DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1, 60, 61, 63, 141, and 142

[Docket No. FAA–2002–12461; Notice No. 02–11]

RIN 2120–AH07

Flight Simulation Device Initial and Continuing Qualification and Use

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: The FAA proposes to amend the regulations to establish flight simulation device qualification requirements for all certificate holders in a new part. The basis of these requirements currently exists in different parts of the FAA's regulations and in advisory circulars, and the proposed changes would consolidate and update flight simulation device requirements. In addition, the FAA is proposing to require a Quality Assurance program. Currently, sponsors of flight simulation devices may elect to have, but are not required to have, a Quality Assurance program. The intended effect of these proposed changes is to ensure that users of flight simulation devices receive the best possible training in devices that closely match the performance and handling characteristics of the airplanes being simulated.

DATES: Send your comments on or before December 24, 2002.

ADDRESSES: Address your comments to the Docket Management System, U.S. Department of Transportation, Room Plaza 401, 400 Seventh Street, SW., Washington, DC 20590–0001. You must identify the docket number FAA–2002–12461 at the beginning of your comments, and you should submit two copies of your comments. If you wish to receive confirmation that FAA received your comments, include a self-addressed, stamped postcard.

You may also submit comments through the Internet to *http://dms.dot.gov*. You may review the public docket containing comments to these proposed regulations in person in the Dockets Office between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The Dockets Office is on the plaza level of the NASSIF Building at the Department of Transportation at the above address. Also, you may review public dockets on the Internet at *http://dms.dot.gov*.

FOR FURTHER INFORMATION CONTACT: Edward Cook, National Simulator Program Staff (AFS–205), Flight Standards Service, Federal Aviation Administration, 1701 Columbia Avenue, College Park, GA 30337; telephone (404) 305–6100.

SUPPLEMENTARY INFORMATION:

Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. We also invite comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. We ask that you send us two copies of written comments.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. The docket is available for public inspection before and after the comment closing date. If you wish to review the docket in person, go to the address in the **ADDRESSES** section of this preamble between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. You may also review the docket using the Internet at the web address in the **ADDRESSES** section.

Before acting on this proposal, we will consider all comments we receive on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay. We may change this proposal in light of the comments we receive.

If you want the FAA to acknowledge receipt of your comments on this proposal, include with your comments a pre-addressed, stamped postcard on which the docket number appears. We will stamp the date on the postcard and mail it to you.

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by taking the following steps:

(1) Go to the search function of the Department of Transportation's electronic Docket Management System (DMS) web page (*http://dms.dot.gov/search*).

(2) On the search page type in the last four digits of the Docket number shown at the beginning of this notice. Click on ''search.''

(3) On the next page, which contains the Docket summary information for the Docket you selected, click on the document number of the item you wish to view.

You can also get an electronic copy using the Internet through the Office of Rulemaking's web page at *http://www.faa.gov/avr/armhome.htm* or the Government Printing Office's web page at *http://www.access.gpo.gov/su_docs/aces/aces140.html.*

You can also get a copy by submitting a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the docket number, notice number, or amendment number of this rulemaking.

Background

For many years the flightcrew training regulations in 14 CFR part 121 subparts N and O allowed simulator training as an enhancement to training and testing in the airplane, but not as a complete replacement for training in the airplane. Due to improvements in flight simulator performance, appendix H was added to part 121 in 1980. Appendix H permitted and expanded use of simulators by air carriers that took advantage of the new simulator performance through an ''Advanced Simulation Training Program.'' Appendix H permits simulators to be used for varying amounts (up to 100%) of the training, testing, and checking required by the FAA. The amount of training permitted depends on the simulator's qualification level.

As the state-of-the-art in simulator technology has advanced, more effective use has been made of the airplane simulator in training, checking, and certification of flightcrew members. Using flight simulators rather than airplanes in training allows for more in-depth training, including the practice of critical emergency procedures, in a safer environment. Not only do simulators provide improvements in safety and in safer training operations, they also provide such benefits as reducing noise, air pollution, and air traffic congestion, and conserving petroleum resources.

Appendix H of 14 CFR part 121 provides an Advanced Simulation plan outlining the steps towards optimum use of flight simulators. The plan consists of several phases of simulation devices and the training allowed in each simulation device level. The intent of including a phased simulation approach was to provide for certificate holders to transition to using the most technically advanced simulation training in order to achieve the maximum benefits of simulation training. Most major air

carriers have taken advantage of appendix H and conduct most or all of their training and checking in simulators.

The FAA originally placed simulator technical requirements in appendix H because part 121 air carriers were the primary users of airplane simulators. As the larger aviation community became interested in using simulators, the FAA in 1980 provided guidance in an advisory circular, AC 121–14C, Aircraft Simulator and Visual System Evaluation and Approval. The AC more fully described what the technical capabilities of simulators should be, how those capabilities might be verified, and how all these capabilities might be incorporated into training programs.

Over the next several years, the FAA in consultation with the aviation industry, refined and republished its guidance material several times. Because the regulations regarding advanced simulators remained in part 121, appendix H, certificate holders who operated under parts other than 121 (such as parts 125 and 135) had to obtain exemptions in order to use simulators as provided in part 121, appendix H. The number of these operators continued to grow.

The ability to manage the increasing number of exemptions, each one with slightly different provisions, conditions, and limitations, became increasingly difficult. The development of 14 CFR part 142, Certification of Training Centers, was seen to be a logical and necessary way to deal with those operators who wished to conduct training for flightcrew members but who did not and would not operate under any of the part 119, 121 125, or 135 passenger carrying rules. However, the regulatory requirements for the technical criteria for a majority of the simulators coming into the U.S. aviation inventory has remained in the part 121 operating rule.

As a result of the above, the FAA is proposing to remove the technical requirements for flight simulation devices (flight simulators and flight training devices) from part 121 and place them in a new part 60, titled ''Flight Simulation Device Qualification.'' The proposed new part 60 would establish flight simulation device (FSD) requirements that could be used by anyone who conducts flightcrew member training, evaluation, and flight experience under any of the Federal Aviation Regulations. The term FSD includes aircraft simulators and aircraft flight training devices (FTD). In short, a flight simulator is a full size replica of a specific type aircraft cockpit, including controls, a visual system, and a motion system; a flight training device is a full size replica of aircraft instruments, equipment, panels, and controls, but does not require a visual system or a motion system. (See proposed § 1.1 for complete definitions of these terms.) Under current 14 CFR Chapter I, there is no general term for these two types of devices.

General Discussion of Proposed Part 60

Proposed new part 60 would contain the requirements for the evaluation, qualification, and maintenance of FSD's. The proposed requirements are based on the current requirements on how to build and use simulators in appendix H of part 121 and in current § 121.407. In a separate rulemaking project that will follow this proposal, other portions of appendix H would be moved to a new subpart of part 121, and appendix H would be deleted.

Part 60 would also contain items (such as frequency, content, and method of evaluation) currently found in the advisory material in AC 120–40B, Airplane Flight Simulator Qualification, in AC 120–45A, Airplane Flight Training Device Qualification, and in AC 120–63, Helicopter Simulator Qualification. Standards from this advisory material and specific items that are subject to change through technological advancements would be placed into one of four appendices to part 60:

- Appendix A, ''Airplane Flight Simulators Qualification Performance Standards.''
- Appendix B, ''Helicopter Flight Simulators Qualification Performance Standards.''
- Appendix C, ''Airplane Flight Training Devices Qualification Performance Standards.''
- Appendix D, ''Helicopter Flight Training Devices Qualification Performance Standards.''

The Standards in these QPS documents are regulatory. Changes and additions to those standards would be subject to notice and comment procedures under the Administrative Procedures Act unless ''good cause'' {see 5 U.S.C.} exists to justify proceeding without notice and comment.

The current and proposed allowable and required uses of flight simulation devices would be in applicable operating, certification, and training center regulations in parts 61, 63, 121, 135, 141, and 142 and in the four QPS documents. The tasks approved for each qualification level would also be provided in the four QPS documents.

For a further discussion of the QPSs, see the preamble discussion on ''Delegation of Authority for Standards Documents.'' The remainder of this discussion of proposed part 60 explains how the proposed rules would be applied. The process described below for obtaining and maintaining FSD qualification is similar to current practice.

Obtaining and Maintaining FSD Qualification under the Proposed Rule

If a certificate holder intends to use an FSD in its training program in order for people to obtain credit toward FAA training, checking or testing requirements, the FSD must be evaluated and qualified by the FAA's National Simulator Program Manager (NSPM) or a person approved by the NSPM. The certificate holder may be the ''sponsor'' of the FSD. An FSD ''sponsor'' seeks qualification and subsequent approval for use of the FSD and agrees to assume responsibility for maintaining the FSD according to prescribed standards. The sponsor may contract with another person for services of document preparation and presentation, as well as FSD inspection, maintenance, repair, servicing, etc., but the sponsor retains ultimate responsibility for the qualification of the FSD. Other certificate holders may seek approval to use the same FSD for credit under an approved training program, but such certificate holders would not be sponsors of the FSD. ''Credit'' means use to meet initial and recurrent training, flight experience requirements or evaluation, such as checking and testing, etc. Although FSD's can be used for ''credit'' to meet certain flight experience requirements (*e.g.*, re-establishing lost recency of experience in landings), time spent in FSD's may not be ''credited'' toward ''operating experience'' requirements (*e.g.*, § 121.434).

Typically, a manufacturer produces an FSD that accurately represents the characteristics of an airplane type, model, and, if applicable, series, such as a Boeing 777–232. The sponsor buys, leases, or otherwise arranges for the use of the FSD in a specific training program, such as its Boeing 777 pilot training program for initial, upgrade, or transition training. First, the sponsor must successfully complete the required objective and subjective tests of the FSD as specified in the appropriate QPS. The findings of these tests indicate whether or not the FSD adequately represents the characteristics of the aircraft in the following areas: cockpit configuration, airplane systems and sub-systems, and performance and flying qualities. These findings also indicate whether or not the FSD adequately represents the

environment in which the aircraft actually operates.

