1) Variable cloud density. (2) Partial obscuration of ground scenes; i.e., the effect of a scattered to broken cloud deck. (3) Gradual break out. (4) Patchy fog. (5) The effect of fog on airport lighting.			X	X	A subjective test is required. The weather representations must be provided at and below an altitude of 2,000 ft (610 m) height above the airport and within a radius of 10 miles (16 km) from the airport.		
s. 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.		X	X	X	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.		
t. 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			X	X	An SOC is required. Dusk (or twilight) scenes, as a minimum, must provide full color presentations of reduced ambient intensity, sufficient surfaces with appropriate textural		

TABLE OF MINIMUM SIMULATOR REQUIREMENTS							
QPS REQUIREMENTS							INFORMATION
General Simulator Requirements	Simulator Levels				Additional Details		
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major landmarks around the airport. The scene content must allow a pilot to successfully accomplish a visual landing.					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		
u. The simulator must have daylight, night, and either 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.				X	An SOC is required. A subjective test is required. Any ambient lighting must not “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 quantization and other distracting visual effects while the simulator is in motion. These requirements are applicable to any level of simulator equipped with a “daylight” visual system.		Brightness capability may be demonstrated with a test pattern of white light using a spot photometer. Daylight visual system is defined as a visual system capable of producing, at a minimum, full color presentations, scene content comparable in detail to that produced by 4,000 edges or 1,000 surfaces for daylight and 4,000 lightpoints for night and dusk scenes, 6 foot-lamberts (20 cd/m^2) of light measured at the pilot's eye position (highlight brightness) and a display which is free of apparent quantization and other distracting visual effects

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QPS REQUIREMENTS						INFORMATION
General Simulator Requirements	**Simulator Levels**				**Additional Details**	
	A	**B**	**C**	**D**		
						while the simulator is in motion.
v. The simulator must provide operational visual scenes that portray physical relationships known to cause landing illusions to pilots.				X	A subjective test is required.	For example: short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path, unique topographic features, etc.
w. The simulator must provide special weather representations of light, medium, and heavy precipitation near a thunderstorm on takeoff and during approach and landing.				X	A subjective test is required. 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. The simulator must present visual scenes of wet and snow-covered landing areas, including lighting reflections for wet conditions, partially obscured lights for snow conditions, or suitable alternative effects.				X	A subjective test is required.	
y. The simulator must present realistic color and directionality of all airport lighting.				X	A subjective test is required.	
7. Sound System.						
a. The simulator must provide cockpit sounds that result from pilot actions that correspond to those that occur in the helicopter.		X	X	X		
b. 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 and thrust reversal sounds; and the sounds of flap, gear, and spoiler extension and retraction.			X	X	An SOC is required. A subjective test is required.	
c. The simulator must provide realistic amplitude				X	Simulator performance must be recorded,	

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and frequency of cockpit noises and sounds.					compared to amplitude and frequency of the same sounds recorded in the helicopter, and be made a part of the QTG. .		
d. Volume control, if installed, must have an indication of the sound level setting.		X	X	X			

TABLE OF MINIMUM SIMULATOR REQUIREMENTS					
QPS REQUIREMENTS					
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Attachment 2 to Appendix C to Part 60--

SIMULATOR OBJECTIVE TESTS

1. General

Begin QPS Requirements

a. Test Requirements.

(1) The ground and flight tests required for qualification are listed in the following Table of Objective Tests. Computer generated simulator test results must be provided for each test. If a flight condition or operating condition is required for the test but which does not apply to the helicopter being simulated or to the qualification level sought, it may be disregarded (for example: an engine out missed approach for a single-engine helicopter; a hover test for a Level B simulator; etc.). Each test result is compared against Flight Test Data described in § 60.13, and Paragraph 9 in the main body of 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 NSPM 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 the Table of Objective Tests. All results must be labeled using the tolerances and units given.

(2) The Table of Objective Tests 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/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.

(3) Certain tests included in this attachment must be supported with a Statement of Compliance and Capability (SOC). In the following tabular listing of simulator tests, requirements for SOC's are indicated in the ``Test Details'' column.

(4) 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 helicopter data throughout a time history, differences must be justified by providing a comparison of other related variables for the condition being assessed.

(5) 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, except as may be authorized by the NSPM. Tests of handling qualities must include validation of augmentation devices.

(6) 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 pounds (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. For example: 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 clearly annotated as to indicated, calibrated, etc., and like values used for comparison.

(7) The QTG provided by the sponsor must describe clearly and distinctly how the simulator will be set up and operated for each test. Overall integrated testing of the simulator must be accomplished to assure that the total simulator system meets the prescribed standards; i.e., it is not acceptable to test only each simulator subsystem independently. A manual test procedure with explicit and detailed steps for completion of each test must also be provided.

(8) In those cases where the objective test results authorize a snapshot" result in lieu of a time-history result, the sponsor must ensure that a steady state condition exists from 5 seconds prior to, through 2 seconds after, the instant of time captured by the ``snapshot."

(9) For previously qualified simulators, the tests and tolerances of this attachment may be used in subsequent recurrent evaluations for any given test providing the sponsor has submitted a proposed MQTG revision to the NSPM and has received NSPM approval.

(10) 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 but identifiable reference points and must also be achieved by driving one degree of freedom at a time.

(11) Simulators for 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, in the unaugmented configuration, is control position, 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 to between the sponsor and the NSPM on a case-by-case basis.

(12) For highly augmented helicopters using helicopter hardware (i.e., ``helicopter modular controllers") in the simulator cockpit, some tests will not be required. Those tests are annotated in the "Additional Requirements" column. However, in these cases the sponsor must supply a statement that the helicopter hardware meets and will continue to meet the appropriate manufacturer's specifications and the sponsor must have supporting information to that fact available for NSPM review.

(13) For objective test purposes, "Near maximum" gross weight is a weight chosen by the sponsor or data provider that is not less than the basic operating weight (BOW) of the helicopter 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. “Light” gross weight is a weight chosen by the sponsor or data provider that is not more than 120% of the BOW of the helicopter being simulated or as limited by the minimum practical operating weight of the test helicopter. “Medium” gross weight is a weight chosen by the sponsor or data provider that is approximately ±10% of the average of the numerical values of the BOW and the maximum certificated gross weight. (Note: BOW is 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. (References: Advisory Circular 120-27, “Aircraft Weight and Balance;” and FAA- H-8083-1, “Aircraft Weight and Balance Handbook.”)

End QPS Requirements

Begin Information

b. Discussion

(1) 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.

(2) The NSPM 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 paragraph 4, Motion System, in the following table).

End Information

Begin QPS Requirements

TABLE OF OBJECTIVE TESTS								
QPS	**REQUIREMENTS**	>>>						**INFORMATION**
TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**SIMULATOR LEVEL**				**TEST DETAILS**	**NOTES**
			A	**B**	**C**	**D**		
1. Performance								
a. Engine Assessment								
(1) Start Operations (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		**X**	**X**	**X**	Record each engine start from the initiation of the start sequence to steady state idle and from steady state idle to operating RPM.	
(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		**X**	**X**	**X**	Record both steady state idle and operating RPM conditions. May be a series of snapshot tests.	
(2) Power Turbine Speed Trim	±10% of total change of power turbine speed.	Ground		**X**	**X**	**X**	Record engine response to trim system actuation in both directions.	
(3) Engine and Rotor Speed Governing	Torque - ±5%, Rotor Speed - 1.5%	Climb, descent		**X**	**X**	**X**	Record results using a step input to the collective. May be conducted concurrently with climb and descent performance tests.	
b. Ground Operations								
(1) Minimum Radius Turn	±3 ft. (0.9m) or 20% of helicopter turn radius.	Ground		**X**	**X**	**X**	If brakes are used, brake force must be matched to the helicopter flight test value.	

TABLE OF OBJECTIVE TESTS

QPS	**REQUIREMENTS**		**>>>**					**INFORMATION**
TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**SIMULATOR LEVEL**				**TEST DETAILS**	**NOTES**
			A	**B**	**C**	**D**		
(2) Rate of Turn vs. Pedal Deflection or Nosewheel Angle	±10% or ±2º/sec. Turn Rate	Ground Takeoff		**X**	**X**	**X**		
(3) Taxi	Pitch Angle - ±1.5º, Torque - ±3%, Longitudinal Control Position - ±5%, Lateral Control Position - ±5%, Directional Control Position ±5%, Collective Control Position - ±5%	Ground		**X**	**X**	**X**	Record results for control position and pitch attitude during ground taxi for a specific ground speed, wind speed and direction, and density altitude.	
(4) Brake Effectiveness	±10% of time and distance.	Ground		**X**	**X**	**X**		
c. Takeoff								
(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 - ±1.5º, Bank Attitude - ±2º, Heading - ±2º, Longitudinal Control Position - ±10%, Lateral Control Position - ±10%, Directional Control Position - ±10%, Collective Control Position - ±10%,	Ground/Takeoff and Initial Segment of Climb		**X**	**X**	**X**	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.	
(2) One Engine	Airspeed - ±3 kt,	Ground/Takeoff;		**X**	**X**	**X**	Record takeoff flight path as	

TABLE OF OBJECTIVE TESTS

QPS	REQUIREMENTS		>>>						INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS		NOTES
			A	B	C	D			
Inoperative.	Altitude - ±20 ft (6.1m), Torque - ±3%, Rotor Speed - ±1.5%, Vertical Velocity - ±100 fpm (0.50m/sec) or 10%, Pitch Attitude - ±1.5º, Bank Attitude - ±2º, Heading - ±2º, Longitudinal Control Position - ±10% Lateral Control Position - ±10%, Directional Control Position - ±10%, Collective Control Position - ±10%,	and Initial Segment of Climb					appropriate to helicopter model simulated. Results must be recorded from the initiation of the takeoff to at least 200 ft (61m) AGL.		
d. Hover									
Performance	Torque - ±3%, Pitch Attitude - ±1.5º, Bank Attitude - ±1.5º, 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)			**X**	**X**	Record results for light and heavy gross weights. May be a series of snapshot tests.		
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			**X**	**X**	Record results for light and heavy gross weights. May be a series of snapshot tests.		.

TABLE OF		OBJECTIVE	TESTS						
QPS	**REQUIREMENTS**		>>>						**INFORMATION**
TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**SIMULATOR LEVEL**				**TEST DETAILS**		**NOTES**
			A	**B**	**C**	**D**			
f. Level Flight									
Performance and Trimmed Flight Control Positions.	Torque - ±3%, Pitch Attitude - ±1.5º, Sideslip Angle - ±2º, Longitudinal Control Position - ±5%, Lateral Control Position - ±5%, Directional Control Position - ±5%, Collective Control Position - ±5%	Cruise (Augmentation On and Off)		**X**	**X**	**X**	Record results for two gross weight and CG combinations with varying trim speeds throughout the airspeed envelope. May be a series of snapshot tests.		
g. Climb									
Performance and Trimmed Flight Control Positions.	Vertical Velocity - ±100 fpm (61m/sec) or ±10%, Pitch Attitude - ±1.5º, Sideslip Angle - ±2º, 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		**X**	**X**	**X**	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.		
h. Descent.									
(1) Descent Performance and Trimmed Flight Control Positions.	Torque - ±3%, Pitch Attitude - ±1.5º, Sideslip Angle - ±2, º Longitudinal Control Position - ±5%, Lateral Control Position - ±5%, Directional Control Position - ±5%, Collective Control Position - ±5%	At or near 1,000 fpm rate of descent (RoD) at normal approach speed. Augmentation System(s) On and Off		**X**	**X**	**X**	Results must be recorded for two gross weight and CG combinations. May be a series of snapshot tests.		

TABLE OF OBJECTIVE TESTS

QPS	REQUIREMENTS		>>>					INFORMATION
TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**SIMULATOR LEVEL**				**TEST DETAILS**	**NOTES**
			A	**B**	**C**	**D**		
(2) Autorotation Performance and Trimmed Flight Control Positions.	Torque - ±3%, Pitch Attitude - ±1.5º, Sideslip Angle - ±2º, Longitudinal Control Position - ±5%, Lateral Control Position - ±5%, Directional Control Position - ±5%, Collective Control Position - ±5% Vertical Velocity ±100 fpm or 19%, Rotor Speed ±1.5%	Steady descents. Augmentation System(s) On and Off		**X**	**X**	**X**	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 approximately 50 kts. through at least maximum glide distance airspeed. May be a series of snapshot tests.	
i. Autorotation.								
Entry**.**	Rotor Speed - ±3% Pitch Attitude ±2º Roll Attitude - ±3º Yaw Attitude - ±5º Airspeed - ±5 kts. Vertical Velocity - ±200 fpm (1.00 m/sec) or 10%	Cruise or Climb			**X**	**X**	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.	
j. Landing.								
(1) All Engines.	Airspeed - ±3 kts., Altitude - ±20 ft. (6.1m), Torque - ±3%, Rotor Speed - ±1.5%, Pitch Attitude - ±1.5º, Bank Attitude - ±1.5º, Heading - ±2º, Longitudinal Control Position -±10%, Lateral Control Position	Approach		**X**	**X**	**X**	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	

	TABLE OF	OBJECTIVE	TESTS						
QPS	REQUIREMENTS		>>>						INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS		NOTES
			A	B	C	D			
	- ±10%, Directional Control Position - ±10%, Collective Control Position - ±10%						effective translational lift.		
(2) One Engine Inoperative.	Airspeed - ±3 kts., Altitude - ±20 ft. (6.1m), Torque - ±3%, Rotor Speed - ±1.5%, Pitch Attitude - ±1.5º, Bank Attitude - ±1.5º, Heading - ±2º, Longitudinal Control Position - ±10%, Lateral Control Position - ±10%, Directional Control Position - ±10%, Collective Control Position - ±10%.	Approach		X	X	X	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.		
(3) Balked Landing	Airspeed - ±3 kts, Altitude - ±20 ft. (6.1m), Torque - ±3%, Rotor Speed - ±1.5%, Pitch Attitude - ±1.5º, Bank Attitude - ±1.5º, Heading - ±2º, Longitudinal Control Position - ±10%, Lateral Control Position - ±10%, Directional Control Position - ±10%, Collective Control Position - ±10%.	Approach		X	X	X	Record the results for the maneuver initiated from a stabilized approach at the landing decision point (LDP).		
(4) Autorotational Landing.	Torque - ±3%, Rotor Speed - ±3%, Vertical Velocity - ±100 fpm (0.50m/sec) or 10%,	Landing			X	X	Record the results of an autorotational deceleration and landing from a stabilized autorotational descent, to touch		

	TABLE OF	OBJECTIVE	TESTS					
QPS	REQUIREMENTS		>>>					INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES
			A	B	C	D		
	Pitch Attitude - ±2º, Bank Attitude - ±2º, Heading - ±5º, Longitudinal Control Position - ±10%, Lateral Control Position - ±10%, Directional Control Position - ±10%, Collective Control Position - ±10%						down.	
2. Handling Qualities.								
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, that show satisfactory agreement. Repeat of the alternative method during the initial or upgrade evaluation would then satisfy this test requirement. For initial and upgrade evaluations, the control dynamic characteristics must be measured at and recorded directly from the cockpit controls, and must be accomplished in hover, climb, cruise, and autorotation.								Contact the NSPM for clarification of any issue regarding helicopters with reversible controls.
(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 .ff		**X**	**X**	**X**	Record results for an uninterrupted control sweep to the stops. (This test does not apply if aircraft hardware modular controllers are used.)	
(2) Collective/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.		**X**	**X**	**X**	Record results for an uninterrupted control sweep to the stops.	