The sponsor then applies for the NSPM evaluation. For the initial NSPM evaluation, the sponsor must allow the NSPM to test the FSD by conducting and comparing objective tests, subjective tests, and performance demonstrations with a series of specific tests conducted the same way in the aircraft. The comparison must show that the performance and flying qualities of the aircraft and FSD are the same, within established tolerances, and that the FSD functions correctly and adequately to perform its planned functions. A successful initial evaluation means that the NSPM agrees with the sponsor's findings that the FSD is an adequate representation of the aircraft.

Once the initial evaluation is successfully completed, the FAA issues a Statement of Qualification (statement). This statement indicates that the FSD is either a flight simulator or an FTD. The statement also indicates the level of qualification assigned to the FSD. Each FSD can be qualified as either a flight simulator (Level A, B, C, or D) or a flight training device (FTD) (Level 2, 3, 4, 5, or 6). The FAA is reserving the term ''Level 1 FTD'' for potential future use. For a further discussion of this issue, see the preamble discussion for ''Conforming changes to other parts.'' The statement also includes a list of all of the operations tasks or simulator systems in the subjective test appendix of the appropriate QPS for which the FSD has not been subjectively tested and for which the FSD is not qualified (*e.g.*, circling approaches, windshear training, etc.). Issuance of the statement means that the FSD: (1) Has been qualified as representative of the aircraft, or set of aircraft, as appropriate; and (2) has been qualified at a level authorized in the QPS.

A qualified FSD still cannot be used for training until it is approved for use in a certificate holder's training program in accordance with the training program regulations in parts 121, 135, 141, and 142. A certificate holder must obtain this approval from the FAA through the training program approval authority. Once the FSD has been approved for use in a training program (and the operator has been approved as the FSD sponsor), the FSD may also be approved for use in a non-sponsor's training program.

If the FSD has been evaluated and qualified and if it has been approved for use in the training program, then it may be used for credit as long as its qualification is maintained. To maintain a qualified FSD, the sponsor must comply with the following continuing qualification requirements. The sponsor must complete performance demonstrations and objective, quarterly checks of the simulator's performance and handling qualities. These quarterly checks are to be evenly spaced throughout the year and include approximately one-fourth of the performance demonstrations and validation tests in the Master Qualification Test Guide (MQTG). All of the MQTG demonstrations and tests would have to be completed annually. The sponsor must maintain the results of these quarterly checks for review by the NSPM. This review may be accomplished at any time, but regularly occurs during scheduled recurrent evaluations. The sponsor must also coordinate with the NSPM to ensure that recurrent evaluations are completed within the required interval. The NSPM conducts recurrent evaluations that consist of performance demonstrations and objective tests in the MQTG and subjective tests.

If an FSD is removed from service for moving, storage, or other purpose, the sponsor must take the additional steps proposed in the rule. In addition if the aircraft is modified to change cockpit configuration, if the certificate holder changes relevant flightcrew member duties, or if new data is developed on relevant performance characteristics, the FSD must be modified to comply with the aircraft changes and incorporate the appropriate information in order for time spent in the FSD to be credited toward meeting training, checking, testing, or experience requirements under Title 14 of the Code of Federal Regulations.

All of these requirements are explained in more detail in the section-by-section discussion below.

Section-by-Section Discussion of Proposed Part 60 and Conforming Changes to Other Parts

Part 1 Amendments

Several proposed definitions would be added to current § 1.1, including, ''Flight simulation device,'' ''Flight simulator,'' and ''Flight training device.'' The abbreviations ''FSD'' and ''FTD,'' for ''flight simulation device'' and ''flight training device,'' respectively, would be added to § 1.2. These terms are being added to the definitions and abbreviations in part 1 because they are used in several parts, including new proposed part 60 as well as current parts 61, 63, 121, 135, 141, and 142.

Section 60.1 Applicability

The proposed section outlines the subjects addressed in proposed part 60. Proposed paragraph (a) is based on language from the first introductory paragraph in the ''Advanced Simulation'' section of existing Appendix H. The proposed language states that part 60 contains requirements governing the initial and continuing qualification and use of all aircraft flight simulation devices (FSD) used for training, evaluation, or obtaining any flight experience (but not operating experience under part 121, 125, or 135) for meeting flightcrew member certification or qualification requirements.

Proposed paragraph (b) clarifies that part 60 applies to anyone who uses an FSD for flightcrew member training, qualification, or experience requirements of 14 CFR chapter I. This includes not only sponsors or owners of FSD's, but also each person who uses an FSD for training, evaluation, or obtaining flight experience required for flightcrew member certification or qualification.

Proposed paragraph (c) clarifies that the rules in proposed § 60.31 regarding falsification of applications, records, or reports apply not only to sponsors or owners of FSD's, but also to each person who uses an FSD for training, evaluation, or obtaining flight experience required for flightcrew member certification or qualification.

Section 60.2 Applicability of Sponsor Rules to Persons Who Are Not Sponsors and Who Are Engaged in Certain Unauthorized Activities

Proposed paragraph (a) proposes that the rules of this part that are addressed to FSD sponsors are also applicable to nonsponsors who inappropriately use or cause the use of an FSD. Proposed rules that are specifically addressed to sponsors included §§ 60.5(a), 60.19(a), 60.23(d), and 60.31. The purpose of § 60.2(a) would be to give the FAA a legal means by which it could charge a nonsponsor, who inappropriately uses or causes the use of an FSD, with violations of the safety rules that are directed to persons who have already become sponsors of FSDs. Because the word ''person'' is already defined in Part 1 of the regulations, this proposed section and all other proposed sections that refer to ''person'' or ''persons'' would apply to individuals and legal entities, including corporations, companies, and partnerships. Therefore, for example, if ''Company A'' made its FSD available to ''Company B'' with representations that the FSD was fully

qualified under Part 60, including a false representation that ''Company A'' was the FAA-approved sponsor for the FSD (see § 60.7(b)), then ''Company A'' could be charged with violating § 60.19(a). Even though § 60.19(a) directs a *sponsor* not to use or allow the use of an FSD to meet any of the requirements of the Federal Aviation Regulations unless certain requirements are met (*e.g.*, a functional ''preflight'' check each calendar day before the FSD is first used), ''Company A'' (a nonsponsor of the FSD) could also be charged with a violation of § 60.19(a) because its actions would meet the elements under proposed § 60.2(a). Meeting the elements under § 60.2(a) would make proposed § 60.19(a) applicable to Company A.

Proposed § 60.2(b) provides an example in which proposed § 60.2(a) would not apply. If an FSD manufacturer sold a FSD to an air carrier and merely made representations that the FSD was in a condition such that it should be able to obtain FAA approval and qualify as an FSD under proposed part 60, that manufacturer would not be subject to a possible violation of any proposed section directed to FSD sponsors as long as the other conditions of proposed paragraph (b) were also met. Thus, an FSD manufacturer that did not falsely claim to be the FSD's FAA-approved sponsor and did not make false representations that someone else was already FAA-approved as the FSD's sponsor and did not claim the FSD was already fully qualified under part 60 (in a case where it really was not qualified pursuant to part 60), would not be subject to § 60.2(a). Not being the FSD's sponsor and not being subject to § 60.2(a) would mean that the manufacturer would not be subject to proposed part 60 rules addressed to ''sponsors.''

Section 60.3 Definitions

This proposed section contains definitions used throughout proposed part 60. The following definitions are included: ''Certificate holder,'' ''Evaluation,'' ''Flight experience,'' ''Flight test data,'' ''FSD Directive,'' ''Master Qualification Test Guide (MQTG),'' ''National Simulator Program Manager (NSPM),'' ''Objective test,'' ''Predicted data,'' ''Qualification level,'' ''Qualification Performance Standard (QPS),'' ''Qualification Test Guide (QTG),'' ''Set of aircraft,'' ''Sponsor,'' ''Subjective test,'' ''Training Program Approval Authority (TPAA),'' and ''Upgrade.''

For purposes of proposed part 60 ''certificate holder'' refers to a person issued an operating certificate under part 119 to conduct operations under part 121 or 135, a person issued a pilot school certificate under part 141, a person issued a training center certificate under part 142, or a person that has FAA approval for a course of training for flight engineers under part 63.

For purposes of proposed part 60, flight experience means only that flight experience used to meet landing recency requirements.

As defined, an FSD Directive is a document issued by the FAA to an FSD sponsor, requiring a modification to the FSD due to a recognized safety-of-flight issue and amending the qualification basis for the FSD. There are several types of situations that might occur that would lead the FAA to issue an FSD Directive. If an aircraft manufacturer develops new data on an aircraft and the FAA decides that the new data might affect aircraft performance or handling qualities, then the FAA may issue an FSD Directive to require each sponsor of that type FSD to make a corresponding change to the FSD. Similarly, the FAA may issue an FSD Directive if a manufacturer or the FAA discovers that the existing data for an aircraft is not accurate. Also, if the FAA issues an Airworthiness Directive on a particular aircraft and the FAA determines that the change required for the aircraft would also affect aircraft performance or handling qualities, the FAA may issue an FSD Directive requiring that a change be made to each affected FSD. Each FSD Directive would be published in the **Federal Register** as an amendment to the Record of FSD Directives appendix for the appropriate QPS. In addition, each sponsor would maintain a list of FSD Directives applicable to each FSD in the Master Qualification Test Guide (MQTG) for that FSD. The list would include a record of the completion of the modification to the FSD.

As defined, an MQTG is approved individually for each FSD, not for each type of aircraft being simulated.

A definition is proposed for ''set of aircraft'' because traditionally an FSD has been qualified for aircraft that share similar handling and operating characteristics, share similar operating envelopes, and have the same number and type of engines or powerplants. Aircraft that meet these criteria are usually referred to as a ''set of aircraft,'' although the term has not previously been defined.

The term ''Training Program Approval Authority'' would be defined to mean a person authorized by the Administrator to approve the aircraft flight training program in which the FSD would be used. This would normally be the Principal Operations Inspector (POI), the Training Center Program Manager (TCPM), or the assigned operations inspector in the local Flight Standards District Office (FSDO).

The proposed definition for ''upgrade'' is ''the improvement or enhancement of an FSD for the purpose of achieving a higher qualification level.'' It is not considered an upgrade when a sponsor chooses to modernize some aspect of the FSD (*e.g.*, visual system, host computer, instructor operating station, etc.) without affecting the qualification level of the device.

Section 60.4 Qualification Performance Standards

Proposed § 60.4 would describe that Appendices A, B, C, and D would contain the Qualification Performance Standards for each family of flight simulation device (Airplane Flight Simulators, Helicopter Flight Simulators, Airplane Flight Training Devices, and Helicopter Flight Training Devices) and describe which appendix contains which QPS: *i.e.*, Appendix A, contains the QPS for Airplane Flight Simulators; Appendix B contains the QPS for Airplane Flight Training Devices; Appendix C contains the QPS for Helicopter Flight Simulators; and Appendix D contains the QPS for Helicopter Flight Training Devices.

Section 60.5 Quality Assurance Program

The basic precept of the quality assurance (QA) program described in this section is for the sponsor ''to say what it does; to do what it says; and to keep good records.'' The proposed requirement for a QA program would require each sponsor to develop a working knowledge of the requirements of part 60 and the relevant QPS document. This knowledge would be demonstrated to the NSPM through a written description of how, how often, when, where, and with what resources the sponsor's organization plans to comply with the requirements of part 60.

By having this written description, the NSPM and the sponsor would be able to compare what is actually done with what the sponsor agreed to do regarding FSD repair, modification, regular maintenance, and daily readiness. The standardization required for such satisfactory comparisons would add to the efficiency and effectiveness of the FSD. Through the reliability of the maintenance and the daily readiness provided by a sound QA program, flightcrew member training, evaluation, and flight experience would be obtained more reliably, on a planned schedule

with less interruption. Additionally, the students would more easily retain the knowledge and skills learned through such standardized, uninterrupted training.

The proposed QA Program would help provide consistent training and repetitive practice in the desirable environment of accurate and realistic simulation. Flightcrew members would be able to more readily, more directly, and more completely transfer and use in the airplane the skills and procedures learned, practiced, and reinforced in reliable FSDs. This process would yield a safer operating flightcrew and, therefore, a higher degree of safety for the traveling public.

Proposed paragraph (a) would state that a sponsor must establish and follow a quality assurance program before the sponsor can use or allow the use of an FSD for flightcrew member training or evaluation, or to obtain flight experience for a flightcrew member. Specific requirements for the quality assurance program are found in the appropriate QPS. The purpose of the quality assurance program is to ensure that the sponsor is capable of addressing their own ability to provide FSDs that continually meet the training, testing, checking, and experience requirements of their respective FAA-approved flight training program(s) and the regulatory requirements of part 60. The quality assurance program would include a complete written description of all of the procedures that the sponsor has developed for complying with all of the requirements of part 60. In addition the quality assurance program would include a regular assessment by the sponsor of the effectiveness of the sponsor's program for complying with part 60. See the ''information'' section of paragraph 5 in each of the QPS documents, published later in this document.

Proposed paragraph (b) would state that the sponsor is responsible for the program regardless of where the FSD is located and regardless of who the sponsor may contract with for inspection, maintenance, repair, servicing, testing, or document preparation and presentation.

Proposed paragraph (c) would state that the program must provide a means for correcting any deficiency in the program; provide a mechanism to incorporate any required or desired modification to the program; and include a means for documenting each such change or modification.

Proposed paragraph (d) would state that when the NSPM finds that the program does not contain adequate procedures and standards to meet the requirements described in this section of the rule, the NSPM may require the sponsor to make an appropriate modification to the program to correct those deficiencies. This paragraph would also state that the sponsor would have the right to appeal to the Administrator such a notification from the NSPM to modify the program. When such an appeal is filed within 30 days of the NSPM notification, the requirement to make the modification would be delayed pending a decision by the Administrator, unless an emergency involving safety of flight requires the immediate modification.

Proposed paragraph (e) would state that each sponsor of an FSD must designate one individual as the management representative (MR) for quality assurance program purposes. The individual would have to be employed by the sponsor and identified by name to the NSPM and TPAA. The MR would be the primary contact point for all matters between the sponsor and the FAA regarding the qualification of that FSD. This individual would be ultimately responsible for the initial and day-to-day qualification of the assigned FSD, although he or she may delegate certain duties associated with FSD qualification, such as maintenance, inspection, and conduct of tests. The FAA assumes that any current FSD sponsor would already have such an individual on staff.

Section 60.7 Sponsor Qualification Requirements

Proposed paragraph (a) would state that eligibility to become a sponsor is based on whether the person holds or is an applicant for a certificate under parts 119, 141, or 142 or whether the person holds or is an applicant for an approved flight engineer course under part 63. This paragraph would also require that the FSD 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 through the TPAA. The primary concern of the FAA regarding an FSD is whether or not the FSD will provide the proper performance and handling qualities to those who are to use it for training, evaluation, or flight experience. The FSD must provide an environment in which flightcrew members can learn, practice, and exhibit the same behavior patterns, the same control input strategies, and the same responses to input stimuli (*i.e.*, the motion, visual, sound, and instrument cueing) as they would expect to exhibit in the real environment. Pilots, instructors, and check airmen are critical in ensuring the FSD is providing what it is intended to provide. It is this group that really has ''control'' of the simulator and is most motivated to ensure it continues to be the appropriate tool for critical training, evaluation, and flight experience tasks. The people in this group are the first to know and in the best position to know when this is being accomplished and when it is not. In short the sponsor must be very motivated regarding the proper function of the FSD. The sponsor must be dependent on the FSD's use for its training program, with the most to lose or gain regarding the proper functioning of the FSD. It is the sponsor with whom the FAA's operational interest is most direct. Therefore, the FAA is proposing that the FSD will be used, or will be offered for use, in the sponsor's FAA-approved flight training program for the aircraft being simulated. The FAA specifically requests comments on the proposal regarding the FSD being used or offered for use in the sponsor's FAA-approved training program for the aircraft being simulated.

Under proposed paragraph (b) a person is a sponsor if the conditions under paragraph (a) continue and if the person has operations specifications for the aircraft type or set being simulated, or if the person has training specifications or a course of training authorizing the use of an FSD for that aircraft type or set. Also, the person would be required to have an approved quality assurance program in accordance with proposed § 60.5. Finally, the NSPM would have had to approve the person as a sponsor and not have withdrawn that approval.

Under proposed paragraph (c), a person would continue to be a sponsor of an FSD if (1) beginning 12 calendar months after the initial qualification and every 12 calendar months thereafter, the FSD is used in the sponsor's FAA-approved flight training program for the aircraft type or set of aircraft for a minimum of 600 hours annually and (2) the use of the FSD meets the requirements of parts 61, 63, 91, 121, or 135. The annual minimum number of hours is proposed to ensure that the sponsor retains the high level of interest needed when using and maintaining each FSD under the requirements of this part. In addition, this minimum number of hours also ensures that the time, effort, and expense incurred by the Administrator for initially and recurrently evaluating the FSD is appropriately incurred. In using the term ''calendar month'' the FAA is allowing flexibility in calculating these hours. For example, if an FSD was initially qualified on March 5, the

sponsor would have until March 31 of the following year to accumulate the minimum 600 hours of use for that FSD. This 600 requirement represents between 5 and 10 percent of the time the FSD could be used throughout the calendar year. For example, 24 hours in a day and 365 days in a year = 8760 hours in a year.

Proposed paragraph (c)(3) would state that if the use requirements in paragraphs (c)(1) and (c)(2) are not met, the person could continue to sponsor the FSD on a provisional basis for an additional 12 calendar months. If, during this additional 12-calendar-month period, the FSD is used as described in paragraphs (c)(1) and (c)(2), the provisional status would be removed and regular sponsorship resumed. If, during this additional 12-calendar-month period, the FSD is not used as described in paragraphs (c)(1) and (c)(2), the FSD would not be qualified and the sponsor could not apply to sponsor the FSD for at least 12 calendar months. This 12 month period in which a person could not sponsor an FSD is necessary to prevent a person from seeking repeated sponsorship of an FSD even though that person has no intention of using the FSD in accordance with the minimum use requirements in § 60.7. Such repeated applications would require the NSPM to expend fiscal and human resources unnecessarily.

Section 60.9 Additional Responsibilities of the Sponsor

Proposed paragraph (a) would state that the sponsor of each FSD used for flightcrew member training or evaluation under this chapter must allow the NSPM to inspect the FSD immediately, including all records and documents relating to the FSD in order to determine its compliance with proposed part 60. The proposed paragraph is similar to the second paragraph in existing Appendix H, ''Advanced Simulation.'' In most cases the inspection would be scheduled at a convenient time for the sponsor; however, the FAA proposes to add the word ''immediately'' to the regulatory language in order to provide authority for an immediate inspection, if warranted.

Proposed paragraph (b) would require each sponsor to develop a method for personnel using or performing work on the FSD (flightcrew members, instructors, check airmen, simulator technicians, and maintenance personnel) to provide comments on the FSD and its operation. The proposed paragraph would require the sponsor to examine each comment for content and importance and to take appropriate action. For example, a comment that indicates a potential malfunction or maintenance issue for the FSD would need to have follow-up action, whereas a comment on the carpet color inside the FSD would have a lower priority because it does not affect FSD performance. This requirement is intended to work in concert with the quality assurance program. It is intended as a mechanism to ensure that the sponsor knows how the FSD is operating and what must be done to maintain its usefulness.