TABLE OF OBJECTIVE TESTS								
QPS	REQUIREMENTS		>>>					INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES
			A	B	C	D		
(3) Brake Pedal Force vs. Position.	±5 lbs. (2.224 daN) or 10%	Ground; Static conditions.		X	X	X		
(4) Trim System Rate (all applicable systems)	Rate - ±10%	Ground; Static conditions. Trim On, Friction Off		X	X	X	The tolerance applies to the recorded value of the trim rate.	
(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			X	X	Results must be recorded for a normal control displacement in both directions in each axis (approximately 25% to 50% of full throw).	Control Dynamics for irreversible control systems may be evaluated in a ground/static condition. Refer to paragraph 5 of this attachment for additional information. "N" is the sequential period of a full cycle of oscillation.
(6) Freeplay	±0.10 in.	Ground; Static conditions.		X	X	X	Record and compare results for all controls.	
b. Low Airspeed Handling Qualities.								
(1) Trimmed Flight Control Positions.	Torque - ±3% Pitch Attitude - ±1.5º Bank Attitude - ±2º 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.			X	X	Record results for several airspeed increments to the translational airspeed limits and for 45 kts. forward airspeed. May be a series of snapshot tests.	
(2) Critical Azimuth	Torque - ±3% Pitch Attitude - ±1.5º, Bank Attitude - ±2º,	Stationary Hover. Augmentation On and Off.			X	X	Record results for three relative wind directions (including the most critical case) in the critical	

TABLE OF OBJECTIVE TESTS

QPS	REQUIREMENTS		>>>					INFORMATION
TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**SIMULATOR LEVEL**				**TEST DETAILS**	**NOTES**
			A	**B**	**C**	**D**		
	Longitudinal Control Position - ±5%, Lateral Control Position - ±5%, Directional Control Position - ±5%, Collective Control Position - ±5%						quadrant. May be a series of snapshot tests.	
(3) Control Response								
(a) Longitudinal	Pitch Rate - ±10% or ±2º/sec. Pitch Attitude Change - ±10% or 1.5º.	Hover. Augmentation On and Off.			X	X	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.	
(b) Lateral	Roll Rate - ±10% or ±3º/sec. Roll Attitude Change - ±10% or ±3º.	Hover Augmentation On and Off.			X	X	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.	
(c) Directional	Yaw Rate - ±10% or ±2º/sec. Heading Change - ±10% or ±2º.	Hover Augmentation On and Off.			X	X	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.	
(d) Vertical	Normal Acceleration - ±0.1 g.	Hover			X	X	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.	
c. Longitudinal Handling Qualities.								
(1) Control Response	Pitch Rate - ±10% or ±2º/sec., Pitch Attitude Change - ±10% or ±1.5º.	Cruise Augmentation On and Off.		X	X	X	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.	

TABLE OF OBJECTIVE TESTS

QPS	REQUIREMENTS		>>>						INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS		NOTES
			A	B	C	D			
(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.		X	X	X	Record results for a minimum of two speeds on each side of the trim speed. May be a series of snapshot tests.		
(3) Dynamic Stability									
(a) Long Term Response.	±10% of calculated period, ±10% of time to ½ or double amplitude, or ±0.02 of damping ratio.	Cruise Augmentation On and Off.		X	X	X	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 time history must be matched.		
(b) Short Term Response.	±1.5º Pitch or ±2º/sec. Pitch Rate. ±0.1 g Normal Acceleration.	Cruise or Climb. Augmentation On and Off.		X	X	X	Record results for at least two airspeeds.		
(4) Maneuvering Stability.	Longitudinal Control Position - ±10% of change from trim or ±0.25 in. (6.3mm) or Longitudinal Control Forces - ±0.5 lb. (0.223 daN) or ±10%.	Cruise or Climb. Augmentation On and Off.		X	X	X	Record results for at least two airspeeds. Record results for Approximately 30º-45º bank angle. The force may be shown as a cross plot for irreversible systems. May be a series of snapshot tests.		
(5) Landing Gear Operating Times	±1 sec.	Takeoff (Retraction) Approach (Extension)		X	X	X			
d. Lateral and Directional Handling Qualities.									

TABLE OF OBJECTIVE TESTS

QPS	REQUIREMENTS		>>>						INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS		NOTES
			A	B	C	D			
(1)Control Response.									
(a) Lateral	Roll Rate - ±10% or ±3º/sec., Roll Attitude Change - ±10% or ±3º.	Cruise Augmentation On and Off.		X	X	X	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.		
(b) Directional	Yaw Rate - ±10% or ±2º/sec., Yaw Attitude Change - ±10% or ±2º.	Cruise Augmentation On and Off.		X	X	X	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.		
(2) Directional Static Stability.	Lateral Control Position - ±10% of change from trim or ±0.25 in. (6.3mm) 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. (6.3mm) or Directional Control Force - ±1 lb. (0.448 daN) or 10%., Longitudinal Control	Cruise; or Climb (may use Descent instead of Climb if desired), Augmentation On and Off.		X	X	X	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.		This is a steady heading sideslip test.

TABLE OF OBJECTIVE TESTS

QPS	REQUIREMENTS		>>>						INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS		NOTES
			A	B	C	D			
	Position - ±10% of change from trim or ±0.25 in. (6.3mm), Vertical Velocity - ±100 fpm (0.50m/sec) or 10%.								
(3) Dynamic Lateral and Directional Stability									
(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.	Cruise or Climb. Augmentation On/Off		X	X	X	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. For non-periodic response, the time history must be matched.		
(b) Spiral Stability	Correct Trend, ±2º bank or ±10% in 20 sec.	Cruise or Climb. Augmentation On and Off.		X	X	X	Record the results of a release from pedal only or cyclic only turns. Results must be recorded from turns in both directions.		
(c) Adverse/Proverse Yaw	Correct Trend, ±2º transient sideslip angle.	Cruise or Climb. Augmentation On and Off.		X	X	X	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.		
3. Motion System									
a. Motion Envelope									
(1) Pitch									
(a) Displacement - TBDº				X					

	TABLE OF	OBJECTIVE	TESTS						
QPS	REQUIREMENTS		>>>						INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS		NOTES
			A	B	C	D			
±25°					X	X			
(b) Velocity - TBD°/sec				X					
±20°/sec					X	X			
(c) Acceleration - TBD°/sec^2				X					
±100°/sec^2					X	X			
(2) Roll									
(a) Displacement - TBD°				X					
±25°					X	X			
(b) Velocity - TBD°/sec				X					
±20°/sec					X	X			
(c) Acceleration - TBD°/sec^2				X					
±100°/sec^2					X	X			
(3) Yaw									
(a) Displacement - ±25°					X	X			
(b) Velocity - ±20°/sec					X	X			
(c) Acceleration - ±100°/sec^2					X	X			
(4) Vertical									
(a) Displacement - TBD in.				X					
±34 in.					X	X			
(b) Velocity - TBD in.				X					
±24 in.					X	X			
(c) Acceleration - TBD g.				X					
±0.8 g.					X	X			
(5) Lateral									

	TABLE OF	OBJECTIVE	TESTS						
QPS	**REQUIREMENTS**		>>>						**INFORMATION**
TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**SIMULATOR LEVEL**				**TEST DETAILS**		**NOTES**
			A	**B**	**C**	**D**			
Displacement: ±45 in.					**X**	**X**			
Velocity: ±28 in/sec.					**X**	**X**			
Acceleration: ±0.6 g.					**X**	**X**			
(6) Longitudinal									
Displacement: ±34 in					**X**	**X**			
Velocity: ±28 in/sec.					**X**	**X**			
Acceleration: ±0.6 g.					**X**	**X**			
(7) Initial Rotational Acceleration Ratio.									
All axes: TBD^{o}/sec^{2}/sec				**X**					
All axes: 300^{o}/ sec^{2}/sec					**X**	**X**			
(8) Initial Linear Acceleration Ratio.									
Vertical: ±TBD g/sec				**X**					
±6g/sec					**X**	**X**			
Lateral: ±3g/sec					**X**	**X**			
Longitudinal: ±3g/sec					**X**	**X**			
b. Frequency Response									
Band, Hz Phase, deg. 0.10 to 0.5 -15 to -20 0.51 to 1.0 -15 to -20 1.1 to 2.0 -20 to -40	Amplitude Ratio, db ±2 ±2 ±4			**X**	**X**	**X**			

TABLE OF OBJECTIVE TESTS								
QPS	REQUIREMENTS		>>>					INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES
			A	B	C	D		
2.1 to 5.0 -20 to -40	±4							
c. Leg Balance.								
Leg Balance	1.5º			X	X	X	The phase shift between a datum jack and any other jack must be measured using a heave (vertical) signal of 0.5 Hz. at ±0.25 g.	
d. Turn Around.								
Turn Around	0.05 g.			X	X	X	The motion base must be driven sinusoidally in heave through a displacement of 6 inches (150mm) peak to peak at a frequency of 0.5 Hz. Deviation from the desired sinusoidal acceleration must be measured.	
4. Visual System Display Tests								
a. Field of View								
(1) Continuous collimated visual field of view	Minimum continuous collimated field of view providing 75° horizontal and 30° vertical field of view for each pilot simultaneously.	N/A		X			An SOC is required. Horizontal field of view is centered on the zero degree azimuth line relative to the aircraft fuselage.	A vertical field of view of 30° may be insufficient to meet visual ground segment requirements. Field of view should be measured using a visual test pattern filling the entire visual scene (all channels) with a matrix of black and white 5° squares. The installed alignment should be
(2) Continuous collimated visual field of view	Minimum continuous collimated field of view providing 150°	N/A			X		An SOC is required. Horizontal field of view is centered on the zero degree	Field of view should be measured using a visual test pattern filling the

TABLE OF OBJECTIVE TESTS

QPS	REQUIREMENTS		>>>					INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS	NOTES
			A	B	C	D		
	horizontal and 40° vertical field of view for each pilot simultaneously.						azimuth line relative to the aircraft fuselage.	entire visual scene (all channels) with a matrix of black and white 5° squares. The installed alignment should be
(3) Continuous collimated visual field of view	Minimum continuous collimated field of view providing 180° horizontal and 60° vertical field of view for each pilot simultaneously.	N/A				X	An SOC is required. Horizontal field of view is centered on the zero degree azimuth line relative to the aircraft fuselage.	Field of view should be measured using a visual test pattern filling the entire visual scene (all channels) with a matrix of black and white 5° squares. The installed alignment should be addressed in the SOC.
c. Surface contrast ratio.	Not less than 5:1	N/A				X	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.	Measurements should 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.
d. Highlight brightness	Not less than six (6) foot-lamberts (20 cd/m^2)	N/A				X	Measure the brightness of the center, white square while superimposing a highlight on	Measurements should be made using a 1° spot photometer and a raster

TABLE OF	OBJECTIVE	TESTS							
QPS	**REQUIREMENTS**		**>>>**						**INFORMATION**
TEST	**TOLERANCE**	**FLIGHT CONDITIONS**	**SIMULATOR LEVEL**				**TEST DETAILS**		**NOTES**
			A	**B**	**C**	**D**			
							that white square. The use of calligraphic capabilities to enhance the raster brightness is acceptable; however, measuring light points is not acceptable.		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.
e. Vernier resolution (surface resolution)	Not greater than 3 arc minutes	N/A			X	X	An SOC is required and must include the appropriate calculations and an explanation of those calculations.		
f. Light point size	Not greater than six (6) arc-minutes.	N/A			**X**	**X**	An SOC is required and must include the relevant calculations and an explanation of those calculations.		Light point size should 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.
g. Light point contrast ratio	Not less than 25:1	N/A			X	X	An SOC is required and must include the relevant calculations.		A 1° spot photometer is 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

	TABLE OF	OBJECTIVE	TESTS						
QPS	REQUIREMENTS		>>>						INFORMATION
TEST	TOLERANCE	FLIGHT CONDITIONS	SIMULATOR LEVEL				TEST DETAILS		NOTES
			A	B	C	D			
									contrast ratio testing, simulator aft-cab and flight deck ambient light levels should be zero.

Begin Information

2. 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 cockpit 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 a simulator to be representative, it too must present the pilot with the proper feel; that of the respective helicopter

b. 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 simulator control loading system to the helicopter systems is essential. The required control feel dynamic tests are described in this attachment. This is usually accomplished by measuring the free response of the controls using a step or pulse input to excite the system.

c. For helicopters with irreversible control systems, measurements may be obtained on the ground. However, proper pitot-static inputs (if applicable) must be provided to represent conditions 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 must be submitted as justification for ground tests or for eliminating a configuration.

(1) 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 simulator 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.

(2) For Levels C and D Simulators. Tests to verify that control feel dynamics represent the helicopter show that the dynamic damping cycles (free response of the control) match that of the helicopter within the specified tolerances. An acceptable method of evaluating the response and the tolerance to be applied are described below for the underdamped and critically damped cases.

d. Tolerances: (1) Underdamped Response. (a) 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(Ad) on Figure 1 of this attachment is +/-5 percent of the initial displacement amplitude Ad 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 would show the same number of significant overshoots to within one when compared against the helicopter data. This procedure for evaluating the response is illustrated in Figure 1 of this attachment.

(2) 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 should 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.

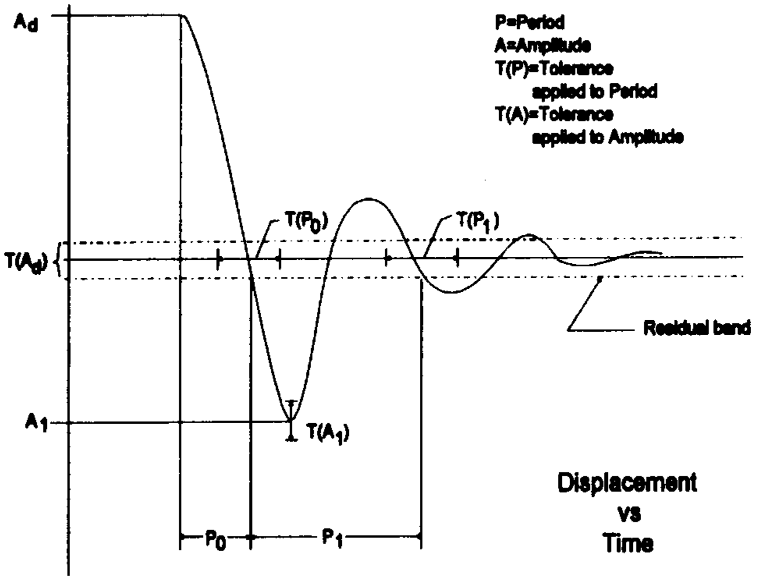
(3) (a) The following summarizes the tolerances, T, for an illustration of the referenced measurements (See Figures 1 and 2 of this attachment):

T(P0) +/-10% of P0
T(P1) +/-20% of P1
T(A) +/-10% of A1, +/-20% of Subsequent Peaks
T(Ad) +/-10% of Ad = Residual Band
Overshoots +/-1

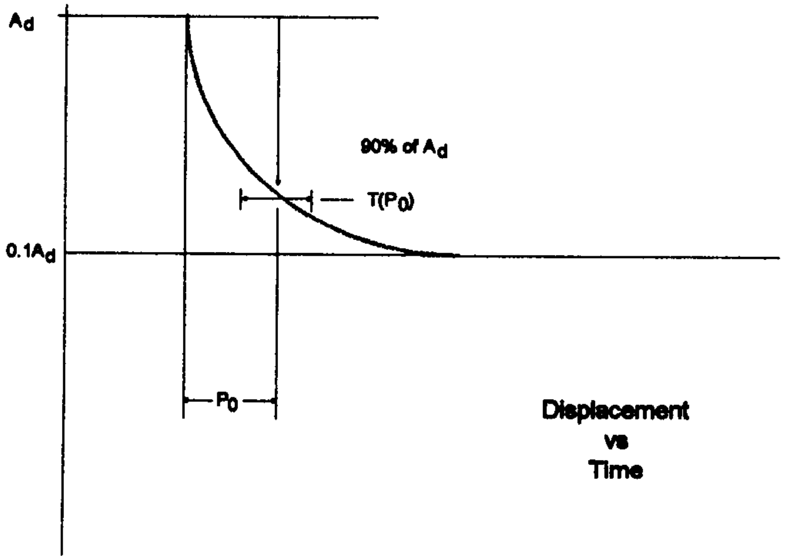
(b) In the event the number of cycles completed outside of the residual band, and thereby significant, exceeds the number depicted in figure 1 of this attachment, the following tolerances (T) will apply:

T(Pn) +/-10%(n+1)% of Pn, where ``n'' is the next in sequence.

Attachment 2 to Appendix C to Part 60—
Figure 1. Under-Damped Step Response



Attachment 2 to Appendix C to Part 60—
Figure 2. Critically-Damped Step Response



3. Motion Cue Repeatability Testing.

a. The motion system characteristics in the Table of Objective
Tests address basic system capability, but not pilot cueing capability. Until there is an objective procedure for determination of the motion cues necessary to support pilot tasks and stimulate the pilot response which occurs in a helicopter for the same tasks, motion systems will continue to be ``tuned'' subjectively. Having tuned a motion system, however, it is important to involve a test to ensure that the system continues to perform as originally qualified.
Any motion performance change from the initially qualified baseline can be measured objectively.

b. An objective assessment of motion performance change is accomplished at lease annually using the following testing procedure:

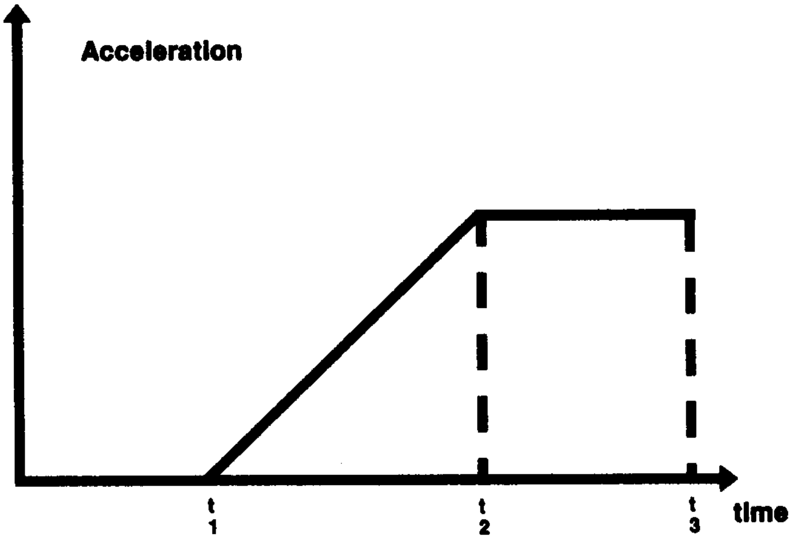
(1) The current performance of the motion system is assessed by comparison with the initial recorded test data.