Proposed paragraph (b) would also require that the sponsor maintain a liaison with the manufacturer of the aircraft being simulated by the FSD to facilitate compliance with § 60.13(f) when necessary.

Finally, proposed paragraph (b) would require that the sponsor post in or adjacent to the FSD the Statement of Qualification issued by the NSPM. This posting would alert users that they may not use the FSD for any specific function for which the FSD has not been qualified. For example, if the Statement of Qualification lists windshear training as a function for which the FSD has not been qualified, then the FSD may not be used for credit for windshear training.

Section 60.11 FSD Use

The introductory text of proposed § 60.11 contains language that assigns responsibility for complying with part 60 to any person who ''uses,'' ''allows the use of,'' or ''offers the use of'' an FSD for meeting training, evaluation, or flight experience requirements. Examples of people who ''use'' an FSD would be a certificate holder or an employee of the certificate holder, a flight instructor, or an individual flightcrew member. The person who ''allows'' or ''offers'' the use of an FSD would be an FSD sponsor who allows other certificate holders to use the FSD. Each flight instructor, check airman, or other evaluator is expected to be knowledgeable and aware of whether the equipment they are using is qualified for the task they are doing at that moment. This provision does not prohibit a person from using an FSD for other than meeting training, evaluation, or flight experience requirements. For example, an FSD that is not currently qualified under part 60 could be used for meeting foreign training requirements or the FSD could be demonstrated for a prospective customer.

Proposed paragraph (a) is similar to existing § 121.407(a)(1)(i). While the existing requirement states that each FSD be specifically approved for the certificate holder, the proposed paragraph would require that each FSD have a sponsor, and not more than one sponsor, who may be any person who meets the definition of ''sponsor'' and who is authorized under this chapter to use a qualified and approved FSD. This clarification is necessary because the current rule is not explicit regarding who the certificate holder must be. The proposed rule requires a specifically-identified certificate holder as the sponsor and sets out specific duties and responsibilities for that sponsor.

Proposed paragraph (a) is also based on existing § 121.407(b), which states that a particular airplane simulator or training device may be approved for use by more than one certificate holder. The proposed paragraph would state that other persons or certificate holders may arrange to use a sponsor's FSD that is already qualified and approved for use within an approved flight training program without an additional qualification process. (See proposed § 60.16 for specific requirements for certificate holders or other persons who wish to use a sponsor's FSD for purposes beyond what the FSD is already qualified for.) However, the sponsor would still remain responsible for ensuring that the FSD continually meets the requirements of proposed part 60 and the FSD would have to be approved separately for use in each approved training program.

Proposed paragraph (b) would state that the FSD must be qualified for the make, model, and series of aircraft or set of aircraft and for all tasks and configurations, as described in the posted Statement of Qualification required by proposed § 60.9(b)(4).

Proposed paragraph (c) would state that the FSD must remain qualified through satisfactory inspection, recurrent evaluations, appropriate maintenance, and use requirements in accordance with proposed part 60 and the appropriate QPS.

Proposed paragraph (d) would require the sponsor to ensure that the software and active programming used during regular flightcrew member training, evaluation, or flight experience is the same as that which is used during FSD evaluations. For example, it would not be acceptable to narrow the range of motion of a simulator or alter the programming, such that in actual training the range of motion or a handling characteristic such as pitch sensitivity is not the same as it was during the initial evaluation of the simulator by the NSPM. The purpose of this requirement is to ensure that people using the FSD receive the best possible training in a device that closely matches

the performance and handling characteristics of the aircraft being simulated.

Section 60.13 FSD Objective Data Requirements

Proposed paragraph (a) would require the sponsor to submit the aircraft manufacturer's flight test data to the NSPM for validating FSD performance and handling qualities during evaluation for qualification. This flight test data must come from the original certification flight tests and must include any data developed after the type certificate was issued (*e.g.*, data developed in response to an Airworthiness Directive) that incorporates a change in performance, handling qualities, functions, or other characteristics of the aircraft that must be considered during flightcrew member training, testing, or checking, or when meeting flightcrew member experience requirements. Also, this requirement would apply not only for initial qualification of an FSD, but also for subsequent recurrent evaluations of the FSD, and evaluations following any modifications to the FSD, including those made in response to an Airworthiness Directive or an FSD Directive. This is to help ensure that the FSD accurately simulates the aircraft being simulated.

Proposed paragraph (b) would state that the sponsor may submit flight test data to the NSPM from a source in addition to or independent of the aircraft manufacturer's data submitted in support of a FSD qualification. This data would have to be gathered and developed by that source in accordance with the flight test methods, including a flight test plan, as described in the appropriate QPS.

Proposed paragraph (c) would state that the sponsor may submit alternative data (such as engineering simulation or calculated or extrapolated data, etc.) acceptable to the NSPM for consideration, approval and possible use in particular applications for FSD qualification.

Proposed paragraph (d) would require that data or other material or elements must be submitted in a form and manner acceptable to the NSPM.

Proposed paragraph (e) would state that the NSPM may require additional flight testing to support certain FSD qualification requirements.

Proposed paragraph (f) would require that, when an FSD sponsor learns or is advised by an aircraft manufacturer or supplemental type certificate (STC) holder, that an addition to, an amendment to, or a revision of the data used to program and operate an FSD used in the sponsor's training program is available, the sponsor must immediately notify the NSPM. This would provide an opportunity for the NSPM to decide if action is needed to incorporate the data into that sponsor's or any other sponsor's FSD.

Section 60.14 Special Equipment and Personnel Requirements for Qualification of the FSD

The proposed new section would require that, when notified by the NSPM, the sponsor must make available all special equipment and specifically qualified personnel needed to accomplish tests during initial or recurrent evaluations.

The NSPM would notify the sponsor at least 24 hours in advance of the evaluation if special equipment or personnel would be required to conduct the evaluation. Examples of special equipment include spot photometers, flight control measurement devices, sound analyzer, etc. Examples of special personnel would be those specifically qualified to install or use any special equipment when its use is required. The purpose of this section is to ensure that the NSPM can conduct a meaningful and useful evaluation.

Section 60.15 Initial Qualification Requirements

Proposed paragraph (a) would require that a sponsor seeking an evaluation for an initial FSD qualification must submit a request to the NSPM through the training program approval authority (TPAA), who is defined in proposed § 60.3 as a person authorized by the Administrator to approve the aircraft flight training program in which the FSD will be used (normally the FAA's assigned POI or TCPM for the sponsor). The request would have to be submitted in a form and manner described in the appropriate QPS. An application for qualification under proposed part 60 would have to be submitted through the TPAA because the design of proposed part 60 is that an FSD evaluation is closely tied to its planned use in an FAA approved training program.

Proposed paragraph (b) outlines what must be included in the sponsor's request for an evaluation. Proposed paragraph (b)(1) would state that the request must include a statement that the FSD meets all of the applicable provisions of proposed part 60. Proposed paragraph (b)(2) would state that the request must include a statement that the sponsor has established a procedure to verify that the configuration of hardware and software present during the evaluation for initial qualification is maintained except where modified as authorized in proposed § 60.23. The statement must include a description of the procedure. Proposed paragraph (b)(3) would state that the request must include a statement signed by at least one pilot who meets the requirements of paragraph (c) asserting that each pilot so approved has determined that: (i) The FSD systems and sub-systems function in a manner that is equivalent to those in the aircraft or set of aircraft, (ii) the performance and flying qualities of the FSD are equivalent to those of the aircraft or set of aircraft, and (iii) for type specific FSD's, the cockpit configuration conforms to the configuration of the aircraft make, model, and series being simulated. These statements are necessary to ensure that the FSD has been thoroughly and competently assessed by the sponsor and that the assessment was done by someone who is competent to make that determination.

Proposed paragraph (b)(4) would require that the sponsor's request include a list of all of the operations tasks or simulator systems in the subjective test appendix of the appropriate QPS for which the FSD has not been subjectively tested (*e.g.*, circling approaches, windshear training, etc.) and for which qualification is not sought. This list would be required so that future or prospective users would be alerted if a particular FSD is not qualified for a particular task.

Proposed paragraph (b)(5) would require that the sponsor's request must include a qualification test guide (QTG) that includes: (i) Objective data from aircraft testing, or another approved source; (ii) correlating objective test results obtained from the performance of the FSD as prescribed in the appropriate QPS; (iii) the general FSD performance or demonstration results prescribed in the appropriate QPS; and (iv) a description of the equipment necessary to perform the evaluation for initial qualification and the recurrent evaluations for continuing qualification. The QTG is necessary to provide documentation of the results of the initial evaluation. The data will be used for comparison purposes in future recurrent evaluations.

Proposed paragraph (c) would require that, except for those FSD's previously qualified and described in § 60.17, each FSD evaluated for initial qualification would have to meet the standards that are in effect at the time of the evaluation. However, if a change to the standards (*i.e.*, tests, tolerances, or other requirements) for the evaluation for initial qualification are published by the FAA, a sponsor may request that the

NSPM apply the standards that were in effect when an FSD was ordered for delivery under certain circumstances listed in the proposal.

Proposed paragraph (d) would require that the pilot or pilots who make the statement required by paragraph (b)(3) must be designated by the sponsor and approved by the TPAA. In addition the pilot or pilots must be qualified in the aircraft or set of aircraft being simulated or, for aircraft types not yet issued a type certificate, the pilot or pilots must be qualified on an aircraft type similar in size and configuration.

Proposed paragraph (e) would require that the subjective tests that form the basis for the statements described in proposed paragraph (b)(3) and the objective tests described in proposed paragraph (b)(5) must be accomplished at the sponsor's training facility, except as provided for in the appropriate QPS. The procedures described in the QPS allow complete testing of the FSD at the manufacturer's facility but requires that this be followed by a re-test of at least a ⅓ cross-section of all tests at the training center location to ensure that any disassembly/reassembly has not affected the performance or handling qualities of the FSD as originally determined (*e.g.*; see paragraph 11(m) in the proposed Airplane Flight Simulators Qualification Performance Standards, FAA Document No. FAA–5–120–40C). If the FSD must be moved after the initial evaluation, the sponsor must follow specific procedures that allow the NSPM to require the sponsor to reaccomplish certain tests to ensure that the performance was not affected by the disassembly and reassembly.

Proposed paragraph (f) would require the person seeking to qualify the FSD to provide the NSPM with access to the FSD for the length of time necessary to complete the required evaluation of the FSD for initial qualification. This evaluation for initial qualification includes performance demonstrations, objective tests, and subjective tests, including general FSD requirements, to determine that the FSD meets the standards in the appropriate QPS.

Proposed paragraph (g) would state that a satisfactory evaluation for initial qualification results in the NSPM issuing a Statement of Qualification which would: (1) Identify the sponsor; (2) identify the make, model, and series of aircraft or set of aircraft being simulated; (3) state that the FSD is qualified as either a flight simulator or an FTD; (4) identify the configuration of the aircraft or set of aircraft being simulated, *e.g.*, engine model or models, flight instruments, navigation or other systems, etc.; (5) list all of the operations tasks or simulator systems in the subjective test appendix of the appropriate QPS for which the FSD has not been subjectively tested and for which the FSD is not qualified, *e.g.*, circling approaches, windshear training, etc.; and (6) indicate the qualification level of the FSD. All of this information would be included on the Statement of Qualification so that future or prospective users of an FSD can determine that the FSD can perform the tasks necessary for their training program.

Proposed paragraph (h) would require that after the NSPM completes the evaluation for initial qualification, the sponsor must update the QTG. The sponsor must incorporate 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.

Proposed paragraph (i) would provide that, upon issuance of the Statement of Qualification, the updated QTG would become the MQTG. The MQTG would have to be made available to the FAA upon request, so that the FAA can go to one source for all test results related to a specific FSD.

Section 60.16 Additional Qualifications for a Currently Qualified FSD

Proposed paragraph (a) would state the additional qualification process required if a user intends to use the FSD for meeting training, evaluation, of flight experience requirements beyond the qualification issued to the sponsor. Proposed paragraph (a) would require the sponsor to:

(i) Submit to the NSPM all modifications to the MQTG that are required to support the additional qualification; (ii) describe to the NSPM all modifications to the FSD that are required to support the additional qualification; and (iii) submit a statement to the NSPM that a pilot, designated by the sponsor and approved by the TPAA, has subjectively evaluated the FSD in those areas not previously evaluated. These requirements are necessary to ensure that training received in an FSD is adequate for a particular training program.

Proposed paragraph (a)(2) would require the FSD to successfully pass an evaluation as follows: (i) For initial qualification, in accordance with proposed § 60.15 if the NSPM has determined that a full evaluation for initial qualification is necessary; or (ii) for those elements of an evaluation for initial qualification (*e.g.*, objective tests, performance demonstrations, or subjective tests) designated as necessary by the NSPM.

Proposed paragraph (b) would require the NSPM, in making the determinations described in paragraph (a)(2) of this section, to consider factors including the existing qualification of the FSD, any modifications to the FSD hardware or software that are involved, and any additions or modifications to the MQTG.

Proposed paragraph (c) would state that, except for those FSD's previously qualified and described in § 60.17, each FSD evaluated for initial qualification must meet the standards that are in effect at the time of the evaluation. However, if a change to the standards (*i.e.*, tests, tolerances, or other requirements) for the evaluation for initial qualification are published by the FAA, a sponsor may request that the NSPM apply the standards that were in effect when an FSD was ordered under certain circumstances listed in the proposal.

Proposed paragraph (d) would state that the FSD is qualified for the additional uses when the NSPM issues an amended Statement of Qualification in accordance with proposed § 60.15(f).

Proposed paragraph (e) would state that the sponsor could not modify the FSD except as described in § 60.23.

Section 60.17 Previously Qualified FSD's

Proposed paragraph (a) would state that any FSD qualified before the effective date of a final rule for part 60 will retain its qualification as long as it continues to meet the standards of its original evaluation, regardless of sponsor, and as long as the sponsor complies with the applicable provisions of proposed part 60. This requirement would be effective unless otherwise specified by an FSD Directive or unless the sponsor elects to comply with later standards, as specified in proposed paragraph (e). However, this grandfathering provision applies only to the qualification basis of the FSD. All of the use requirements in part 60, such as the sponsor responsibility for a quality assurance program and the recurrent evaluation, maintenance, and recordkeeping requirements would apply to these grandfathered FSD's.

Proposed paragraph (b) would require that sponsors of previously qualified FSD's obtain a Statement of Qualification, including the Configuration List and the Restrictions to Qualification List within six (6) years after the effective date of this rule in accordance with the procedures set out in the appropriate QPS. This is necessary so that all qualified FSD's will

have a Statement of Qualification, and the information contained therein and retained on file with the NSPM will be useful to the sponsor, potential users, and the FAA.

The FAA is allowing the grandfathering process described above to ensure a stable regulatory design for investment and use of FSD's as long as the FSD is used continually under the rules in proposed § 60.7. At the same time, the FAA wants to encourage industry to use the most up to date standards and in some cases will mandate the use of new standards by issuing an FSD Directive.

Proposed paragraph (c) would state that if the FSD qualification is lost under proposed § 60.27 and is not restored for two or more years, then the basis for requalification would be those standards in effect at the time the sponsor applies for requalification. This is important because the FAA does not want to expend resources to requalify an unused FSD using out of date standards; rather, the FAA wants to encourage industry to use the most up to date standards in the requalification process. In other words, the FAA wants to discourage new investment in old technology and expenditure of public funds to requalify old technology. However, if an FSD is continually in use, the FAA will allow the FSD to continue to operate under the original standards.

Proposed paragraph (d) would require that all changes to FSD qualification levels initiated on or after the effective date of a final rule would require an evaluation for initial qualification in accordance with part 60 unless the sponsor chooses to downgrade the FSD, as specified in proposed paragraph (e). Subsequent recurrent evaluations would use the existing MQTG, modified as necessary to reflect the new qualification level.

Proposed paragraph (f) describes the requirements when a sponsor elects to adopt tests and tolerances described in qualifications standards developed after an FSD was initially qualified. The sponsor would have to provide appropriate validation data and obtain the approval of the NSPM. The NSPM would make the updated tests and tolerances a permanent part of the QTG/MTQG.

The FAA would like to note that there is another category of training devices. Although proposed § 60.17 would not specifically disallow the use of these devices, they would not be considered FTDs under this proposal. These training devices, approved under § 61.4 for use in other than FAA-approved training programs, have been treated as Level 1 FTDs. However, because these devices were not originally qualified under FAA standards and no objective or subjective tests were required before their approval, they do not meet the proposed definition of an FTD. These devices would continue to be allowed under part 61 for certain training, evaluation, and flight experience requirements, as described under the preamble discussion for ''Conforming changes to other parts.''

Section 60.19 Inspection, Recurrent Evaluation, and Maintenance Requirements

Proposed § 60.19 contains the specific requirements for conducting periodic inspections and evaluations and for maintaining FSD's. These requirements are necessary to ensure that the FSD continues to meet the standards under which it was originally qualified, so that any training, evaluation, and flight experience conducted in the FSD is reliable and adequate for meeting the objectives of the approved training program under which they occur.

Proposed paragraph (a)(1) would require that to maintain the qualification level for each FSD the sponsor must accomplish all appropriate QPS Appendix 1 performance demonstrations and all appropriate QPS Appendix 2 objective tests each year. To do this, the sponsor would be required to conduct quarterly inspections of the FSD evenly spaced throughout the year. All of the MQTG performance demonstrations and objective tests would have to be completed annually. The sequence and content of each inspection would be developed by the sponsor and submitted to the NSPM for approval. In deciding whether to approve the test sequence and the content of each inspection, the NSPM would look for a balance and a mix from the performance demonstrations and objective test requirement areas; *i.e.*, performance, handling qualities, motion system (where appropriate), visual system (where appropriate), sound system (where appropriate), and other FSD systems.

Proposed paragraphs (a)(2) and (a)(3) would require that to maintain the qualification level for each FSD the sponsor must ensure that the FSD be given a functional check-out, in accordance with the appropriate QPS, before each day's use, or not less than weekly when the FSD is not in use. The proposed paragraphs are similar to existing § 121.407(a)(4).

Proposed paragraph (a)(4) would state that to maintain the qualification level for each FSD the sponsor must maintain a discrepancy log. The discrepancy log would be maintained in or immediately adjacent to the FSD to advise users of the FSD of the current maintenance status and the status of each discrepancy, including the corrective action, recorded for at least the preceding 30 days. Under proposed paragraph (a)(5) the sponsor would have to ensure that, when a discrepancy is discovered, each discrepancy entry is maintained in the log until the discrepancy is corrected under the requirements of proposed § 60.25(b), and that the discrepancy entry, its corrective action, and the date the corrective action was taken remain in the log for at least 30 days after the discrepancy is corrected. Finally, the sponsor would be required to ensure that the discrepancy log be kept in a form and manner acceptable to the Administrator and must be kept in or immediately adjacent to the FSD. The proposed paragraphs are similar to existing § 121.407(a)(5).

Proposed paragraph (b) would specify the requirements for a recurrent evaluation to be conducted by the NSPM. Proposed paragraph (b)(1) would require that, with certain exceptions, a recurrent evaluation consist of performance demonstrations and objective and subjective tests in accordance with the qualification standards in effect at the time of the initial evaluation or as may be amended by an FSD Directive.

Proposed paragraph (b)(2) would require that the sponsor must coordinate with the NSPM to ensure that the FSD is evaluated within the established recurrent evaluation interval. The sponsor would have to contact the NSPM 60 days before the recurrent evaluation is due to schedule the evaluation.