(2) The parameters to be recorded are the outputs of the motion drive algorithms and the jack position transducers.

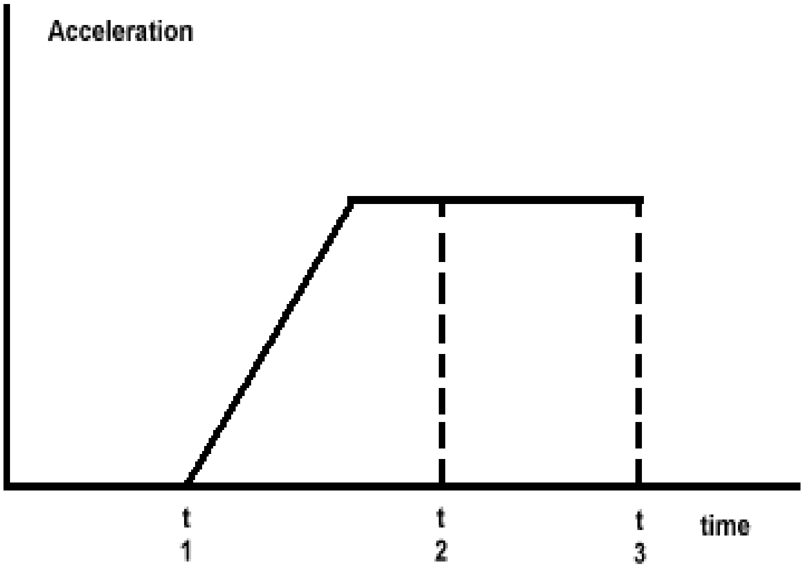
(3) The test input signals are inserted at an appropriate point prior to the integrations in the equations of motion (see figure 3 of this attachment).

(4) The characteristics of the test signal (see figure 4 of this attachment) are adjusted to ensure that the motion is exercised through approximately 2/3 of the maximum displacement capability in each axis. The time segment T0--T1 , must be of sufficient duration to ensure steady initial conditions.

Attachment 2 to Appendix C to Part 60—
Figure 3. Acceleration Test Signals



Attachment 2 to Appendix C to Part 60—
Figure 4. Test Signal Characteristics



NOTE: If the simulator weight changes for any reason (i.e., visual change, or structural change), then the motion system baseline performance repeatability tests must be rerun and the new results used for future comparison.

End Information

Attachment 3 to Appendix C to Part 60—
SIMULATOR SUBJECTIVE TESTS

1. Requirements

Begin QPS Requirements

Airports represented in visual scenes required by this part must be representations of real-world, operational airports, helipads, or other designated landing areas, or representations of fictional airports, helipads, or other designated landing areas. In the remainder of this part, the use of the designation ‘airport’ shall be considered to include helipads, or other designated landing areas.

a. If real-world, operational airports are simulated, the visual representation and scene content is compared to that of the actual airport. This comparison requires accurate simulation of that airport to the extent required by this part and as required by the qualification level sought. It also requires the visual scene to be modified when the airport is modified; e.g., when additional runways or taxiways are added; when existing runway(s) are lengthened or permanently closed; when magnetic bearings to or from a runway or helipad are changed; when significant and recognizable changes are made to the terminal, other airport buildings, or surrounding terrain; etc.

b. If fictional airports are used, the navigational aids and all appropriate maps, charts, and other navigational reference material for such airports (and surrounding areas as necessary), are evaluated for compatibility, completeness, and accuracy. These items are compared to the visual presentation and scene content of the fictional airport and require simulation to the extent set out in this document and as required by the qualification level sought. An SOC must be submitted that addresses navigation aid installation and performance (including obstruction clearance protection, etc.) and other criteria for all instrument approaches that are available in the simulator. The SOC must reference and account for information in the Terminal Instrument Procedures Manual (“Terps” Manual, FAA Handbook 8260.3, as amended) and the construction and availability of the required maps, charts, and other navigational material. This material must be appropriately marked "for training purposes only."

End QPS Requirements

---

2. Discussion

Begin Information

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 Table of Functions and Subjective Tests are for simulator evaluation purposes only. They must not be used to limit or exceed the authorizations for use of a given level of simulator as described on the Statement of Qualification or as may be approved by the TPAA. All items in the following paragraphs are subject to an examination.

b. The Table of Functions and Subjective Tests in this attachment addresses pilot functions, including maneuvers and procedures (called flight tasks), and is divided by flight phases. The performance of these tasks by the NSPM 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 Table of Functions and Subjective Tests in this attachment addresses 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 flightcrew 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 NSP 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 - 14CFR, §91.175(e)).

f. At the request of the TPAA, the NSP 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.

End Information

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS

Begin QPS Requirements

The NSP pilot, or the pilot designated by the NSPM, will evaluate the FTD in the following Operations Tasks, as applicable to the helicopter and FTD level, using the sponsor's approved manuals and checklists.

a. Preparation for Flight.

(1) Preflight. Accomplish a functions check of all switches, indicators, systems, and equipment at all cockpit crewmembers' and instructors' stations, and determine that the cockpit design and functions are identical to that of the helicopter simulated.

(2) APU/Engine start and run-up.
- (a) Normal start procedures.
- (b) Alternate start procedures.
- (c) Abnormal starts and shutdowns (hot start, hung start, etc.)
- (d) Rotor engagement.
- (e) System checks.
- (f) Other.

b. Takeoff.

(1) Normal.
- (a) From ground.
- (b) From hover.
  - (i) Cat A.
  - (ii) Cat B.
- (c) Running.
- (d) Crosswind/tailwind.
- (e) Maximum performance.
- (f) Instrument.

(2) Abnormal/emergency procedures:
- (a) Takeoff with engine failure after critical decision point (CDP).
  - (i) Cat A.
  - (ii) Cat B.
- (b) Other

c. Climb.

(1) Normal.
(2) One engine inoperative.
(3) Other.

d. Cruise.

(1) Performance.
(2) Flying qualities.
(3) Turns.
- (a) Timed.
- (b) Normal.
- (c) Steep.

(4) Accelerations and decelerations.
(5) High speed vibrations.
(6) Abnormal/emergency procedures, for example:
- (a) Engine fire.
- (b) Engine failure.
- (c) Inflight engine shutdown and restart.
- (d) Fuel governing system failures.
- (e) Directional control malfunction.
- (f) Hydraulic failure.

        (g) Stability system failure.
        (h) Rotor vibrations.
        (i) Other.

e. Descent.

(1) Normal.
(2) Maximum rate.
(3) Other.

f. Approach.

(1) Non-precision.
    (a) All engines operating.
    (b) One or more engines inoperative.
    (c) Approach procedures:
        (i) NDB
        (ii) VOR, RNAV, TACAN
        (iii) ASR
        (iv) Helicopter only.
        (v) Other.
    (d) Missed approach.
        (i) All engines operating.
        (ii) One or more engines inoperative.
(2) Precision.
    (a) All engines operating.
    (b) One or more engines inoperative.
    (c) Approach procedures:
        (i) PAR
        (ii) MLS
        (iii) ILS
        (iv) Manual (raw data).
        (v) Flight director only.
        (vi) Autopilot coupled.
            A Cat I
            B Cat II
        (vii) Other.
    (d) Missed approach.
        (i) All engines operating.
        (ii) One or more engines inoperative.
        (iii) Stability system failure.
    (e) Other

g. Any Flight Phase.

(1) Helicopter and powerplant systems operation.
    (a) Air conditioning.
    (b) Anti-icing/deicing.
    (c) Auxiliary power plant.
    (d) Communications.
    (e) Electrical.
    (f) Fire detection and suppression.
    (g) Stabilizer.
    (h) Flight controls.
    (i) Fuel and oil.
    (j) Hydraulic.
    (k) Landing gear.
    (l) Oxygen.
    (m) Pneumatic.

    - (n) Powerplant.
    - (o) Flight control computers.
    - (p) Stability and control augmentation.
    - (q) Other.
- (2) Flight management and guidance system.
    - (a) Airborne radar.
    - (b) Automatic landing aids.
    - (c) Autopilot.
    - (d) Collision avoidance system.
    - (e) Flight data displays.
    - (f) Flight management computers.
    - (g) Head-up displays.
    - (h) Navigation systems.
    - (i) Other.
- (3) Airborne procedures.
    - (a) Holding.
    - (b) Air hazard avoidance.
    - (c) Retreating blade stall recovery.
    - (d) Mast bumping.
    - (e) Other.

h. Engine Shutdown and Parking.

- (1) Engine and systems operation.
- (2) Parking brake operation.
- (3) Rotor brake operation.
- (4) Abnormal/emergency procedures.

End QPS Requirements

3. SIMULATOR SYSTEMS.

Begin QPS Requirements

a. Instructor Operating Station (IOS).

- (1) Power switch(es).
- (2) Helicopter conditions.
    - (a) Gross weight, center of gravity, fuel loading and allocation, etc.
    - (b) Helicopter systems status.
    - (c) Ground crew functions (e.g., external power connections, push back, etc.)
    - (d) Other.
- (3) Airports or Landing Areas.
    - (a) Number and selection.
    - (b) Runway or landing area selection.
    - (c) Landing surface condition (e.g., rough, smooth, icy, wet, dry, etc.)
    - (d) Preset positions (e.g. ramp, gate, #1 for takeoff, takeoff position, over FAF, etc.)
    - (e) Lighting controls.
    - (f) Other.
- (4) Environmental controls.
    - (a) Temperature.
    - (b) Climate conditions (e.g., ice, snow, rain, etc.).
    - (c) Wind speed and direction.
    - (d) Other.
- (5) Helicopter system malfunctions.
    - (a) Insertion / deletion.
    - (b) Problem clear.
    - (c) Other

(6) Locks, freezes, and repositioning.
    (a) Problem (all) freeze / release.
    (b) Position (geographic) freeze / release.
    (c) Repositioning (locations, freezes, and releases).
    (d) Two times or one-half ground speed control.
    (e) Other
(7) Remote IOS.
(8) Other.

b Sound Controls. On / off / rheostat

c. Control Loading System. On / off / emergency stop.

d. Observer Stations.
(1) Position.
(2) Adjustments.

End QPS Requirements

Attachment 4 to Appendix C to Part 60—

SAMPLE DOCUMENTS

Table of Contents

Title of Sample

ATTACHMENT 4 TO APPENDIX A TO PART 60—

Figure 1 – Sample Letter , Request for Initial, Upgrade, or Reinstatement Evaluation..

INFORMATION

Edward Cook, PhD.
Manager, National Simulator Program
Federal Aviation Administration
P.O. Box 20636 (AFS-205)
Atlanta, GA 30320

Dear Dr. Cook:

RE: Request for Initial [Upgrade / Reinstatement] Evaluation

(Sponsor's name) ___________________ requests your evaluation of our (make, model, series) ________ helicopter simulator for Level ______ qualification, located in (City/State) at the (Facility) on (proposed evaluation date). [The proposed evaluation date must not be more than 180 days following the date of this letter.] This simulator [has / has not] been previously qualified by the FAA [and had been issued FAA identification number XXX]. Under separate cover, we have asked our Principal Operations Inspector (POI) (Training Center Program Manager, TCPM), Mr./Ms.__________________(Name), to forward to you a letter concurring with this request.

[The history of this simulator is as follows: ____.]

We agree to provide a Qualification Test Guide (QTG) to your staff not later than 45 days prior to the proposed evaluation date [if tests not run at training site, an additional "1/3 on-site" tests must be provided not later than 14 days prior the proposed evaluation date]. If we are unable to meet the above date for the evaluation, this may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation. With our forwarding the QTG, we acknowledge that the simulator meets all applicable requirements of Title 14 of the Code of Federal Regulation (14 CFR) Part 60; that it meets the requirements of the Helicopter Flight Simulator Qualification Performance Standards (QPS); and that appropriate hardware and software configuration control procedures have been established.

We also agree to forward to you, not later than five (5) business days prior to the scheduled evaluation of this simulator, a confirmation statement that will include the following information:

1. That (a) pilot(s) we have designated, who is(are) qualified on the (make, model, series) _______ helicopter, has(have) assessed the simulator and found that the performance and flying qualities of the simulator represent the (make, model, series) _______ helicopter. This determination will be made after flying all the maneuvers and procedures and exercising the tasks listed in the Table of Functions and Subjective Tests in Attachment 3 to the Helicopter Simulator QPS (except for those listed in the attachment to this letter).

2. That (a) pilot(s), or (an)other person(s) we have designated, has(have) found the simulator systems

and sub-systems (including simulated aircraft systems) functionally represent the (make, model, series) ________ helicopter. This determination will be made after having exercised the operation of the simulator and the functions available through the Instructor Operating Station.

3. That, for type specific helicopters, (a) pilot(s), or (an)other person(s) we have designated, has(have) found the cockpit configuration represents the configuration of the (make, model, and series) ________ aircraft.

The names of the person(s) providing this information will be available to you upon your request.

[Added comments from Operator/Sponsor, if any]

Please contact (Name and Telephone Number of Sponsor's Contact) to confirm the date for this initial (upgrade / re-instatement) evaluation. We understand a member of your National Simulator Program staff will respond to this request within 14 days.

Sincerely,

(Signature –Management Representative)

ATTACHMENT 4 TO APPENDIX A TO PART 60--

Figure 2 – Sample Qualification Test Guide Cover Page

INFORMATION

SPONSOR NAME

SPONSOR ADDRESS

FAA QUALIFICATION TEST GUIDE

(SPECIFIC HELICOPTER MODEL)
(*for example*)
(Vertiflite AB-320)

(Simulator Identification Including Manufacturer, Serial Number, Visual System Used)

(Simulator Level)

(Qualification Performance Standard Used)

(Simulator Location)

FAA Initial Evaluation

Date: _____________

__________________________ Date: ___________
(Sponsor)

__________________________ Date: ___________
Manager, National
Simulator Program, FAA

Attachment 4 to Appendix C to Part 60—
Figure 3 – Sample Simulator Information Page

INFORMATION

SPONSOR NAME	
SPONSOR SIMULATOR CODE:	AB-320 #1
HELICOPTER MODEL:	Vertiflite AB-320
AERODYNAMIC DATA REVISION:	AB-320, CPX-8D, January 1988
ENGINE MODEL(S) AND REVISION:	CPX-8D; RPT-6, January 1988 DRQ-4002, RPT-3, April 1991
FLIGHT CONTROLS DATA REVISION:	AB-320MMM; May 1988
FLIGHT MANAGEMENT SYSTEM:	Berry XP
SIMULATOR MODEL AND MANUFACTURER:	VTF-320, Tinker Simulators, Inc.
DATE OF SIMULATOR MANUFACTURE:	1988
SIMULATOR COMPUTER:	CIA
VISUAL SYSTEM MODEL, MANUFACTURER, and DISPLAY TYPE:	ClearView, Inc. “Real World H6;” Projected Visual System
VISUAL SYSTEM COMPUTER:	LMB-H6
MOTION SYSTEM:	Tinker 6 DOF

Information on this page must be updated and kept current with any modifications or changes made to the simulator and reflected on the log of revisions and the list of effective pages.