Proposed paragraph (b)(3) would require that the sponsor must provide the NSPM access to the objective test results and general FSD performance or demonstration results in the MQTG and access to the FSD for the length of time necessary to complete the required recurrent evaluations. Access to the FSD would have to be provided weekdays between 6 AM and 6 PM (local time).

Proposed paragraph (b)(4) would provide that the frequency of NSPM-conducted recurrent evaluations for each FSD will be established by the NSPM and specified in the MQTG. Currently, NSPM evaluations are conducted annually. Proposed paragraph (b)(4) would allow these evaluations to be conducted at different intervals.

Proposed paragraph (b)(5) would provide that recurrent evaluations

conducted in the calendar month before or after the calendar month in which the recurrent evaluations are required will be considered to have been conducted in the calendar month in which they were required.

Proposed paragraph (b)(6) would prohibit the sponsor from using, or offering for use, an FSD for flightcrew member training or evaluation, or for obtaining flight experience under this chapter, unless the FSD has been recurrently evaluated by the NSPM within the timeframe specified in the MQTG.

Proposed paragraph (c) would state that the sponsor is responsible for not only the on-going preventive maintenance, but also for the continuing corrective maintenance. By preventive maintenance the FAA means those actions that are necessary to prevent maintenance discrepancies to the largest possible degree and to continue the FSD in proper service condition (*e.g.*, change hydraulic fluid and filters as prescribed by the manufacturer). By corrective maintenance the FAA means that the sponsor is to ''repair'' the device when it becomes necessary.

Section 60.20 Logging FSD Discrepancies

Proposed § 60.20 would require that each instructor, check airman, or representative of the Administrator conducting training or evaluation, or observing flight experience for flightcrew member certification or qualification, and each person conducting the preflight inspection (§ 60.19(a)(2), (3), and (4)), who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the FSD, would have to write or cause to be written a description of that discrepancy into the discrepancy log at the end of the FSD preflight or FSD use session. The FAA believes that the proposed section is important so that the sponsor will be alerted when a repair is necessary and the user will know that a particular task must not be done because any training, testing, or checking accomplished may result in incomplete or negative learning on the part of the pilot. The proposed section is similar to existing § 121.407(a)(5). Compliance with proposed § 60.20 would help FSD users comply with proposed § 60.25(a). In part, proposed § 60.25(a) provides that no person may use an FSD with a missing, malfunctioning, or inoperative component to meet any training, evaluation, or flight experience requirements for this chapter for which the correctly operating component is needed.

Section 60.21 Interim Qualification of FSD's for New Aircraft Types or Models

Proposed § 60.21 would provide for interim qualification of FSD's for new aircraft types or models under certain conditions when the final flight test data package has not been released by the aircraft manufacturer. In cases where an operator is adding a new aircraft type or model to its fleet, it may be necessary to begin training before the final flight test data is available, so that the operator can put the aircraft into service as soon as possible.

Under proposed § 60.21(a) the FSD may be eligible for interim qualification if the sponsor provides the aircraft manufacturer's predicted data, validated by a limited set of flight test data; the aircraft manufacturer's description of the prediction methodology used to develop the predicted data; and the QTG test results.

Proposed paragraph (b) states that in this situation, the interim qualification will be considered the same as initial qualification. The interim qualification would terminate one year after its issuance, if the sponsor has not applied for initial qualification using the final test data, unless the NSPM determines that specific conditions warrant otherwise. Under proposed paragraph (c), within six months of the release of the final flight test data package by the aircraft manufacturer, but no later than one year after the issuance of the interim qualification, the sponsor would have to apply for initial qualification based on the final flight test data package.

Proposed paragraph (d) states that an FSD with interim qualification may be modified only in accordance with § 60.23.

Section 60.23 Modifications to FSD's

Proposed § 60.23 outlines the circumstances under which a sponsor would have to modify an FSD and the procedural requirements the sponsor must follow for modifications. The purpose of this section is to ensure that the FSD continues to accurately simulate the aircraft and that if certain changes are made in the aircraft, the sponsor makes corresponding changes to the FSD. Proposed paragraph (a) would require that an FSD be modified when the FAA determines that the FSD cannot be used adequately for training, evaluating, or providing flight experience for flightcrew members, and when the sponsor or the FAA determines that any of the following circumstances exist:

(1) The aircraft manufacturer or another approved source develops new data regarding the performance, functions, or other characteristics of the aircraft being simulated;

(2) A change in aircraft performance, functions, or other characteristics occurs;

(3) A change in operational procedures or requirements occurs;

(4) Other circumstances as determined by the NSPM.

Proposed paragraph (b) would state that when the FAA determines that FSD modification is necessary for safety of flight reasons, then the sponsor of each affected FSD must ensure that the FSD is modified according to the FSD Directive, regardless of the FSD's original qualification standards.

Proposed paragraph (c) would set forth requirements for sponsors in notifying the NSPM and TPAA about FSD modifications. The notification would have to include a complete description of the planned modification, including a description of the operational and engineering effect the proposed modification will have on the operation of the FSD, and be submitted in a form and manner as specified in the appropriate QPS. This notification is considered important to ensure that the FAA agrees with the modification before the modification is incorporated into training. In addition, the notification would ensure that training is consistent with the latest data, changes in aircraft performance, and changes in procedures.

Proposed paragraph (d) would set forth notification requirements if the sponsor intends to do any of the following: add additional equipment or devices intended to simulate aircraft appliances; modify hardware or software that would affect flight or ground dynamics; or change the motion, visual, or control loading systems (or sound system for FSD levels requiring sound tests and measurements). In any of these cases the sponsor would have to follow paragraph (c) plus provide a statement of the results of all objective tests that have been rerun with the modification incorporated, including any necessary updates to the MQTG. These notification requirements would not apply to routine maintenance or repair, but only for modifications to the FSD. The modifications could not be implemented until the sponsor receives written approval from the NSPM, who may require that the modified FSD be evaluated for full or partial initial qualification. The NSPM would evaluate at least the newly installed or changed equipment, any device intended to simulate an aircraft appliance, the new or changed software or hardware, and any other aspect of the

original FSD that might affect or be affected by the installation or change.

Proposed paragraph (e) would state that the sponsor may not modify a qualified FSD until, for circumstances described in paragraph (b) or (d), the sponsor receives written approval from the NSPM that the modification is authorized. For circumstances other than those described in paragraph (b) or (d), if the NSPM or TPAA does not otherwise notify the sponsor within 21 days after receiving the sponsor's notification, the sponsor may modify the FSD after the 21 days have passed.

Proposed paragraph (f) would require the sponsor to notify certificate holders about modifications made to an FSD before the certificate holders' first use of the FSD after the modification.

Proposed paragraph (g) would require that each time an FSD is modified and the modification affects an objective test, then the MQTG must be updated accordingly. The MQTG should reflect current objective test results (in accordance with § 60.15(b)(4)) and appropriate flight test data (in accordance with § 60.13). If this update is initiated by the FAA, the requirement to make this modification would be found in an FSD Directive. The MQTG would also have to be updated with the direction to make these changes, along with the record of the completion of the modification.

Section 60.25 Operation With Missing, Malfunctioning, or Inoperative Components

The FAA is proposing this section because it believes that users must be alerted when an FSD has a missing, malfunctioning, or inoperative component thereby limiting its use for certain tasks, while also providing the sponsor a reasonable time period to make repairs. If a user is unaware of a missing, malfunctioning or inoperative component, the training may be incomplete or even have negative results.

Proposed paragraph (a) would limit the use of FSD's with a missing, malfunctioning, or inoperative component. This restriction would prevent the potential of incomplete or negative learning on the part of the pilot, by preventing all maneuvers, procedures, or tasks that require the use of the correctly operating component from being conducted during flight training, evaluation, or flight experience activities when that component is not present and operating correctly. Due to the fact that the typical use of a ''minimum equipment list'' is associated with ''safety of flight operations,'' which is not applicable to the use of simulation for training, testing, or checking, the FAA is not describing or requiring the use of an FSD ''minimum equipment list.'' Instead, the FAA believes that those who operate the FSD for credit purposes (*e.g.*, instructors, check airmen, Aircrew Program Designees, representatives of the Administrator, etc.) are familiar with the components of a normally operating aircraft for each particular task, and know that if a normally functioning component, otherwise required for that task, were to become missing, malfunctioning, or inoperative, that task would have to be omitted from the syllabus, or delayed, until such time as that component is repaired or replaced. Except as provided below, this is not intended to restrict the operation of the FSD for accomplishment of a given task when a component is missing, malfunctioning, or inoperative, if that component is listed in the airplane ''minimum equipment list'' and the FSD is operated as the airplane would be operated, in accordance with any requirements listed in the ''minimum equipment list'' and that task is accomplished through use of alternative equipment. However, if the FAA-approved training program being administered requires that the task be completed using the correctly operating component, using the provisions of a ''minimum equipment list'' to complete the task without that component operating properly would not be permitted under this regulation. The FAA believes that this paragraph, together with the requirements of proposed § 60.20 (that would require each person who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the FSD, would have to write or cause to be written a description of that discrepancy into the discrepancy log) is representative of the current practice in FSD's that has well served the FAA, the industry, and the individual pilot for at least two decades. The FAA has, at this time, no reason to change this practice; however, should this position be found to be deficient in some way, additional steps may have to be considered.

Proposed paragraph (b) would require that within 7 calendar days, each missing, malfunctioning, or inoperative component must be repaired or replaced, unless the NSPM requires a shorter time or authorizes a longer time. If the sponsor does not repair or replace the component within 7 calendar days (or the shorter period required or longer period authorized under paragraph (b)), the NSPM may consider taking some action, including removing the qualification of the FSD. The requirement to repair each missing, malfunctioning, or inoperative component applies not only to components that are necessary for flightcrew member training, evaluation, or flight experience, but also to all other components of the FSD.

Proposed paragraph (c) would require that missing, malfunctioning, or inoperative components must be placarded on or adjacent to the component or the control for that component in the FSD and that a list of currently missing, malfunctioning, or inoperative components must be readily available in or immediately adjacent to the FSD for review by users of the device.