Attachment 4 to Appendix C to Part 60—
Figure 4 – Sample Statement of Qualification

Federal Aviation Administration
National Simulator Program

Statement
of
Qualification

This is to certify that representatives of the
National Simulator Program
completed an evaluation of the

Go-Fast Training Center
Vertiflite AB-320 Flight Simulator
FAA Identification Number 888

and found it to meet the standards set forth
in the Qualification Performance Standards
for a simulator at

Level C

(date) **for the NSPM**

Subject to the attached
Configuration List and Restrictions

Attachment 4 to Appendix C to Part 60—
Figure 4A – Sample Statement of Qualification; Configuration List

INFORMATION

STATEMENT of QUALIFICATION
CONFIGURATION LIST
Go-Fast Training Center Vertiflite AB-320 -- Level C -- FAA ID# 888

Configuration		Date Qualified
Helicopter Model:......................	AB-320..	July 12, 1988
Engine Model(s) and Revision:...	CPX-8D, RPT-6........................	July 12, 1988
	DRQ-4002, RPT-3....................	April 1, 1991
Flight Management System:.......	Berry XP..	July 12, 1988
Visual System / Manufacturer:	Real World H6, Clear View, Inc.	
CRT Installation:....................	....	
Projected System:....................	210° Horizontal Viewing Angle.......	July 12, 1988
Flight Instruments:		
Display (CRT, LCD, etc.).......	....	July 12, 1988
Flight Director:		
Single Cue..............................	Sperry..	July 12, 1988
Engine Instruments:		
Display (CRT, LCD, etc.).......	....	July 12, 1988
Navigation Type(s):		
ADF.......................................	....	July 12, 1988
VOR/ILS...............................	....	July 12, 1988
GPS......................................	....	July 12, 1988
Weather Radar:	Jones Industries, Inc.	July 12, 1988
ACARS	……………………………………	April 1, 1991

Attachment 4 to Appendix C to Part 60—
Figure 4B – Sample Statement of Qualification
Non-Qualified Maneuvers, Procedures, and Tasks
INFORMATION

STATEMENT of QUALIFICATION

Non-Qualified Maneuvers, Procedures, and Tasks

Go-Fast Training Center Vertiflite AB-320 -- Level C -- FAA ID# 888

The FFS is qualified to perform all of the Maneuvers, Procedures, Tasks, and Functions listed in the Table of Functions and Subjective Tests,
Part 60, Appendix C, Attachment 3,
In Effect on [mm/dd/yyyy] except for the following listed Tasks or Functions.

(*Example*)

Non-Qualified Operations Tasks and Functions

Normal Takeoff, Daylight Conditions.
Precision Approaches, Precision Approach Radar (PAR)
Communications (ACARS)

Non-Qualified Simulator Systems:

Remote IOS

Additional Qualified Tasks or Functions in addition to those listed in the Table of Functions and Subjective Tests, Part 60, Appendix C, Attachment 3.

(None)

Attachment 4 to Appendix C to Part 60—
Figure 5 – Sample Recurrent Evaluation Requirements Page

Recurrent Evaluation Requirements
Completed at conclusion of Initial Evaluation

Recurrent Evaluations to be conducted each	Recurrent evaluations are due as follows:
_(fill in)__ months	_(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate)
Allotting ______ hours of FTD time.	
Signed: ________________________________ NSPM / Evaluation Team Leader	______________________ Date

Revision:

Based on (enter reasoning):

Recurrent Evaluations are to be conducted each	Recurrent evaluations are due as follows:
_(fill in)__ months. Allotting ______ hours.	_(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate)
Signed: ________________________________ NSPM Evaluation Team Leader	______________________ Date

Revision:

Based on (enter reasoning):

Recurrent Evaluations are to be conducted each	Recurrent evaluations are due as follows:
_(fill in)__ months. Allotting ______ hours.	_(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate)
Signed: ________________________________ NSPM Evaluation Team Leader	______________________ Date

(Repeat as Necessary)

Attachment 4 to Appendix C to Part 60—
Figure 6 – Sample MQTG Index of Effective FSD Directives

INFORMATION

Index of Effective FSD Directives
Filed in this Section

Notification Number	**Received From: (TPAA/NSPM)**	**Date of Notification**	**Date of Modification Completion**

Continue as Necessary....

Appendix D to Part 60--Qualification Performance Standards for Helicopter Flight Training Devices

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Begin Information

This appendix establishes the standards for Helicopter Flight Training Device (FTD) evaluation and qualification. The Flight Standards Service, National Simulator Program (NSP) staff, under the direction of the NSP Manager (NSPM), is responsible for the development, application, and interpretation of the standards contained within this appendix.

The procedures and criteria specified in this document will be used by the NSPM, or a person or persons assigned by the NSPM (e.g., FAA pilots and/or FAA aeronautical engineers, assigned to and trained under the direction of the NSP--referred to as NSP pilots or NSP engineers, other FAA personnel, etc.) when conducting helicopter FTD flight simulator evaluations.

Table of Contents

7. Additional Responsibilities of the Sponsor (§ 60.9).

8. FTD Use (§ 60.11).

9. FTD Objective Data Requirements (§ 60.13)

10. Special Equipment and Personnel Requirements for Qualification of the FTD (§ 60.14).

11. Initial (and Upgrade) Qualification Requirements (§ 60.15).

12. Additional Qualifications for a Currently Qualified FTD (§ 60.16).

13. Previously Qualified FTDs (§ 60.17).

14. Inspection, Continuing Qualification Evaluation, and Maintenance Requirements (§ 60.19).

15. . Logging FTD Discrepancies (§ 60.20).

16. Interim Qualification of FTDs for New Helicopter FTD Types or Models (§ 60.21).

17. Modifications to FTDs (§ 60.23).

18. Operation with Missing, Malfunctioning, or Inoperative Components (§ 60.25).

19. Automatic Loss of Qualification and Procedures for Restoration of Qualification (§ 60.27).

20. Other Losses of Qualification and Procedures for Restoration of Qualification (§ 60.29).

21. Recordkeeping and Reporting (§ 60.31).

22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements (§ 60.33).

23. [Reserved].

24.[Reserved].

25. FTD Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA) (§ 60.37).

Attachment 1 to Appendix D to Part 60--General FTD Requirements.

Attachment 2 to Appendix D to Part 60--FTD Objective Tests.

Attachment 3 to Appendix D to Part 60--FTD Subjective Evaluation.

Attachment 4 to Appendix D to Part 60--Sample Documents.

1. Introduction

Begin Information

a. This appendix contains background information as well as material that is either directive or informative in nature as described later in this section. Except for this Introduction section, the directive or the informative material is presented in sections that correspond with sections of part 60. This material provides additional requirements and/or provides information regarding that subject. Some sections will have neither additional regulatory or informational material. In these instances the corresponding section in the Table of Contents will show "(No Info)."

b. To assist the reader in determining what areas are directive
or required and what areas are guiding or permissive—

(1) The text in this appendix is contained within one of two sections: regulatory requirements that are in addition to the requirements in part 60 but are found only in this appendix, referred to as “QPS Requirements;” and advisory or informative material, referred to as “Information.”

(2) The text presented between horizontal lines beginning with the heading “Begin QPS Requirements” and ending with the heading “End QPS Requirements,” contains the regulatory requirements that are in addition to the requirements in the body of the part 60 language but found only in this appendix.

(3) The text presented between horizontal lines beginning with the heading “Begin Information” and ending with the heading “End Information,” is advisory or informative.

(4) The tables in this appendix have rows across the top of each table--

(a) The data presented in columns under the heading ``QPS REQUIREMENTS'' is regulatory but is found only in this appendix.

(b) The data presented in columns under the heading ``INFORMATION'' is advisory or informative.

c. Questions regarding the contents of this publication should be sent to: U.S. Department of Transportation, Federal Aviation Administration, Flight Standards Service, National Simulator Program Staff, AFS-205, PO Box 20636 Atlanta, Georgia 30320. Telephone

contact numbers are: phone, 404-305-6100; fax, 404-305-6118. The

National Simulator Program Internet Web Site address is:

http://frwebgate.access.gpo.gov/cgi-bin/leaving.cgi?from=leavingFR.html&log=linklog&to=http://www.faa.gov/nsp. On this Web Site you will find an NSP personnel list with contact information, a list of qualified flight simulation devices, advisory circulars, a description of the qualification process, NSP policy, and an NSP ``In-Works" section. Also linked from this site are additional information sources, handbook bulletins, frequently asked questions, a listing and text of the Federal Aviation Regulations, Flight Standards Inspector's handbooks, and other FAA links.

d. The NSPM encourages the use of electronic media for communication and the gathering, storage, presentation, or transmission of any record, report, request, test, or statement required by this QPS provided the media used has adequate provision or security and is acceptable to the NSPM. The NSPM recommends inquiries on system compatibility prior to any such activity. Minimum System requirements may be found on the NSP Web site.

e. Related Reading References

(1) 14CFR part 60

(2) 14CFR part 61.

(3) 14CFR part 63.

(4) 14CFR part 119

(5) 14CFR part 121.

(6) 14CFR part 125

(7) 14CFR part 135.

(8) 14CFR part 141

(9) 14CFR part 142

(10) Advisory Circular (AC) 120-28C, Criteria for Approval of Category III Landing Weather Minima.

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

(12) AC 120-35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.

(13) AC 120-41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.

(14) AC 120-57A, Surface Movement Guidance and Control System (SMGS).

(15) AC 150/5300-13, Airport Design.

(16) AC 150/5340-1G, Standards for Airport Markings.

(17) AC 150/5340-4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.

(18) AC 150/5340-19, Taxiway Centerline Lighting System.

(19) AC 150/5340-24, Runway and Taxiway Edge Lighting System.

(20) AC 150/5345-28D, Precision Approach Path Indicator (PAPI) Systems

(21) International Air Transport Association document, “Flight Simulator Design and Performance Data Requirements," as amended

(22) AC 29-2B, Flight Test Guide for Certification of Transport

Category Rotorcraft.

(23) AC 27-1A, Flight Test Guide for Certification of Normal

Category Rotorcraft.

(24) International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, as amended.

(25) Airplane Flight Simulator Evaluation Handbook, Volume I, as amended and Volume II, as amended, The Royal Aeronautical Society, London, UK.

(26) FAA Publication FAA-S-8081 series (Practical Test Standards for Airline Transport Pilot Certificate, Type Ratings, Commercial Pilot, and Instrument Ratings).

(27) The FAA Aeronautical Information Manual (AIM), FAA Handbook XXXXX

f. Background. Reserved

End Information

2. Applicability (§§ 60.1 & 60.2)

There is no additional regulatory or informational material that 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)

Begin Information

See Appendix F 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)

There is no additional regulatory or informational material that applies to § 60.4, Qualification Performance Standards.

5. Quality Management System (§ 60.5).

Begin Information

Additional regulatory material and informational material regarding Quality Management Systems for Flight Simulation Training Devices may be found in appendix E of this part.

End Information

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6. Sponsor Qualification Requirements (§ 60.7).

Begin Information

a. The intent of the language used in § 60.7(b) is to have a specific FTD, identified by the sponsor, used by the sponsor at least once in the sponsor's FAA-approved flight training program for the helicopter FTD 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. To assist in avoiding confusion regarding the requirements for use of a qualified FTD the following examples/descriptions are provided to describe acceptable operational practices:

(1) Example One.

a. A sponsor is sponsoring a single, specific FTD for their own use, in their 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 FTD simulated. This 12-month period is established according to the following:

(i) If the FTD was qualified prior to [insert the effective date of this rule] the 12-month period begins on the date of the first NSPM-conducted continuing qualification after [insert the effective date of this rule] and continues for each subsequent 12-month period;

(ii) If the FTD satisfactorily completes an initial or upgrade evaluation on or after [insert the effective date of this rule] the 12-month period begins on the date of that completed initial or upgrade evaluation and continues for each subsequent 12-month period.

b. There is no minimum number of hours or minimum FTD periods 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 their facility or elsewhere. Each such additionally sponsored FTD must be –

(i) Used by the sponsor in the sponsor's FAA-approved flight training program for the helicopter FTD simulated [as described in § 60.7(d)(1)] at least once in each 12-month period in that sponsor's FAA-approved flight training program for the helicopter FTD simulated (this 12-month period is established in the same manner as in example one);

OR

(ii) Used by another FAA certificate holder in that other certificate holder's FAA-approved flight training program for the helicopter FTD simulated [as described in § 60.7(d)(1)] at least once in each 12-month period in that certificate holder's FAA-approved flight training program for the helicopter FTD simulated (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 FTD, 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 FTD [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 or minimum FTD periods required.

(3) Example Three.

a. A sponsor (in this example, a Part 142 certificate holder) in "New York" (having at least one FTD used at least once per year in the sponsor's FAA-approved flight training program) establishes a "satellite" training center in "Chicago" and/or a satellite center in "Moscow."

b. The satellite function means that the "Chicago" and/or "Moscow" center(s) 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, etc.).

c. All of the FTDs in the "Chicago" center and/or the "Moscow" center could be dry-leased (i.e., the certificate holder does not have and utilize FAA-approved flight training programs for the FTDs in the "Chicago" and/or the

"Moscow" center) because –

(i) Each FTD in the "Chicago" center and/or 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 FTD [as described in § 60.7(d)(1)];or

(ii) A statement is obtained from a qualified pilot (having flown the helicopter FTD, 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" center and/or each FTD in the "Moscow" center represent the helicopter FTD [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…" as found in § 60.9(a), means without unnecessarily disrupting or delaying beyond a reasonable time the training, evaluation, or experience being conducted in the FSTD.

End Information

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8. FTD Use (§ 60.11).

There is no additional regulatory or informational material that applies to § 60.11, FTD Use.

---

9. FTD Objective Data Requirements (§ 60.13)

Begin QPS Requirements

a. The FTD sponsor must 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/or, if appropriate, with the person having supplied the aircraft data package for the FTD in order to facilitate the notification described in this paragraph. The sponsor must immediately notify the NSPM when an addition to or a revision of the flight related data or helicopter FTD systems related data is available if this data is used to program and/or 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 notification must also provide technical information about this data to the NSPM relative to the data's significance for training, evaluation, or flight experience activities in the FTD.

b. 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, that contains:

(a) The required maneuvers and procedures.

(b) For each maneuver or procedure --

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

(ii) The atmospheric and environmental conditions.

(iii) The initial flight conditions.

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

(v) The data that is to be gathered.

(vi) Any other appropriate factors.

(2) Appropriately qualified flight test personnel.

(3) An understanding of the accuracy of the data to be gathered.

(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.

(5) Calibration of data acquisition equipment and helicopter FTD performance instrumentation must be current and traceable to a recognized standard.

c. The data, regardless of source, must be presented:

(1) in a format that supports the flight 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 of this appendix.

(4) with any necessary guidance information provided; and

(5) without alteration, adjustments, or bias; however the data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation.

d. 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.

End QPS Requirements

Begin Information

e. It is the intent of the NSPM 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 NSPM for approval, a descriptive document (a validation data roadmap) 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 rationale or explanations for cases where data or data parameters are missing, where engineering simulation data are used, where flight test methods require further explanations, etc. and provide a brief narrative describing the cause and effect of any deviation from data requirements. This document may be provided by the aircraft manufacturer.

f. There is no requirement for any flight test data supplier to submit a flight test plan/program prior to gathering flight test data. However, the NSP staff has experience that indicates at least some data gatherers, primarily those that do not have a satisfactory "history" of supplying such data, often provide data that is irrelevant, not properly marked, without adequate justification for selection, without adequate information regarding initial conditions, without adequate information regarding the test maneuver, etc. The NSP staff has been forced to not accept such data submissions as validation data for FTD evaluation. It is for this reason that the NSP staff 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 NSP staff well in advance of commencing the flight tests.

g. The NSPM will consider, on a case-by-case basis, whether or not 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 NSPM determines that special equipment or (a) specifically qualified person(s) will be required for the conduct of any evaluation, the NSPM 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, sound analyzer, etc. Examples of specially qualified personnel would be those specifically qualified to install or use any special equipment when its use is required.

b. Examples of a special evaluation would be an evaluation conducted after the move of a FTD; at the request of the TPAA; as a result of comments received from users of the FTD that, upon analysis and confirmation, might cause a question as to the continued qualification or use of the FTD; etc.

End Information

---

11. Initial (and Upgrade) Qualification Requirements (§ 60.15).

Begin QPS Requirements

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

(1) A statement that the FSTD 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 NSPM 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 NSPM via traditional or electronic means.

(3) A qualification test guide (QTG), acceptable to the NSPM, that includes all of the following:

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

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

(iii) The result of FSTD performance demonstrations prescribed in the appropriate QPS.

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

b. 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 of this appendix.

c. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, to the NSPM 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 automatically and manually conducted tests;

(3) A means of comparing the FTD's test results to the objective data;

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

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

d. 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 2, for a sample QTG cover page).

(2) A continuing qualification evaluation schedule requirements page – to be used by the NSPM to establish and record the frequency with which continuing qualification evaluations must be conducted and any subsequent changes that may be determined by the NSPM. See Attachment 4, Figure 4, for a sample Continuing Qualification Evaluation Schedule Requirements page.

(3) A FTD information page that provides the information listed in this paragraph (see Attachment 4, Figure 3, for a sample FTD information page). For convertible FTDs, a separate page is submitted for each configuration of the FTD.

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

(b) The helicopter FTD model and series being simulated.

(c) The aerodynamic data revision number or reference.

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

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

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

(g) The FTD model and manufacturer.

(h) The date of FTD manufacture.

(i) The FTD computer identification.

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

(k) 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's) with certain requirements. SOC's must provide references to the sources of information for showing the capability of the FTD to comply with the requirement, a rationale explaining how the referenced material is used, mathematical equations and parameter values used, and the conclusions reached; i.e. that the FTD complies with the requirement. Refer to the "Additional Details" column in attachment 1, "FTD Standards," or in the “Test Details” column in attachment 2, “FTD Objective Tests,” to see when SOC's are required.

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

(10) The following information for each objective test designated in attachment 2, 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 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) 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.

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

(1) The sponsor's FTD test results must be recorded in a manner, acceptable to the NSPM, that will allow easy comparison of the FTD test results to the validation data (e.g., use of a multi-channel recorder, line printer, cross plotting, overlays, transparencies, etc.).

(2) FTD results must be labeled using terminology common to helicopter FTD 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 of this appendix.

(5) For 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 FTD with respect to time. Time histories recorded via a line printer are to be clearly identified for cross-plotting on the helicopter FTD data. Over-plots must not obscure the reference data.

f. The sponsor may elect to complete the QTG objective tests at the manufacturer’s facility. Tests performed at this location must be conducted after assembly of the FTD has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate FTD performance at the sponsor's training facility by repeating a representative sampling of all the objective tests in the QTG and submitting these repeated test results to the NSPM. This sample must consist of at least one-third of the QTG objective tests. The QTG must be clearly annotated to indicate when and where each test was accomplished.

g. While the subjective tests are normally accomplished at the sponsor's training facility, the sponsor may elect to complete the subjective tests at the manufacturer's facility. Tests performed at this location will be conducted after assembly of the FTD has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate FTD performance at the sponsor's training facility by having the pilot(s) who performed these tests originally (or similarly qualified pilot(s)), repeat a representative sampling of these subjective tests (need not take more than one normal FTD period – e.g., 4 hours) and submit a statement to the NSPM that the FTD has not changed from the original determination. This statement must clearly indicate when and where these repeated tests were completed.

h. The sponsor must maintain a copy of the MQTG at the FTD location. j. All FTDs for which the initial qualification is conducted after [insert 6 years after effective date of this rule] must have an electronic MQTG (eMQTG) including all objective data obtained from helicopter FTD 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 general FTD performance or demonstration results (reformatted or digitized) prescribed in this appendix, and a description of the equipment necessary to perform the evaluation for initial qualification and the continuing qualification evaluations for continuing qualification. This 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. An eMQTG must be provided to the NSPM.

i. All other FTDs (not covered in subparagraph "i") must have an electronic copy of the MQTG by and after [insert 6 years after effective date of this rule], a copy of which must be provided to the NSPM. This may be provided by an electronic scan presented in a Portable Document File (PDF), or similar format, acceptable to the NSPM.

End QPS Requirements

Begin Information

j. Only those FTDs that are sponsored by a certificate holder (as defined for use in part 60 and this QPS appendix) will be evaluated by the NSPM. 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.

k. 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 and performance demonstrations in attachment 1, the objective tests listed in attachment 2, and the subjective tests listed in attachment 3 of this appendix. The evaluation(s) described herein will include, but not necessarily be limited to the following, as appropriate, for the qualification level of the FTD:

(1) Helicopter FTD responses, including longitudinal and lateral-directional control responses (see attachment 2 of this appendix);

(2) Performance in authorized portions of the simulated helicopter FTD's operating envelope, to include tasks evaluated by the NSPM in the areas of ground operations, takeoff, climb, cruise, descent, approach, and landing as well as abnormal and emergency operations (see paragraph [check reference] and attachment 2 of this appendix);

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

(4) Cockpit 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 FTD systems and sub-systems (as appropriate) as compared to the helicopter FTD 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 complexity of the FTD 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.

l. The NSPM administers the objective and subjective tests, which includes an examination of functions. The tests include a qualitative assessment of the FTD by an NSP pilot. The NSP 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.

m. The tolerances for the test parameters listed in attachment 2 of this appendix are the maximum acceptable to the NSPM 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 NSPM 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.

n. In addition to the scheduled continuing qualification evaluation (see paragraph [check reference]), each FTD is subject to evaluations conducted by the NSPM at any time with no 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 crew member 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.

o. Problems with objective test results are handled according to the following:

(1) If a problem with an objective test result is detected by the NSP evaluation team during an evaluation, the test may be repeated and/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 NSPM may qualify the FTD at that lower level.

p. After the NSPM issues a statement of qualification to the sponsor when a FTD is successfully evaluated, the FTD is recommended to the TPAA, who will exercise authority on behalf of the Administrator in approving the FTD in the appropriate helicopter FTD flight training program.

q. Under normal circumstances, the NSPM 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; however, once a schedule is agreed to, any slippage of the evaluation date at the sponsor's request may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation. A sponsor may commit to an initial evaluation date under this early process, in coordination with and the agreement of the NSPM, but the request must be in writing and must include an acknowledgment of the potential schedule impact if the sponsor slips the evaluation from this early-committed date. See Attachment 4, figure 5, Sample Request for Initial Evaluation Date.

r. A convertible FTD is addressed as a separate FTD for each model and series helicopter FTD to which it will be converted and for the FAA qualification level sought. An NSP evaluation is required for each configuration. For example, if a sponsor seeks qualification for two models of a helicopter FTD type using a convertible FTD, two QTG's, or a supplemented QTG, and two evaluations are required.

s. 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.

t. If additional information is needed regarding the preferred qualifications of pilots used to meet the requirements of §60.15(e), the reader should contact the NSPM or visit the NSPM website.

u. Examples of the exclusions for which the FTD might not have been subjectively tested by the sponsor or the NSPM and for which qualification might not be sought or granted, as described in §60.15(h)(6), include windshear training, circling approaches, etc.

End Information

12. Additional Qualifications for a Currently Qualified FTD (§ 60.16).

There is no additional regulatory or informational material that applies to § 60.16, Additional Qualifications for a Currently Qualified FTD.

13. Previously Qualified FTDs (§ 60.17).

Begin QPS Requirements

a. In instances where a sponsor plans to remove a FTD from active status for prolonged periods, the following procedures will apply:

(1) The NSPM must be advised in writing and the advisement must include an estimate of the period that the FTD will be inactive;

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

(3) The NSPM will remove the FTD from the list of qualified FSTD’s 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 may be restored to qualified status, it will require an evaluation by the NSPM. The evaluation content and time required for accomplishment will be based on the number of continuing qualification evaluations and sponsor-conducted 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;

(5) The sponsor must notify the NSPM of any changes to the original scheduled time out of service;

(6) The FTD will normally be re-qualified 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 a review of the qualification basis and will likely result in the re-qualification to be against the standards in effect and current at the time of re-qualification.

End QPS Requirements

Begin Information

b. Other certificate holders or persons desiring to use a flight FTD may contract with FTD sponsors to use those FTDs already qualified at a particular level for a helicopter FTD 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 paragraph 12 of this appendix.

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

d. The intent of the requirement listed in § 60.17(b), for each FTD to have a Statement of Qualification 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.

e. Downgrading of a FTD is a permanent change in qualification level. If a temporary restriction is placed on a FTD because of a missing, malfunctioning, or inoperative component or some repair is in progress, the restriction is not a permanent change in qualification level and such a temporary restriction can, and is, removed when the reason for the restriction has been resolved. It would be inappropriate to permanently downgrade a FTD and, at some undetermined time in the future, allow that FTD to be returned to its original status (i.e., accomplish an “upgrade”) using the original qualification standards.

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 in this sequence will be developed by the sponsor and will be acceptable to the NSPM.

b. The description of what constitutes the functional preflight inspection will 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.

End QPS Requirements

Begin Information

d. In determining the acceptability of the sponsor's test sequence and the content of each quarterly inspection required in § 60.19(a)(1), the NSPM looks for a balance and a mix from the performance demonstrations and 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.

e. If the NSP 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. These tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests.

f. The continuing qualification evaluations, described in § 60.19(b), normally will require 4 hours of FTD time. Flexibility is necessary to address those situations that are not normal or those that involve aircraft with additional levels of complexity (e.g. computer controlled aircraft) and may require additional time. The continuing qualification evaluations will consist of the following:

(1) Review of the results of the objective tests and all the designated FTD performance demonstrations (quarterly inspections) conducted by the sponsor since the last scheduled continuing qualification evaluation.

(2) At the discretion of the evaluator, a selection of approximately 8 to 15 objective tests from the MQTG, that will, in the opinion of the evaluator, provide an adequate opportunity to evaluate, first hand, the performance of the FTD. The tests chosen will be performed either automatically or manually, at the discretion of the evaluator 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, selected at the discretion of the evaluator. 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, to include, but not necessarily limited to, the motion system, visual system, sound system, instructor operating station, and the normal functions and simulated malfunctions of the simulated helicopter FTD systems. This examination is normally accomplished simultaneously with the subjective evaluation requirements noted in subparagraph d(3).

g. The requirement established in § 60.19(b)(4) regarding the frequency of NSPM-conducted continuing qualification evaluations for each FTD is typically 12 months. However, the establishment and satisfactory operation of an approved quality management system for a sponsor will provide a basis for adjusting the interval between evaluations on some FTDs at a given sponsor's location to exceed this 12-month interval.

End Information

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15. Logging FTD Discrepancies (§ 60.20).

There is no additional regulatory or informational material that applies to § 60.20. Logging FTD Discrepancies.

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16. Interim Qualification of FTDs for New Helicopter FTD Types or Models (§ 60.21).

There is no additional regulatory or informational material that applies to § 60.21, Interim Qualification of FTDs for New Helicopter FTD Types or Models.

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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 FFS and the results that are expected with the modification incorporated.

b. Prior to using the modified FFS:

(i) All the applicable objective tests that have been run with the modification incorporated, including any necessary updates to the MQTG must be acceptable to the NSPM; and

(ii) The sponsor must provide the NSPM with a statement signed by the MR that the factors cited in § 60.15(b) are addressed by the appropriate personnel as described in that section.

End QPS Requirements

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18. Operation with Missing, Malfunctioning, or Inoperative Components (§ 60.25).

Begin Information

a. Once the sponsor fairly and accurately advises the user of a FTD's current status, including any missing, malfunctioning, or inoperative (MMI) component(s), the sponsor's responsibility with respect to § 60.25(a) will have been satisfied.

b. 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 intent of the FAA is to automatically extend the deadline until the next business day.

c. In accordance with the authorization described in § 60.25(b), the NSPM may find as acceptable a discrepancy prioritizing system wherein the length of time authorized to repair or replace any given MMI component is based on the level of impact on the capability of the FTD to provide the required training, evaluation, or flight experience, with the larger impact on this capability associated with 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 is to 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, etc.) there is a greater likelihood of being able to determine the amount of testing that would be required for re-qualification.

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 is to 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, etc.) there is a greater likelihood of being able to determine the amount of testing that would be required for re-qualification.

End Information

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21. Recordkeeping and Reporting (§ 60.31).

Begin QPS Requirements

a. The minimally acceptable record of programming changes, as described in § 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 illegal or 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).

There are no additional QPS requirements or informational material that apply to § 60.33, Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements.

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23. [Reserved].

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24. [Reserved].

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25. FTD Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA) (§ 60.37).

There are no additional QPS requirements or informational material that apply to § 60.37, FTD Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA).

Attachment 1 to Appendix D to Part 60--

FTD STANDARDS

1. General

a. Requirements

Begin QPS Reqirements

Certain FTD requirements included in this appendix must be supported with a Statement of Compliance and Capability (SOC) and, in designated cases, FTD performance must be recorded and the results made part of the QTG. In the following tabular listing of FTD standards, requirements for SOC's are indicated in the "Additional Details" column.

End QPS Requirements

b. Discussion

Begin Information

(1) This attachment describes the minimum requirements for qualifying Level 2 through Level 6 flight training devices. To determine the complete requirements for a specific level FTD, the objective tests in attachment 2 of this appendix and the subjective tests listed in attachment 3 of this appendix for this QPS must be consulted.

(2) The material contained in this attachment is divided into the following categories:

- (a) General cockpit configuration.
- (b) Simulator programming.
- (c) Equipment operation.
- (d) Equipment and facilities for instructor/evaluator functions.
- (e) Sound system.

End Information

< < QPS Requirement > > > > > > >					< INFORMATION >
General FTD Standards	**FTD Level**			**Additional Details**	**Notes**
	4	**5**	**6**		
2. General Cockpit Configuration.					
a. The FTD must have a cockpit that is a full-scale replica of the helicopter, or set of helicopters, simulated with controls, equipment, observable cockpit 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.			**X**	Crewmember seats must afford the capability for the occupant to be able to achieve the design “eye position” for specific helicopters, or to approximate such a position for a generic set of helicopters.	For FTD purposes, the cockpit 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 crewmember duty stations and those required bulkheads aft of the pilot seats.
b. The FTD must have equipment (i.e., instruments, panels, systems, 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 cockpit or an open flight deck area. Actuation of this equipment must replicate the appropriate function in the helicopter.	**X**	**X**			
c. Circuit breakers must function accurately when they are involved in operating procedures or malfunctions requiring or involving flight crew response.		**X**	**X**	Level 6 devices must have installed circuit breakers properly located in the FTD cockpit.	
3. Programming.					
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.		**X**	**X**	Levels 6 additionally requires the effects of change in gross weight and center of gravity. Level 5 requires only generic aerodynamic programming.	
b. The FTD must have the computer (analog or digital) capability (i.e., capacity, accuracy, resolution, and dynamic response) needed to meet	**X**	**X**	**X**		

< < QPS Requirement > > > > > > >					< INFORMATION >
General FTD Standards	FTD Level			Additional Details	Notes
	4	5	6		
the qualification level sought.					
c. The FTD hardware and programming must be updated within 6 months of any helicopter modifications or data releases (or any such modification or data releases applicable to the set of helicopters) unless, with prior coordination, the NSPM authorizes otherwise.	**X**	**X**	**X**		
d. Relative responses of the cockpit instruments (and the visual and motion systems, if installed and training, testing, or checking credits are being sought) must be coupled closely to provide integrated sensory cues. The instruments (and the visual and motion systems, if installed, and training, testing, or checking credits are being sought) must respond to abrupt input at the pilot's position within the allotted time, but not before the time, when the helicopter or set of helicopters would respond under the same conditions. (If a visual system is installed and training, testing, or checking credits are sought, the visual scene changes from steady state disturbance must occur within the appropriate system dynamic response limit but not before the instrument response (and not before the motion system onset if a motion system is installed)).		**X**	**X**	A demonstration is required and must simultaneously record: the analog output from the pilot's control column, wheel, and pedals; and the output signal to the pilot's attitude indicator. These recordings must be compared to helicopter response data in the following configurations: takeoff, cruise, and approach or landing. The results must be recorded in the QTG. Additionally, if a visual system is installed and training, testing, or checking credits are sought, the output signal to the visual system display (including visual system analog delays must be recorded); and if a motion system is installed and training, testing, or checking credits are sought, the output from an accelerometer attached to the motion system platform located at an acceptable location near the pilots' seats is also required.	

< < QPS Requirement > >	> >			> > >		< INFORMATION >
General FTD Standards	**FTD Level**			**Additional Details**		**Notes**
	4	**5**	**6**			
4. Equipment Operation.						
a. All relevant instrument indications involved in the simulation of the helicopter (or set of helicopters) must automatically respond to control movement or external disturbances to the simulated helicopter or set of helicopters; e.g., turbulence or winds.		**X**	**X**			
b. Navigation equipment must be installed and operate within the tolerances applicable for the helicopter or set of helicopters.		**X**	**X**	Level 5 only needs that navigation equipment necessary to fly an instrument approach. Level 6 must also include communication equipment (inter-phone and air/ground) like that in the helicopter, or set of helicopters, and, if appropriate to the operation being conducted, an oxygen mask microphone system.		
c. Installed systems must simulate the applicable helicopter (or set of helicopters) 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.	**X**	**X**	**X**	Level 6 must simulate all applicable helicopter flight, navigation, and systems operation. Level 5 must have functional flight and navigational controls, displays, and instrumentation.		
d. The lighting environment for panels and instruments must be sufficient for the operation being conducted.	**X**	**X**	**X**			
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			**X**			

< < QPS Requirement > >	> >	>	>	> >	< INFORMATION >
General FTD Standards	**FTD Level**			**Additional Details**	**Notes**
	4	**5**	**6**		
conditions.					
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**			
5. Instructor or Evaluator Facilities.					
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**		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.
b. The FTD must have instructor controls that permit activation of normal, abnormal, and emergency conditions, as may be 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**		
6. Motion System.					
a. The FTD may have a motion system; if desired, although it is not required.	**X**	**X**	**X**	If installed, the motion system operation may not be distracting. The motion system standards set out in QPS FAA-S-120-40C for at least Level A simulators is acceptable.	
7. Visual System.					
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: (1) Single channel, uncollimated display is acceptable. (2) Minimum field of view: 18° vertical / 24° horizontal for the pilot flying.	**X**	**X**	**X**	A statement of capability is required. A demonstration of latency or through-put is required. Visual system standards set out in QPS FAA-S-120-40C, for at least Level A simulators is	.