Section 60.27 Automatic Loss of Qualification and Procedures for Restoration of Qualification

Proposed paragraph (a) would establish criteria that would indicate when an FSD is no longer qualified. When any of the circumstances in proposed paragraphs (a)(1) through (a)(5) occur, the FSD is automatically no longer qualified, without notification by the NSPM. In these circumstances, something has happened without the FAA's knowledge that makes the FSD not qualified for training, so the FSD should not be used until the FAA can evaluate the FSD under the procedures in proposed paragraph (b).

Proposed paragraphs (b) and (c) would contain requirements for restoring FSD qualification when it is lost under proposed paragraph (a). The NSPM would determine how the FSD qualification must be restored. The NSPM determination could range from requiring no evaluation, a partial evaluation for initial qualification, or a full evaluation for initial qualification. The basis for determining the evaluation content and time required for the evaluation would include: The number of recurrent evaluations missed during the inactive period, the amount of disassembly and reassembly that was accomplished, and the care that had been taken of the device since the last evaluation and since its loss of qualification.

Section 60.29 Other Losses of Qualification and Procedures for Restoration of Qualification

Proposed § 60.29 contains the procedures to be followed when an FSD loses its qualification in circumstances other than those covered in proposed § 60.27. The purpose of this section is to allow a sponsor to officially question loss of FSD qualification before the FSD

actually loses its qualification, except in emergency situations.

Proposed paragraphs (a)(1)–(3) would set forth the procedures for the NSPM or TPAA to follow in communicating with the sponsor when an FSD no longer meets qualification standards, including written notification to the sponsor; establishing a time period in which the NSPM or TPAA may respond with written information, views, and arguments on FSD qualification; and consideration of the sponsor's arguments and notification to the sponsor of the FSD qualification.

Proposed paragraph (a)(4) would require that if the NSPM or TPAA determines that an FSD is no longer qualified, the loss of qualification would be effective 30 days after the sponsor receives notice. The exceptions to this requirement would be if the NSPM or TPAA finds under paragraph (c) of this section that there is an emergency requiring immediate action with respect to safety in air transportation or air commerce, or if the sponsor petitions for reconsideration of the NSPM or the TPAA finding under paragraph (b) of this section.

Proposed paragraph (b) would set forth the procedures for a sponsor to follow when the sponsor seeks reconsideration of the NSPM or TPAA decision regarding FSD qualification. This would include submitting a petition for reconsideration, addressed to the Director of Flight Standards Service, within 30 days after the sponsor receives notice that some or all of the FSD is no longer qualified. This petition for reconsideration would suspend the NSPM's or TPAA's determination that the FSD is no longer qualified. However, this provision would not apply if the NSPM or the TPAA finds that, under paragraph (c) of this section, an emergency exists requiring immediate action with respect to safety in air transportation or air commerce.

Proposed paragraph (c) would set forth the procedures for the NSPM or TPAA to follow if they find an emergency exists that would require immediate action with respect to safety in air transportation or air commerce; such an emergency would make the procedures set out in other parts of this section impracticable or contrary to the public interest. Proposed paragraph (c)(1) would allow the NSPM or TPAA to withdraw qualification of some or all of the FSD and make the withdrawal of qualification effective on the day the sponsor receives notice of it. Proposed paragraph (c)(2) would require that the NSPM's or TPAA's notice to the sponsor articulate the reasons for its finding that an emergency exists. The notice would have to state that such an emergency would require immediate action with respect to safety in air transportation or air commerce, or that the emergency makes it impracticable or contrary to the public interest to stay the effectiveness of the finding.

Examples of such emergencies described in proposed paragraph (c) include: A finding by the FAA that the training conducted in the FSD is or may be incomplete, inaccurate, or negative because of a specified finding of a problem with the FSD. The finding of a specific problem with the FSD could be a reasonable basis for the NSPM questioning whether or not the FSD continues to meet its qualification level. Aviation safety requires that if the FAA has a reasonable basis for questioning whether the FSD continues to meet its qualification level, that it not be used for required flightcrew member training, testing, or flight experience until its known that the FSD is qualified.

Section 60.31 Recordkeeping and Reporting

This proposed section is based on the current recordkeeping practices of FSD sponsors and is necessary to ensure that the FSD is complete and operating correctly; that problems are noted and due dates are identified for correcting malfunctions; that users are alerted to approved uses for the FSD; and that training is useful and adequate.

Proposed paragraphs (a)(1)–(3) would require the FSD sponsor to maintain the following records for each FSD: (1) The MQTG and each amendment to the MQTG; (2) A copy of the programming used during evaluation of the FSD for initial qualification or upgrade, as well as a copy of all programming changes made since the evaluation for initial qualification; (3) A copy of results of evaluations for initial and upgrade qualification; the results of the quarterly objective tests and the approved performance demonstrations, which must be kept for 2 years; the results of either the previous three recurrent evaluations or the recurrent evaluations from the previous 2 years, whichever covers a longer period; and any comments obtained under § 60.9(b)(1), which must be maintained for at least 18 months.

Proposed paragraph (a)(4) would require the FSD sponsor to maintain a record of all discrepancies entered in the discrepancy log over the previous 2 years, including a current listing of components/equipment that have become missing, malfunctioning, or inoperative; the action taken to correct the deficiency; and the date of the corrective action. The list must be available for NSPM review at any time.

This proposed requirement should not be confused with the proposed requirement in § 60.19(a)(5)(ii), where the sponsor would be required to maintain a record of the discrepancy, and the corrective action, in the discrepancy log for a period of at least 30 days. The proposal in this section would require the sponsor to maintain these records for an additional 23 months; however, the sponsor would not necessarily have to keep the records in the discrepancy log in or immediately adjacent to the FSD for more than 30 days. Wherever the sponsor elects to keep the records, they must be available for NSPM review.

Proposed paragraph (a)(5) would require the FSD sponsor to keep a record of all modifications to FSD hardware or software configurations from the initial qualification configuration.

Proposed paragraph (b) would require the FSD sponsor to keep a current record of each certificate holder using the FSD and to provide a copy of this list to the NSPM at least semiannually.

Proposed paragraph (c) states that the records specified in this section would have to 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. The FAA accepts and encourages the use of electronic records and reporting for all of these proposed requirements, assuming the sponsor has appropriate security or controls to prevent the illegal or inappropriate alteration of such records after the fact.

Proposed paragraph (d) would require the sponsor to submit an annual report certifying that the FSD continues to perform and handle as qualified by the NSPM. This report would have to be signed by the management representative.

Section 60.33 Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements

The proposed section is based on other FAA regulations addressing falsification of applications, reports, and records. The proposal is intended to ensure that a proposed sponsor or a user of an FSD understands that aviation safety requires accuracy and truthfulness in applications, reports, and records. Therefore, depending on the circumstances, there are consequences associated with falsification of applications, reports, and records.

Proposed paragraph (a) prohibits any person from making fraudulent or intentionally false statements, false entries, omissions, or fraudulent reproduction or alteration in any applications, reports, records, or test results required under proposed part 60 or the QPS, or to exercise any privileges under any other FAA regulation.

Proposed paragraph (b) would state that if any person commits any of the above acts, that person is subject to civil penalty, certificate suspension or revocation, or the removal of FSD qualification and approval for use in a training program issued under this part or QPS. The certificate suspension or revocation could apply to either an airman certificate, in a case involving an individual, or to an operating certificate, in a case involving a certificate holder.

Proposed paragraph (c) states the actions that could serve as a basis for removal of qualification of an FSD, including the withdrawal of authorization for use of an FSD or denying an application for a qualification. These actions include: (1) An incorrect statement, on which the FAA relied or could have relied, that was made in support of an application for a qualification or a request for approval for use; or (2) an incorrect entry, on 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 FSD qualification or an approval for use.

Section 60.35 Specific Simulator Compliance Requirements

The proposed section addresses the goal of providing complete, accurate training and evaluation of flightcrew members in a flight simulator. This proposed requirement would help ensure that all aspects of a flightcrew member's training needs will be able to be addressed competently in a flight simulator.

Proposed paragraph (a) sets forth simulator requirements that would take effect 18 months after the effective date of the final rule for proposed part 60. These proposed requirements state that the flight simulator being evaluated for initial or upgrade qualification must conform to the aircraft being simulated, and must simulate the operation of all equipment or devices intended to simulate aircraft appliances installed and operating on the aircraft. Any simulator that was qualified before that date would remain qualified; however, if the sponsor decided to upgrade the simulator for any reason, it would also have to be upgraded to comply with this paragraph.

Proposed paragraph (b) sets forth simulator requirements that would take effect 2 years after the effective date of the final rule for proposed part 60. These proposed requirements state that each flight simulator used for meeting flightcrew member training, evaluation, or flight experience requirements of this chapter for certification or qualification that cannot perform satisfactorily in ground operations, takeoff, climb, cruise, descent, approach, and landing (including normal, abnormal, and emergency landings) would no longer be qualified as a simulator. The only significant change from existing practice is the addition of landings to this list. The net effect of this added requirement would be to eliminate the use of level A simulators.

The FAA is proposing this change because landings are an essential part of complete training conducted in simulators. The concern is that level A simulators do not provide adequate training on takeoffs and landings in normal and asymmetrical thrust conditions. Sponsors of level A simulators would have the option of downgrading to an FTD or upgrading to a level B simulator within 2 years after the effective date of the final rule.

The level A simulator is the least sophisticated of today's simulator levels and is today's reference for the historic ''visual'' simulator that was referenced in the regulations as far back as the mid- to late 1960's, when visual systems first appeared as attachments to the (non-visual) simulators that had been used in pilot training activities up to that time.