< < QPS Requirement > >	> > >			> >	**< INFORMATION >**
General FTD Standards	**FTD Level**			**Additional Details**	**Notes**
	4	**5**	**6**		
(3) Maximum paralax error: 10° per pilot. (4) Scene content may not be distracting. (5) 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. (6) Minimum resolution of 5 arc-min. for both computed and displayed pixel size. (7) Maximum latency or through-put must not exceed 300 milliseconds.				acceptable. However, if additional authorizations (training, testing, or checking credits) are sought that require the use of a visual system, the Level A simulator visual system standards apply.	
8. Sound System.					
a. The FTD must simulate significant cockpit sounds resulting from pilot actions that correspond to those heard in the helicopter.			**X**		

Attachment 2 to Appendix D to Part 60--
FLIGHT TRAINING DEVICE (FTD) OBJECTIVE TESTS

1. General

a. Test Requirements.

Begin QPS Requirements

(1) The ground and flight tests required for qualification are listed in the following Table of Objective Tests. Computer generated FTD test results must be provided for each test. If a flight condition or operating condition is required for the test but which does not apply to the helicopter being simulated or to the qualification level sought, it may be disregarded (for example: an engine out climb capability for a single-engine helicopter; etc.). Each test result is compared against Flight Test Data described in §60.13, and Paragraph 9 of this appendix. (See paragraph 1.b of this attachment for additional information.) Although use of a driver program designed to automatically accomplish the tests is authorized, each test must be able to be accomplished manually while recording all appropriate parameters. The results must be produced on a multi-channel recorder, line printer, or other appropriate recording device acceptable to the NSPM. Time histories are required unless otherwise indicated in the Table of Objective Tests. All results must be labeled using the tolerances and units given.

(2) The Table of Objective Tests 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 aerodynamic modeling and acquisition/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.

(3) Certain tests included in this attachment must be supported with a Statement of Compliance and Capability (SOC). In the following tabular listing of FTD tests, requirements for SOC's are indicated in the "Test Details" column.

(4) 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.

(5) It is not sufficient, nor is it acceptable, to program the FTD so that the aerodynamic modeling is correct only at the validation test points. Unless noted otherwise, tests must represent helicopter performance and handling qualities at normal operating weights and centers of gravity (CG). 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 Levels 3 and 6 are expected to be indicative of the device's performance and handling qualities throughout the following:

(a) the helicopter weight and CG envelope;

(b) the operational envelope; and

(c) varying atmospheric ambient and environmental conditions – including the extremes authorized for the respective helicopter or set of helicopters.

(6) 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 pounds (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. 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 clearly annotated as to indicated, calibrated, etc., and like values used for comparison.

(7) The QTG provided by the sponsor must describe clearly and distinctly how the FTD will be set up and operated for each test. Overall integrated testing of the FTD must be accomplished to assure that the total FTD system meets the prescribed standards; i.e., it is not acceptable to test only each FTD subsystem independently. A manual test procedure with explicit and detailed steps for completion of each test must also be provided.

(8) In those cases where the objective test results authorize a “snapshot” result in lieu of a time-history result, the sponsor must ensure that a steady state condition exists from 5 seconds prior to, through 2 seconds after, the instant of time captured by the “snapshot.”

(9) For previously qualified FTDs, the tests and tolerances of this appendix may be used in subsequent recurrent evaluations for any given test providing the sponsor has submitted a proposed MQTG revision to the NSPM and has received NSPM approval.

(10) 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. Requirements for testing will be mutually agreed to between the sponsor and the NSPM on a case-by-case basis.

End QPS Requirements

b. Discussion.

Begin Information

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.

End Information

Table of Objective Tests

<<< QPS REQUIREMENT								INFORMATION
TEST	**TOLERENCE**	**FLIGHT CONDITIONS**	**TEST DETAILS**					**NOTES**
			4	**5**	**6**			
2. Performance								
a. Engine Assessment								
(1) Start Operations								
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			**X**	Record each engine start from the initiation of the start sequence to steady state idle and from steady state idle to operating RPM.		.
(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		**X**	**X**	Record both steady state idle and operating RPM conditions. May be a series of snapshot tests.		
(2) Power Turbine Speed Trim	±10% of total change of power turbine speed.	Ground			**X**	Record engine response to trim system actuation in both		

Table of Objective Tests

<<< QPS REQUIREMENT								INFORMATION
TEST	**TOLERENCE**	**FLIGHT CONDITIONS**	**TEST DETAILS**					**NOTES**
			4	**5**	**6**			
						directions.		
(3) Engine and Rotor Speed Governing	Torque - ±5% Rotor Speed - ±1.5%	1) Climb 2) Descent			**X**	Record results using a step input to the collective. May be conducted concurrently with climb and descent performance tests.		
b. In Flight								
Performance and Trimmed Flight Control Positions.	Torque - ±3% Pitch Attitude - ±1.5º Sideslip Angle - ±2º Longitudinal Control Position - ±5% Lateral Control Position - ±5% Directional Control Position - ±5% Collective Control Position - ±5%	Cruise (Augmentation On and Off)		**X**	**X**	Record results for two gross weight and CG combinations with varying trim speeds throughout the airspeed envelope. May be a series of snapshot tests.		
c. Climb								
Performance and Trimmed Flight Control Positions.	Vertical Velocity - ±100 fpm (61m/sec) or ±10% Pitch Attitude - ±1.5º Sideslip Angle - ±2º Longitudinal Control Position - ±5%	All engines operating. One engine inoperative.		**X**	**X**	Record results for two gross weight and CG combinations. The data presented must be for normal climb power conditions.		

Table of Objective Tests								
<<< QPS REQUIREMENT								INFORMATION
TEST	TOLERENCE	FLIGHT CONDITIONS				TEST DETAILS		NOTES
			4	5	6			
	Lateral Control Position - ±5% Directional Control Position - ±5% Collective Control Position - ±5%	Augmentation System(s) On and Off				May be a series of snapshot tests.		
d. Descent.								
(1) Descent Performance and Trimmed Flight Control Positions.	Torque - ±3% Pitch Attitude - ±1.5º Sideslip Angle - ±2º Longitudinal Control Position - ±5% Lateral Control Position - ±5% Directional Control Position - ±5% Collective Control Position - ±5%	At or near 1,000 fpm rate of descent (RoD) at normal approach speed. Augmentation System(s) On and Off		X	X	Record results for two gross weight and CG combinations. May be a series of snapshot tests.		
(2) Autorotation Performance and Trimmed Flight Control Positions.	Torque - ±3% Pitch Attitude - ±1.5º Sideslip Angle - ±2º Longitudinal Control Position - ±5% Lateral Control Position - ±5% Directional Control Position - ±5%	Steady descents. Augmentation System(s) On and Off		X	X	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		

Table of)bjective Tests

<<< QPS REQUIREMENT								INFORMATION
TEST	TOLERENCE	FLIGHT CONDITIONS	TEST DETAILS					NOTES
			4	5	6			
	Collective Control Position - ±5%					for speeds from approximately 50 kts. through at least maximum glide distance airspeed. May be a series of snapshot tests.		
d. Autorotation.								
Entry**.**	Rotor Speed - ±3% Pitch Attitude ±2º Roll Attitude - ±3º Yaw Attitude - ±5º Airspeed - ±5 kts. Vertical Velocity - ±200 fpm (1.00 m/sec) or 10%	1) Cruise; or 2) Climb			X	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.		

2. Handling Qualities.								
a. Control System Mechanical Characteristics.								

Contact the NSPM

Table of Objective Tests

<<< QPS REQUIREMENT								INFORMATION
TEST	TOLERENCE	FLIGHT CONDITIONS	TEST DETAILS					NOTES
			4	5	6			

for clarification of any issue regarding helicopters with reversible controls.

(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		X	X	Record results for an uninterrupted control sweep to the stops. [This test does not apply if aircraft hardware modular controllers are used.]		
(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.		X	X	Record results for an uninterrupted control *sweep* to the stops.		
(3) Brake Pedal Force vs. Position.	±5 lbs. (2.224 daN) or 10%	Ground; Static conditions.		X	X			
(4) Trim System Rate (all applicable systems)	Rate - ±10%	Ground; Static conditions. Trim On Friction Off		X	X	The tolerance applies to the recorded value of the trim rate.		
(5) Control Dynamics (all axes)	±10% of time for first zero crossing and ±10 (N+1)% of period thereafter. ±10% of amplitude of	Hover/Cruise Trim On Friction Off			X	Results must be recorded for a normal control displacement in both directions in each axis (approximately		Control Dynamics for irreversible control systems may be evaluated in a ground/static

<<< QPS REQUIREMENT								INFORMATION
TEST	TOLERENCE	FLIGHT CONDITIONS	TEST DETAILS					NOTES
			4	5	6			
	first overshoot. ±20% of amplitude of 2nd and subsequent overshoots greater than 5% of initial displacement. ±1 overshoot.					25% to 50% of full throw).		condition. Refer to paragraph 3 of this attachment for additional information. “N” is the sequential period of a full cycle of oscillation.
(6) Freeplay	±0.10 in.	Ground; Static conditions.		X	X	Record and compare results for all controls..		
b. Longitudinal Handling Qualities.								
(1) Control Response	Pitch Rate - ±10% or ±2º/sec. Pitch Attitude Change - ±10% or ±1.5º.	Cruise Augmentation On and Off.		X	X	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.		
(2) Static Stability	Longitudinal Control Position: ±10% of change from trim or ±0.25 in. (6.3 mm) or Longitudinal Control	Cruise or Climb. Autorotation. Augmentation On and Off.		X	X	Record results for a minimum of two speeds on each side of the trim speed. May be a series of		

<<< QPS REQUIREMENT								INFORMATION
TEST	TOLERENCE	FLIGHT CONDITIONS	TEST DETAILS					NOTES
			4	5	6			
	Force : ±0.5 lb. (0.223 daN) or ±10%.					snapshot tests.		
(3) Dynamic Stability								
(a) Long Term Response.	±10% of calculated period. ±10% of time to ½ or double amplitude, or ±0.02 of damping ratio.	Cruise Augmentation On and Off.		X	X	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 time history must be matched.		
(b) Short Term Response.	±1.5º Pitch or ±2º/sec. Pitch Rate. ±0.1 g Normal Acceleration.	Cruise or Climb. Augmentation On and Off.			X	Record results for at least two airspeeds.		
(4) Maneuvering Stability.	Longitudinal Control Position - ±10% of change from trim or ±0.25 in. (6.3mm) or Longitudinal Control Forces - ±0.5 lb. (0.223 daN) or ±10%.	Cruise or Climb. Augmentation On and Off.			X	Record results for at least two airspeeds. Record results for Approximately 30º-45º bank angle. The force may be shown as a cross plot		

<<< QPS REQUIREMENT								INFORMATION
TEST	TOLERENCE	FLIGHT CONDITIONS	TEST DETAILS					NOTES
			4	5	6			
						for irreversible systems. May be a series of snapshot tests.		
(5) Landing Gear Operating Times	±1 sec.	Takeoff (Retraction) Approach (Extension)		X	X			
d. Lateral and Directional Handling Qualities.								
(1)Control Response.								
(a) Lateral	Roll Rate - ±10% or ±3º/sec. Roll Attitude Change - ±10% or ±3º.	Cruise Augmentation On and Off.		X	X	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.		

<<< QPS REQUIREMENT								INFORMATION
TEST	TOLERENCE	FLIGHT CONDITIONS	TEST DETAILS					NOTES
			4	5	6			
(b) Directional	Yaw Rate - ±10% or ±2º/sec. Yaw Attitude Change - ±10% or ±2º.	Cruise Augmentation On and Off.		X	X	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.		
(2) Directional Static Stability.	Lateral Control Position - ±10% of change from trim or ±0.25 in. (6.3mm) 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. (6.3mm) or Directional Control Force - ±1 lb. (0.448 daN) or 10%. Longitudinal Control Position - ±10% of	1) Cruise; or 2) Climb (may use Descent instead of Climb if desired) Augmentation On and Off.		X	X	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.		This is a steady heading sideslip test.

<<< QPS REQUIREMENT								INFORMATION
TEST	TOLERENCE	FLIGHT CONDITIONS	TEST DETAILS					NOTES
			4	5	6			
	change from trim or ±0.25 in. (6.3mm). Vertical Velocity - ±100 fpm (0.50m/sec) or 10%.							
(3) Dynamic Lateral and Directional Stability								
(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.	Cruise or Climb Augmentation On/Off		X	X	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. For non-periodic response, the time history must be matched.		
(b) Spiral Stability	Correct Trend, ±2º bank	Cruise or Climb.		X	X	Record the results of a		

Table of Objective Tests

<<< QPS REQUIREMENT								INFORMATION
TEST	TOLERENCE	FLIGHT CONDITIONS	TEST DETAILS					NOTES
			4	5	6			
	or ±10% in 20 sec.	Augmentation On and Off.				release from pedal only or cyclic only turns. Results must be recorded from turns in both directions.		
(c) Adverse / Proverse Yaw	Correct Trend, ±2º transient sideslip angle.	Cruise or Climb. Augmentation On and Off.		X	X	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.		

3. Control Dynamics.

Begin Information

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 cockpit 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.

b. 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 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.

c. For initial and upgrade evaluations, it is required that control dynamic characteristics be measured at and recorded directly from the cockpit 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. Proper pitot-static inputs (if appropriate) must be provided to represent airspeeds typical of those encountered in flight.

d. 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 would then satisfy this test requirement.

e. 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.

f. 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.

g. Tolerances.

(1) Underdamped Response.

(a) 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.

(2) 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.

(3) (a) The following summarizes the tolerances, T, for an illustration of the referenced measurements. (See Figures 1 and 2, above)

$T(P_0)$	$\pm10\%$ of P_0
$T(P_1)$	$\pm20\%$ of P_1
$T(A)$	$\pm10\%$ of A_1, $\pm20\%$ of Subsequent Peaks
$T(A_d)$	$\pm10\%$ of A_d = Residual Band
Overshoots ±1	

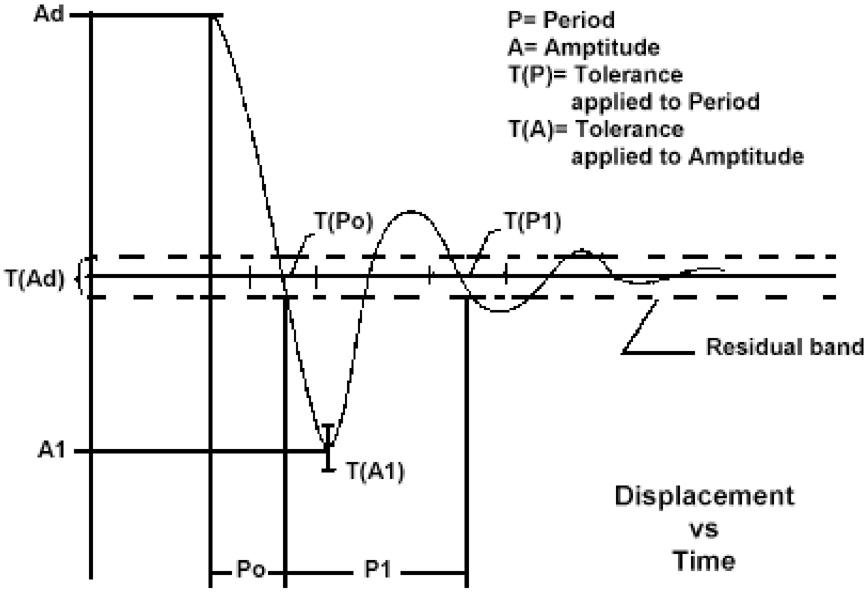
(b) In the event the number of cycles completed outside of the residual band, and thereby significant, exceeds the number depicted in figure 1, the following tolerances (T) will apply:

$T(P_n)$ $\pm10\%(n+1)\%$ of P_n, where “n” is the next in sequence.

End Information

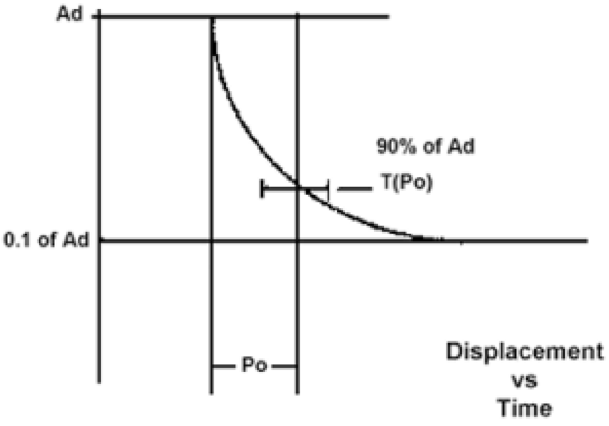
Attachment 2 to Appendix D to Part 60—

FIGURE 1. UNDER-DAMPED STEP RESPONSE



Attachment 2 to Appendix D to Part 60—

FIGURE 2. CRITICALLY-DAMPED STEP RESPONSE



Attachment 3 to Appendix D to Part 60--
FTD SUBJECTIVE TESTS

1. DISCUSSION.

Begin Information

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 may be approved by the TPAA. All items in the following paragraphs are subject to an examination of function.

b. The List of Operations Tasks 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 NSP 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 NSP 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 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.

End Information

2. LIST OF OPERATIONS TASKS
Begin QPS Requirements

The NSP pilot, or the pilot designated by the NSPM, will evaluate the FTD in the following Operations Tasks, as applicable to the helicopter and FTD level, using the sponsor's approved manuals and checklists.

a. Preparation for Flight.

(1) Preflight. Accomplish a functions check of all switches, indicators, systems, and equipment at all cockpit crewmembers' and instructors' stations, and determine that the cockpit design and functions are identical to that of the helicopter simulated.

(2) APU/Engine start and run-up.

  (a) Normal start procedures.

  (b) Alternate start procedures.

  (c) Abnormal starts and shutdowns (hot start, hung start, etc.)

  (d) Rotor engagement.

  (e) System checks.

  (f) Other.

b. Takeoff.

(1) Normal.

  (a) From ground.

  (b) From hover.

    (i) Cat A.

    (ii) Cat B.

  (c) Running.

  (d) Crosswind/tailwind.

  (e) Maximum performance.

  (f) Instrument.

(2) Abnormal/emergency procedures:

  (a) Takeoff with engine failure after critical decision point (CDP).

    (i) Cat A.

    (ii) Cat B.

  (b) Other

c. Climb.

(1) Normal.

(2) One engine inoperative.

(3) Other.

d. Cruise.

(1) Performance.

(2) Flying qualities.

(3) Turns.

    (a) Timed.

    (b) Normal.

    (c) Steep.

(4) Accelerations and decelerations.

(5) High speed vibrations.

(6) Abnormal/emergency procedures, for example:

    (a) Engine fire.

    (b) Engine failure.

    (c) Inflight engine shutdown and restart.

    (d) Fuel governing system failures.

    (e) Directional control malfunction.

    (f) Hydraulic failure.

    (g) Stability system failure.

    (h) Rotor vibrations.

    (i) Other.

e. Descent.

(1) Normal.

(2) Maximum rate.

(3) Other.

f. Approach.

(1) Non-precision.

    (a) All engines operating.

    (b) One or more engines inoperative.

    (c) Approach procedures:

        (i) NDB

        (ii) VOR, RNAV, TACAN

        (iii) ASR

        (iv) Helicopter only.

        (v) Other.

- (d) Missed approach.
    - (i) All engines operating.
    - (ii) One or more engines inoperative.

(2) Precision.

- (a) All engines operating.
- (b) One or more engines inoperative.
- (c) Approach procedures:
    - (i) PAR
    - (ii) MLS
    - (iii) ILS
    - (iv) Manual (raw data).
    - (v) Flight director only.
    - (vi) Autopilot coupled.
        - A Cat I
        - B Cat II
    - (vii) Other.
- (d) Missed approach.
    - (i) All engines operating.
    - (ii) One or more engines inoperative.
    - (iii) Stability system failure.
- (e) Other

g Any Flight Phase.

(1) Helicopter and powerplant systems operation.

- (a) Air conditioning.
- (b) Anti-icing/deicing.
- (c) Auxiliary power plant.
- (d) Communications.
- (e) Electrical.
- (f) Fire detection and suppression.
- (g) Stabilizer.
- (h) Flight controls.
- (i) Fuel and oil.
- (j) Hydraulic.
- (k) Landing gear.

- (l) Oxygen.
- (m) Pneumatic.
- (n) Powerplant.
- (o) Flight control computers.
- (p) Stability and control augmentation.
- (q) Other.

(2) Flight management and guidance system.

- (a) Airborne radar.
- (b) Automatic landing aids.
- (c) Autopilot.
- (d) Collision avoidance system.
- (e) Flight data displays.
- (f) Flight management computers.
- (g) Head-up displays.
- (h) Navigation systems.
- (i) Other.

(3) Airborne procedures.

- (a) Holding.
- (b) Air hazard avoidance.
- (c) Retreating blade stall recovery.
- (d) Mast bumping.
- (e) Other.

h. Engine Shutdown and Parking.

(1) Engine and systems operation.
(2) Parking brake operation.
(3) Rotor brake operation.
(4) Abnormal/emergency procedures.

End QPS Requirements

3. FTD SYSTEMS.

Begin QPS Requirements

a Operating Station (IOS).

(1) Power switch(es).

(2) Helicopter conditions.

    (a) Gross weight, center of gravity, fuel loading and allocation, etc.

    (b) Helicopter systems status.

    (c) Ground crew functions (e.g., external power connections, push back, etc.)

    (d) Other.

(3) Airports or Landing Areas.

    (a) Number and selection.

    (b) Runway or landing area selection.

    (c) Landing surface condition (e.g., rough, smooth, icy, wet, dry, etc.)

    (d) Preset positions (e.g. ramp, gate, #1 for takeoff, takeoff position, over FAF, etc.)

    (e) Lighting controls.

    (f) Other.

(4) Environmental controls.

    (a) Temperature.

    (b) Climate conditions (e.g., ice, snow, rain, etc.).

    (c) Wind speed and direction.

    (d) Other.

(5) Helicopter system malfunctions.

    (a) Insertion / deletion.

    (b) Problem clear.

    (c) Other

(6) Locks, freezes, and repositioning.

    (a) Problem (all) freeze / release.

    (b) Position (geographic) freeze / release.

    (c) Repositioning (locations, freezes, and releases).

    (d) Two times or one-half ground speed control.

    (e) Other

(7) Remote IOS.

(8) Other.

b. Sound Controls. On / off / rheostat

c. Control Loading System. On / off / emergency stop.

d. Observer Stations.

(1) Position.

(2) Adjustments.

End QPS Requirements

Attachment 4 to Appendix D to Part 60—

SAMPLE DOCUMENTS

Attachment 4 to Appendix D to Part 60—

Figure 1 – Sample Letter, Request for Initial, Upgrade, or Reinstatement Evaluation

INFORMATION

Date

Name, POI, ____________________________(Certificate Holder)
FAA FSDO ________________________________
Address
City, State, Zip

Dear Mr./Ms. ______________________________:

(Sponsor's name) __________________ requests evaluation of our (type) ________________ helicopter FTD for Level ______ qualification. The (name) _______________ FTD with (name) _________________visual system is fully defined on page ________ of the accompanying qualification test guide (QTG). We have completed tests of the FTD and confirm that it meets all applicable requirements of Title 14 of the Code of Federal Regulation (14 CFR) part 60 and the requirements of the Helicopter Flight FTD Qualification Performance Standards (QPS). Appropriate hardware and software configuration control procedures have been established.

Our pilot(s) (name) _________________ [and (name)_________________], who is(are) qualified on (type) __________ helicopter, has(have) assessed the FTD and found that it conforms to the (sponsor name) ___________________ (type) __________ helicopter cockpit configuration and that the simulated systems and subsystems have been evaluated and found to function equivalently to those in the helicopter. The above named pilot(s) has(have) found that the FTD represents the respective helicopter in accordance with the attached Configuration List. He/She(They) has(have) also subjectively assessed the performance and flying qualities of the FTD and state that it represents the helicopter. He/She(They) has(have) not subjectively tested the FTD for those tasks on the attached Restrictions-to-Qualification list and we do not seek qualification in these areas.

(Added comments as desired.)

Sincerely,

(Signature of Appropriate Person)

Attachment 4 to Appendix D to Part 60—

Figure 2 – 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: ___________
Manager, National Simulator Program, FAA

Attachment 4 to Appendix D to Part 60—

Figure 3 – Sample FTD Information Page

INFORMATION

SPONSOR NAME SPONSOR FTD CODE:	AB-320 #1
HELICOPTER MODEL:	Vertiflite AB-320
AERODYNAMIC DATA REVISION:	AB-320, CPX-8D, January 1988
ENGINE MODEL(S) AND REVISION:	CPX-8D; RPT-6, January 1988 DRQ-4002, RPT-3, April 1991
FLIGHT CONTROLS DATA REVISION:	AB-320MMM; May 1988
FLIGHT MANAGEMENT SYSTEM:	Berry XP
FTD MODEL AND MANUFACTURER:	VTF-320, Tinker Simulators, Inc.
DATE OF FTD MANUFACTURE:	1988
FTD COMPUTER:	CIA
VISUAL SYSTEM MODEL, MANUFACTURER, and DISPLAY TYPE:	ClearView, Inc. “Real World H1;” CRT Visual System
VISUAL SYSTEM COMPUTER:	LMB-H1
MOTION SYSTEM:	N/A

Note for Figure 3: Information on this page must be updated and kept current with any modifications or changes made to the FTD and reflected on the log of revisions and the list of effective pages.

Attachment 4 to Appendix D to Part 60—

Figure 4 – Sample Statement of Qualification

Federal Aviation Administration
National Simulator Program

Statement
of
Qualification

This is to certify that representatives of the
National Simulator Program
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 the Qualification Performance Standards
For a flight training device at

Level 6

______________________ ______________________________

(date) for the NSPM

Subject to the attached
Configuration List and Restrictions

Attachment 4 to Appendix D to Part 60—

Figure 4A – Sample Statement of Qualification; Configuration List

INFORMATION

STATEMENT of QUALIFICATION
CONFIGURATION LIST
Go-Fast Training Center Vertiflite AB-320 -- Level 6 -- FAA ID# 889

Configuration		**Date Qualified**
Helicopter Model:.......................	AB-320...	July 12, 1988
Engine Model(s) and Revision:...	☐ CPX-8D, RPT-6.........................	July 12, 1988
	☐ DRQ-4002, RPT-3....................	April 1, 1991
Flight Management System:.......	Berry XP...	July 12, 1988
Visual System / Manufacturer:	Real World H1, Clear View, Inc.	
CRT Installation:....................	1 Channel, 2 Window CRT............	July 12, 1988
Flight Instruments:		
Display (CRT, LCD, etc.).......	....	July 12, 1988
Flight Director:		
Single Cue..............................	Sperry..	July 12, 1988
Engine Instruments:		
☐ Display (CRT, LCD, etc.).......	....	July 12, 1988
Navigation Type(s):		
ADF.......................................	....	July 12, 1988
VOR/ILS................................	....	July 12, 1988
GPS.......................................	....	July 12, 1988
ACARS…………………………	……………………………………	April 1, 1991

Attachment 4 to Appendix D to Part 60—
Figure 4B – Sample Statement of Qualification
Non-Qualified Maneuvers, Procedures, and Tasks
INFORMATION

STATEMENT of QUALIFICATION
Non-Qualified Maneuvers, Procedures, and 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 the Table of Functions and Subjective Tests, Part 60, Appendix D, Attachment 3, In Effect on [mm/dd/yyyy] except for the following listed Tasks or Functions.

(*Example*)

Non-Qualified Operations Tasks and Functions

Normal Takeoff, Daylight Conditions.
Precision Approaches, Precision Approach Radar (PAR)
Communications (ACARS)

Non-Qualified Simulator Systems:

Remote IOS

Additional Qualified Tasks or Functions in addition to those listed in the Table of Functions and Subjective Tests, Part 60, Appendix D, Attachment 3.

(None)

Attachment 4 to Appendix D to Part 60—

Figure 5 – Sample Continuing Qualification Evaluation Requirements Page

INFORMATION

Recurrent Evaluation Requirements
Completed at conclusion of Initial Evaluation

Recurrent Evaluations to be conducted each _(fill in)__ months Allotting ______ hours of FTD time. Signed: ___________________________________ NSPM / Evaluation Team Leader	Recurrent evaluations are due as follows: _(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate) _______________________ Date

Revision:

Based on (enter reasoning):

Recurrent Evaluations are to be conducted each _(fill in)__ months. Allotting ______ hours. Signed: ___________________________________ NSPM Evaluation Team Leader	Recurrent evaluations are due as follows: _(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate) _______________________ Date

Revision:

Based on (enter reasoning):

Recurrent Evaluations are to be conducted each _(fill in)__ months. Allotting ______ hours. Signed: ___________________________________ NSPM Evaluation Team Leader	Recurrent evaluations are due as follows: _(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate) _______________________ Date

(Repeat as Necessary)

Attachment 4 to Appendix D to Part 60—

Figure 6 – Sample MQTG Index of Effective FSD Directives

INFORMATION

Index of Effective FSD Directives
Filed in this Section

Notification Number	**Received From: (TPAA/NSPM)**	**Date of Notification**	**Date of Modification Completion**

Continue as Necessary....

Appendix E to Part 60—Qualification Performance Standards for Quality Management Systems for Flight Simulation Training Devices

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Begin QPS Requirements

a. Not later than [insert date 12 months after the effective date of the final rule] all current sponsors of FSTD's must submit to the NSPM a proposed Quality Management System (QMS) program as described in this QPS appendix. The NSPM will review the program in order of receipt and notify the sponsor within 90 days of beginning the review regarding 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 audit(s), make any required program adjustments as a result of any internal audit, and have the NSPM initial audit scheduled.

b. For first-time FSTD sponsors, not later than 120 days prior to the date scheduled for the initial FSTD evaluation, the sponsor must submit to the NSPM the proposed QMS program as described in this QPS appendix. The NSPM will review the program and notify the sponsor within 90 days of beginning the review regarding 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 audit(s), make any required program adjustments as a result of any internal audit, and have the NSPM initial audit scheduled.

c. When a sponsor includes a "foreign FSTD" (i.e., one maintained by a person other than a US certificate holder) under their sponsorship, the sponsor remains responsible for the QMS program for that FSTD; however –

(1) If that foreign FSTD is maintained under a QMS program accepted by that foreign regulatory authority and that authority and the NSPM have agreed to accept each other's QMS programs (e.g., the Joint Aviation Authorities, JAA, of Europe), no additional requirements must be met; or

(2) If that foreign FSTD is not maintained under a QMS program accepted by that foreign regulatory authority or that authority and the NSPM have not agreed to accept each other's QMS programs, the sponsor will be required to reach an agreement with the NSPM regarding those aspects of the sponsor's QMS program that may be met by the sponsor in regard to this specific FSTD without having any other authority regarding the specific FSTD in question.

d. 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 who has the responsibility and authority to establish and modify the sponsor's policies, practices, and procedures regarding the QMS program for the recurring qualification of, and the day-to-day use of, each FSTD.

e. An acceptable Quality Management System (QMS) Program must contain an accurate written description of and/or procedures for –

(1) The method used by management to communicate the importance of meeting the regulatory standards contained in Part 60 and this QPS appendix and the importance of establishing and meeting the requirements of a QMS Program as defined in this paragraph f.

(2) The method(s) used by management to determine that the regulatory standards and the QMS program requirements are being met, and if or when not met, what actions are taken to correct the deficiency and prevent its recurrence.

(3) The method used by management to determine that the sponsor is, on a timely and regular basis, presenting a qualified FSTD.

(4) The method used to maintain and control appropriate technical and reference documents, appropriate training records, and other documents for –

    (a) continuing FSTD qualification; and
    (b) the QMS program.

(5) The criteria the sponsor uses (e.g., training, experience, etc.) to determine who may be assigned to duties of § 60.19 inspection, testing, and maintenance (preventive and corrective) on FSTD's.

(6) The method used to track § 60.19 inspection, testing, and maintenance (preventive and corrective) on each FSTD.

(7) The method used to inform instructors, check airmen, and those who conduct the daily preflight, of what circumstance(s) constitute(s) a discrepancy regarding the FSTD and its operation.

(8) The method used to ensure that instructors, check airmen, and those who conduct the daily preflight know they are to record in the FSTD discrepancy log each newly discovered FSTD discrepancy and each newly discovered missing, malfunctioning, or inoperative FSTD component.

(9) The method used to verify that instructors, check airmen, or other appropriate personnel, know that they are to completely and accurately log the number of disruptions and time not available for training, testing, checking, or obtaining flight experience during a scheduled FSTD use-period, including the cause(s) of the disruption, if known.

(10) The method used by the sponsor to notify users of the FSTD of missing, malfunctioning, or inoperative components that restrict the use of the FSTD.

(11) The method of recording NSPM-conducted evaluations and other inspections (e.g., daily preflight inspections, sponsor conducted quarterly inspections, etc.), including the evaluation or inspection date, test results, discrepancies and recommendations, and all corrective actions taken.

(12) The method for ensuring that the FSTD is configured appropriately for the relevant training, evaluation, and/or experience requirements authorized and that the system(s) function(s) correctly.

(13) The method(s) for:

(a) determining whether or not modifications of the aircraft or aircraft data package are necessary to be incorporated into the FSTD;

(b) determining whether or not proposed changes to the FSTD are considered modifications in accordance with § 60.23;

(c) coordinating and communicating these items, as appropriate, with the sponsor's training organization, other users (e.g., lease or service contract users), the TPAA, and the NSPM.

(14) How information found in the discrepancy log is used to correct discrepancies and whether or not this information is used to review and, if necessary, modify existing procedures for FSTD maintenance.

(15) The method for how and when software or hardware modifications (made in accordance with § 60.23) are accomplished and tracked.

(16) The method for acquiring independent feedback regarding FSTD operation (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) including a description of the process for addressing these comments.

(17) How devices used to test, measure, and monitor correct FSTD operation are calibrated and adjusted for accuracy, including traceability of that accuracy to a recognized standard, and how these devices are maintained in good operating condition.

(18) How, by whom, and how frequently internal audits of the QMS program are conducted and where and how the results of such audits are maintained and reported to responsible management, the NSPM, and the TPAA.

End QPS Requirements

Begin Information

f. Additional Information.

(1) In addition to specifically designated QMS evaluations, the NSPM 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 14CFR part 60.

(2) The sponsor, through the MR, may delegate duties associated with maintaining the qualification of the FSTD (e.g., corrective and preventive maintenance, scheduling for and the conducting of tests and/or inspections, functional preflight checks, etc.) but retains the responsibility and authority for the day-to-day qualification and quality of the FSTD. One person may serve in this capacity for more than one FSTD, but one FSTD would not have more than one person serving in this capacity.

(3) The QMS requirements should not be read to preclude a given QMS program from being applicable to more than one certificate holder (e.g., part 119 and part 142 or two part 119 certificate holders) and should not be read to preclude an individual from being a Management Representative (MR) for more than one certificate holder (e.g., part 119 and part 142 or two part 119 certificate holders) as long as the other QMS program requirements and/or the other MR requirements are respectively met for each such certificate holder.

(4) The NSPM may conditionally approve a QMS program, on a temporary basis, under appropriate circumstances (e.g., meaningful progress being made, management completely committed, adequate funding appropriated, etc.) even though additional work might be necessary to develop the QMS program to the point that it would meet the requirements of part 60.

End Information

Appendix F to Part 60--

DEFINITIONS AND ABBREVIATIONS FOR FLIGHT SIMULATION TRAINING DEVICES

1. Definitions.

Note: The definitions presented below in *Italic type face* are repeated from the regulatory definitions found in part 1 or part 60, as indicated. In the event that a discrepancy exists between a definition found here, and one found in part 1 or part 60, the part 1 or part 60 definition prevails. They are provided here in addition to other definitions, presented in regular type, mixed together, in alphabetical order,

1st Segment - is that portion of the takeoff profile from liftoff to gear retraction.

2nd Segment - is that portion of the takeoff profile from after gear retraction to initial flap/slat retraction.

3rd Segment - is that portion of the takeoff profile after flap/slat retraction is complete.

Aircraft data package - is a combination of the various types of data used to design, program, manufacture, modify, and test the FSTD.

Airspeed - is calibrated airspeed unless otherwise specified and is expressed in terms of nautical miles per hour (knots).

Altitude - is pressure altitude (meters or feet) unless specified otherwise.

Angle of attack - is the angle between the airplane longitudinal axis and the relative wind vector projected onto the airplane plane of symmetry.

Automatic Testing - is FSTD testing wherein all stimuli are under computer control.

Bank - is the airplane attitude with respect to or around the longitudinal axis, or roll angle (degrees).

Breakout - is 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. (Part 60)*

Closed Loop Testing - is a test method for which the input stimuli are generated by controllers, which drive the FSTD to follow a pre-defined target response.

Computer Controlled Airplane - is an airplane where all pilot inputs to the control surfaces are transferred and augmented by computers.

Control Sweep - is 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 - is 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, cockpit shell, motion system, visual system, computers, and necessary peripheral equipment can thus be used in more than one simulation.

Critical Engine Parameter - is the parameter, which is the most accurate measure of propulsive force.

Deadband - is 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 - is the length of space between two points and is expressed in terms of nautical miles unless specified otherwise.

Downgrade – is a permanent change in the qualification level of an FSTD to a lower level.

Driven - is a test method where the input stimulus or variable is positioned by automatic means, generally a computer input.

Electronic Copy of the MQTG – an electronic copy of the MQTG provided by an electronic scan presented in a Portable Document File (PDF), or similar format, acceptable to the NSPM

Electronic Master Qualification Test Guide – is 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.

Evaluation *- With respect to an individual, the checking, testing, or review associated with flightcrew member qualification, training, and certification under parts 61, 63, 121, or 135 of this chapter. With respect to an FSTD, the qualification activities (e.g., the objective and subjective tests, the inspections, the continuing qualification evaluations.) associated with the requirements of this part. (Part 60)*

Flight experience *- Flight experience means recency of flight experience for landing credit purposes. (Part 60)*

Flight simulation training device (FSTD) *means 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 supplier of data that are acceptable to the NSPM) during an aircraft flight test program. (Part 60)*

Flight training device (FTD) *means a replica of aircraft instruments, equipment, panels, and controls in an open flight deck area or an enclosed aircraft cockpit 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 - is the response of the FSTD after completion of a control input or disturbance.

Frozen - is a test condition where one or more variables are held constant with time.

FSTD Approval - is the extent to which an FSTD may be used by a certificate holder as authorized by the FAA. It takes into account aircraft to FSTD differences and the training ability of the organization.

FSTD Directive *- A document issued by the FAA to an FSTD sponsor, requiring a modification to the FSTD due to a recognized safety-of-flight issue and amending the qualification basis for the FSTD. (Part 60)*

FSTD Latency - is the additional time beyond that of the response time of the aircraft due to the response of the FSTD.

FSTD Performance *- The overall performance of the FSTD includes aircraft performance (e.g., thrust/drag relationships, climb, range) as well as flight and ground handling. (Part 60)*

***Full flight simulator (FFS)** means a replica of a specific type; or make, model, and series aircraft cockpit. It includes the assemblage of equipment and computer programs necessary to represent aircraft operations in ground and flight conditions, a visual system providing an out-of-the-cockpit 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 qualification performance standards (QPS) for a specific FFS qualification level. (Part 1)*

Gross Weight - For objective test purposes:

Basic Operating Weight – (BOW) is 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.

Near Maximum Gross Weight – is a weight chosen by the sponsor or data provider that is not less than the basic operating weight (BOW) of the airplane 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.

Light Gross Weight – is a weight chosen by the sponsor or data provider that is not more than 120% of the BOW of the airplane being simulated or as limited by the minimum practical operating weight of the test airplane.

Medium Gross Weight – is a weight chosen by the sponsor or data provider that is approximately ±10% of the average of the numerical values of the BOW and the maximum certificated gross weight.

Ground Effect - is the change in aerodynamic characteristics due to modification of the airflow past the aircraft caused by the proximity of the earth's surface to the airplane.

Hands Off - is a test maneuver conducted or completed without pilot control inputs.

Hands On - is a test maneuver conducted or completed with pilot control inputs as required.

Heave - is FSTD movement with respect to or along the vertical axis.

Height - is the height above ground level (or AGL) expressed in meters or feet.

Integrated Testing - is testing of the FSTD such that all aircraft system models are active and contribute appropriately to the results where none of the models used are substituted with models or other algorithms intended for testing only.

Irreversible Control System - is a control system in which movement of the control surface will not backdrive the pilot's control in the cockpit.

Locked - is a test condition where one or more variables are held constant with time.

Manual Testing - is FSTD testing wherein the pilot conducts the test 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. (Part 60)*

Medium - is the normal operational weight for a given flight segment.

National Simulator Program Manager (NSPM) *- The FAA manager responsible for the overall administration and direction of the National Simulator Program (NSP), or a person approved by that FAA manager. (Part 60)*

Nominal - is the normal operational weight, configuration, speed, etc., for the flight segment specified.

Non-Normal Control - is a term used in reference to Computer Controlled Airplanes and 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, BACKUP, etc., may be used to define an actual level of degradation.

Normal Control - is a term used in reference to Computer Controlled Airplanes and 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. (Part 60)*

Pitch - is the airplane attitude with respect to, or around, the lateral axis expressed in degrees.

Power Lever Angle - is the angle of the pilot's primary engine control lever(s) in the cockpit. This may also be referred to as PLA, THROTTLE, or POWER LEVER.

Predicted data *- Estimations or extrapolations of either existing flight test data or data from other simulation models using engineering analyses, engineering simulations, design data, and/or wind tunnel data. (Part 60)*

Protection Functions - are systems functions designed to protect an airplane from exceeding its flight maneuver limitations.

Pulse Input - is 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 FSTD's demonstrated technical and operational capabilities as set out in this part. (Part 60)*

Qualification Performance Standard (QPS) *- The collection of procedures and criteria published by the FAA to be used when conducting objective tests and subjective tests, including general FSTD requirements, for establishing FSTD qualification levels. The QPS are set forth in the following FAA appendices: Appendix A, for Airplane Simulators; Appendix B, for Airplane Flight Training Devices; Appendix C, for Helicopter Simulators; Appendix D, for Helicopter Flight Training Devices; and Appendix E for Quality Management Systems for Flight Simulation Training Devices. (Part 60)*

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. (Part 60)*

Quality Management System (QMS) – the initial aviation standard dealing with quality-system requirements addressing flight simulation that can be used for external quality-assurance purposes. It is a collection of requirements, generic and independent of any specific industry or economic sector, not to enforce uniformity of quality systems, but to identify the processes needed; determine the sequence and interaction of these processes; determine criteria and methods required to ensure the effective operation and control of these processes; ensure the availability of information necessary to support the operation and monitoring of these processes; measure, monitor and analyze these processes; and implement the actions necessary to achieve planned results. The design and implementation of a specific quality management system will be influenced by the varying needs of the individual sponsor, their particular objectives, the flight simulation products and services supplied, and the processes and specific practices employed.

Reversible Control System - is a control system in which movement of the control surface will backdrive the pilot's control in the cockpit.

Roll - is 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 and similar operating envelopes and have the same number and type of engines or power plants. (Part 60)*

Sideslip Angle - is the angle between the relative wind vector and the airplane plane of symmetry. (note: this definition replaces the current definition of "sideslip.")

Snapshot - is a presentation of one or more variables at a given instant of time.

Special Evaluation – is an evaluation of the FSTD for purposes other than initial, upgrade, or continuing qualification. Circumstances that might indicate the need for a special evaluation would include, but not necessarily be limited to, the following: after the FSTD is moved and reinstalled at another location; after an update to FSTD software or hardware that might affect performance or flying qualities; after a substantial update to FSTD avionics packages (autopilot, flight management systems, etc.); after substantial modifications to FSTD configuration; after a complaint is received from a credible source indicating that the FSTD does not perform or handle like the aircraft it simulates; etc.

***Sponsor** - A certificate holder who seeks or maintains FSTD qualification and is responsible for the prescribed actions as set out in this part and the QPS for the appropriate FSTD and qualification level. (Part 60)*

Statement of Compliance and Capability (SOC) - is a declaration that specific requirements have been met. It must declare that compliance with the requirement is achieved and explain how the requirement is met (e.g., gear modeling approach, coefficient of friction sources, etc.). It must also describe the capability of the FSTD to meet the requirement (e.g., computer speed, visual system refresh rate, etc.). In doing this, the statement must provide references to needed 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 - is an abrupt control input held at a constant value.

Subjective test *- A qualitative assessment of the performance and operation of the FSTD. (Part 60)*

Surge - is FSTD movement with respect to or along the longitudinal axis.

Sway - is FSTD movement with respect to or along the lateral axis.

Time History - is 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. (Part 60)*

Training Restriction – is a temporary condition where, due to a Missing, Malfunctioning, or Inoperative (MMI) Component condition, the FSTD may continue to be used at the qualification level indicated on its SOQ but restricted from accomplishing the task for which the correct function of the MMI component is required..

Transport Delay or "Throughput" - is 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 until output response. It does not include the characteristic delay of the airplane simulated.

Upgrade *- The improvement or enhancement of an FSTD for the purpose of achieving a higher qualification level. (Part 60)*

Validation Data - Objective data used to determine if the FSTD performance is within the tolerances prescribed in the QPS.

Validation Test – An objective test whereby FSTD parameters are compared to the relevant validation data to ensure that the FSTD performance is within the tolerances prescribed in the QPS.

Visual System Response Time - is 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 - is airplane attitude with respect to, or around, the vertical axis expressed in degrees.

2. Abbreviations.

AFM	Approved Flight Manual.
AGL	Above Ground Level (meters or feet).
AOA	Angle of Attack (degrees).
APD	Aircrew Program Designee.
CCA	Computer Controlled Airplane.
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.).
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.
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.
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 Airplanes.
nm	Nautical Mile(s) 1 Nautical Mile = 6,080 feet.
NN	NON-NORMAL CONTROL Used in reference to Computer Controlled Airplanes.
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.
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.
SOC	Statement of Compliance and Capability.
Tf	Total time of the flare maneuver duration.
Ti	Total time from initial throttle movement until a 10% response of a critical engine parameter.
TIR	Type Inspection Report.
T/O	Takeoff.
Tt	Total time from Ti to a 90% increase or decrease in the power level specified.
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.
Vs	Stall Speed or minimum speed in the stall.
WAT	Weight, Altitude, Temperature.

Part 121, Appendix H--Advanced Simulation.

This appendix provides guidelines and a means for achieving flightcrew training in advanced airplane simulators. The requirements in this appendix are in addition to the simulator approval requirements in Sec. 121.407. Each simulator which is used under this appendix must be approved as a Level B, C, or D simulator, as appropriate.

ADVANCED SIMULATION TRAINING PROGRAM

For an operator to conduct Level C or D training under this appendix all required simulator instruction and checks must be conducted under an advanced simulation training program which is approved by the Administrator for the operator. This program must also ensure that all instructors and check airmen used in Appendix H training and checking are highly qualified to provide the training required in the training program. The advanced simulation training program shall include the following:

1. The operator's initial, transition, upgrade, and recurrent simulator training programs and its procedures for re-establishing recency of experience in the simulator.

2. How the training program will integrate Level B, C, and D simulators with other simulators and training devices to maximize the total training, checking, and certification functions.

3. Documentation that each instructor and check airman has served for at least 1 year in that capacity in a certificate holder's approved program or has served for at least 1 year as a pilot in command or second in command in an airplane of the group in which that pilot is instructing or checking.

4. A procedure to ensure that each instructor and check airman actively participates in either an approved regularly scheduled line flying program as a flight crewmember or an approved line observation program in the same airplane type for which that person is instructing or checking.

5. A procedure to ensure that each instructor and check airman is given a minimum of 4 hours of training each year to become familiar with the operator's advanced simulation training program, or changes to it, and to emphasize their respective roles in the program. Training for simulator instructors and check airmen shall include training policies and procedures, instruction methods and techniques, operation of simulator controls (including environmental and trouble panels), limitations of the simulator, and minimum equipment required for each course of training.

6. A special Line Oriented Flight Training (LOFT) program to facilitate the transition from the simulator to line flying. This LOFT program consists of at least a 4-hour course of training for each flightcrew. It also contains at least two representative flight segments of the operator's route. One of the flight segments contains strictly normal operating procedures from push back at one airport to arrival at another. Another flight segment contains training in appropriate abnormal and emergency flight operations.

LEVEL B

Training and Checking Permitted

1. Recency of experience (Sec. 121.439).

2. Night takeoffs and landings (Part 121, Appendix E).

3. Landings in a proficiency check without the landing on the line requirements (Sec. 121.441).

LEVEL C

Training and Checking Permitted

1. For all pilots, transition training between airplanes in the same group, and for a pilot in command the certification check required by Sec. 61.153 of this chapter.

2. Upgrade to pilot-in-command training and the certification check when the pilot—

    a. Has previously qualified as second in command in the equipment to which the pilot is upgrading;

    b. Has at least 500 hours of actual flight time while serving as second in command in an airplane of the same group; and

    c. Is currently serving as second in command in an airplane in this same group.

3. Initial pilot-in-command training and the certification check when the pilot—

    a. Is currently serving as second in command in an airplane of the same group;

    b. Has a minimum of 2,500 flight hours as second in command in an airplane of the same group; and

    c. Has served as second in command on at least two airplanes of the same group.

4. For all second-in command pilot applicants who meet the aeronautical experience requirements of Sec. 61.159 of this chapter in the airplane, the initial and upgrade training and checking required by this part, and the certification check requirements of Sec. 61.153 of this chapter.

LEVEL D

Training and Checking Permitted

Except for the requirements listed in the next sentence, all pilot flight training and checking required by this part and the certification check requirements of Sec. 61.153(G) of this chapter. The line check required by Sec. 121.440 of this part, the static airplane requirements of appendix E of this part, and the operating experience requirements of Sec. 121.434 must still be performed in the airplane.