The requirements for data applicable to simulators of this vintage, both ''visual'' and ''non-visual,'' were elementary, and relatively primitive when compared to today's standards. The two most common visual systems consisted of either a Visual Anthropomorphic Motion Picture system that projected a motion picture of the final approach course from approximately three to four miles from the approach end of the runway—sometimes, through the beginning of the missed approach; or a closed circuit television camera mounted on a movable ''gondola'' that provided TV pictures as the camera was ''flown'' over a model terrain board containing a model airport and its surrounding environment. In addition to the inherent propensity for malfunctions (e.g., the reduction of the final approach length due to continual breakage of brittle film and the resulting splicing, or the limitations of the TV cable to twist or turn and become unplugged), the ''requirements'' for a visual system were completely subjective and the direct projected system provided an agreeable presentation to only one pilot at a time. The guidance given was that ''* * * visual systems may be approved for the specific maneuver(s), procedure(s), or function(s) requested by the applicant provided the evaluation indicates the training and checking objectives can be accomplished as well as in (the) airplane.''

Motion system requirements for visual and non-visual simulators were not as sophisticated as the requirements for a visual system. As the industry moved into the 1970's, the simulator motion system requirement stated that ''* * * visual and non-visual simulators, to be approved for any of the maneuvers * * * to be performed in a simulator in lieu of the aircraft, must have motion.'' Most such motion systems were either two or three degrees-of-freedom (dof), and not moving through much distance—just enough to let the occupants of the simulator know they were ''moving.'' While there was some effort expended in most cases to try to subjectively coordinate this simulator ''movement'' with what was thought to be what the pilot would feel in the airplane, there was little or no data on which to base this coordination and, therefore, no standards for such systems. Even though the industry formally acknowledged the value of a 6-dof motion system in the mid-1970's, the ''standards'' for motion systems had not yet pointed to a specific requirement for motion cueing or motion system operation. In fact, it wasn't until the beginning of the 1980's that any ''requirements'' for motion systems were formalized and published.

In the last two decades there have been two major advancements in the field of simulation. First, computer speed and capability have accelerated at a staggering rate; and second, there has been a recognition of the necessity for gathering meaningful airplane flight test data against which simulator performance and handling comparisons may be made. Computer speed and this newly acquired data have been incorporated rapidly into simulation and, overall, simulation has advanced considerably during this time period. Of significant note is that the levels of simulation that are the most affected by these advancements are the level C and level D simulators, with some, limited advancement in level B. Notably, however, there has not been an advancement in the data, nor in the data application, for the level A simulators probably due to the fact that very few new, level A simulators have been built and that it would be costly to modify current level A simulators to

incorporate the data/data applications that might be applicable.

The efficacy of training and testing using level A simulators has long been a topic of discussion among members of the industry and the FAA. The National Transportation Safety Board (NTSB) has also discussed the same topic when conducting investigations of several accidents/incidents during this same two decade period. Perhaps the most extensive discussion of this topic by the NTSB occurred during the investigation of the DC–9–14 accident at Milwaukee, Wisconsin, in September, 1985. In the report of that accident, the NTSB stated that ''* * * advanced (6 dof) simulators are not available for that series DC–9 * * * (and) this results in a requirement that landing credits, which cannot be obtained in the simulator, must be acquired in the airplane.'' The report went on to say, ''However, the practicing of engine failure maneuvers on takeoff, are authorized in the visual flight simulator.''

The dichotomy that has existed with this position—and remains true today—is the premise that the level A simulator has sufficient performance and handling qualities, supported by data and data application (*e.g.*, for motion system response), for all takeoffs (including the engine-out takeoff), but does not have sufficient performance and handling qualities, supported by data and data application, for landing maneuvers. Since takeoffs and landings occur in the same portion of the flight envelope (in and through ''ground effect''), the premise that takeoffs are supportable and landings are not supportable is clearly inconsistent. Either the data and their application are present and useable or they are not. This case is one where they are not present, and, therefore, cannot be useable.

Any authorizations must be based on the capability of the simulator to provide accurate simulation. This cannot occur without the availability of accurate data properly incorporated into the operation of the simulator.

Simplistically, an order changing the authorizations of level A simulators to disallow takeoff training, including the takeoff-with-engine-failure task, might seem to be all that is appropriate. However, the FAA is concerned that unnecessary confusion, perhaps confusion leading to misuse and possible negative training, might result. However, the FAA provides for additional levels of simulation that do not allow takeoff or landing tasks. One level of these flight training devices, FTD Level 6, equipped with a proper visual system and a proper motion system (which are not required but may be incorporated) may be authorized to conduct all of the flight training tasks that might otherwise be allowed in a ''revised'' approval of a level A simulator. FTDs, including those equipped with motion and/or visual systems, are not authorized for flightcrew member testing, checking, or review. Additionally, such an approach is more in line with the on-going harmonization effort currently underway with the Joint Aviation Authorities (JAA) in Europe for comparable simulation equipment.

Therefore, the FAA is proposing to eliminate the level A simulator from the inventory within the prescribed two year time frame described in the proposed rule.

Section 60.37 Simulator Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA)

The proposed section is based on existing Simulator Implementation Procedures, supported by existing BASAs, currently in place and others that are pending. Adding this to the rule provides the FAA with a regulatory basis for entering into such agreements for simulator evaluation/qualification purposes.

Proposed paragraph (a) would state that an evaluation or qualification of an airplane simulator by a contracting State to the Convention on International Civil Aviation for the sponsor of an aircraft simulator located in that contracting State may be used as the basis for the NSPM issuing a U.S. statement of qualification to the sponsor. A sample statement of qualification appears in the appropriate QPS, in appendix 5, figure 4. This would be in accordance with a BASA between the United States and the Contracting State that issued the qualification, and a Simulator Implementation Procedure (SIP) established under the BASA.

Proposed paragraph (b) would state that the SIP must contain any conditions and limitations on validation and issuance of such qualification by the U.S.

Conforming Changes to Parts 61, 63, 141, and 142

Because proposed part 60 contains the FAA requirements for evaluation and qualification of flight simulation devices, specific qualification requirements are no longer needed in other regulations that address the use of simulation in flightcrew member training. Therefore, changes are proposed in parts 61, 63, 141, and 142 to delete specific flight simulation device qualification requirements and substitute cross references to proposed part 60.

In addition, a number of changes are proposed for part 61 to provide for the continuing use of certain training devices that have been approved by the FAA under part 61 for use in other than FAA-approved training programs. These devices are currently designated as Level 1 flight training devices, but they do not meet the proposed definition for flight training devices in this NPRM. Under this proposed rule, these devices would retain their approval and can continue to be used for their current purposes; however, they would no longer be treated as flight training devices and would not fall under the qualification or use requirements of proposed part 60. Therefore, they would not need to follow the requirements for establishment of a quality assurance program, recurrent evaluation, maintenance, and recordkeeping. The approval for these devices is described in proposed § 61.4(b). They would be referred to as ''other devices approved under § 61.4(b).'' These devices could be used only for private pilot certificate and instrument rating training, evaluation, and flight experience requirements. A number of sections in part 61 would be amended to provide specific approval to use these devices for meeting certain requirements of part 61. The sections that would be amended are §§ 61.1, 61.23, 61.31, 61.51, 61.65 and 61.109.

Also, some minor clarifying changes are proposed to part 63. Section 63.39(b)(3) and Appendix C, paragraph (a)(3)(iv) refer to the activity to be accomplished ''* * * in an airplane simulator, or in an approved flight engineer training device.'' The FAA is proposing to use the term ''appropriately equipped cockpit specific flight training device qualified in accordance with part 60 of this chapter'' instead of ''approved flight engineer training device'' because flight training device is the term used in part 60. This should avoid confusion since part 60 describes qualification requirements for FTDs whereas ''approved flight engineer training device'' is not a defined term.

Delegation of Authority for Standards Documents

The FAA proposes to delegate final authority to review and issue amendments to the QPSs proposed elsewhere in this notice from the Administrator to the Director, Flight Standards Service. Specifically, these standards documents are the QPSs for: Airplane Flight Simulators; Airplane Flight Training Devices; Helicopter

Flight Simulators; and Helicopter Flight Training Devices.

The FAA anticipates that these documents will require routine changes for a variety of reasons, *e.g.*, increased knowledge about human factors, analysis of incident/accident data, and changes in aircraft or simulation technology. Because these standards will be regulatory in nature, current FAA policy provides for the Administrator to review changes before final action on them is complete. This process involves significant levels of participation in the review process by individuals at all levels of the agency.

The FAA expects that most future changes to the standards/rule sections of the QPS documents will be published in the **Federal Register** as NPRMs for public comment, just as they are published as part of this NPRM. This will be true unless ''good cause'' exists under the Administrative Procedure Act (APA), which would warrant the FAA publishing such a change to a QPS document without following the standard notice and comment procedures. Under the APA, in order for the FAA to issue a rule without following notice and comment procedures, the FAA would have to make a good cause finding that following such notice and public procedures would be impracticable, unnecessary, or contrary to the public interest.

The FAA does not expect that many changes to these standards documents will justify the expenditure of time and resources at the highest levels of the agency that the standard procedures for final review of rulemakings requires. Therefore, consistent with good government, the FAA proposes to streamline the process for making technical changes to these standards documents by delegating authority for final review and issuance from the Administrator to the Director, Flight Standards Service. The FAA believes that the delegation will result in more timely responses to incident/accident data and advances in aircraft or simulation technology.

Consistent with similar delegations of authority, this authority would be exercised with the concurrence of the Office of the Chief Counsel. If, at any time during the amendment process the Administrator or the Director, Flight Standards Service, determines that a proposed amendment would not be appropriate for this streamlined process, the rulemaking project would proceed in accordance with the agency's normal rulemaking procedures.

Paperwork Reduction Act

This proposal contains the following new information collection requirements. As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the Department of Transportation has submitted the information requirements associated with this proposal to the Office of Management and Budget for its review.

Title: Flight Simulation Device Initial and Continuing Qualification and Use.

Summary: The FAA proposes to amend the regulations to establish flight simulation device qualification requirements for all certificate holders in a new part. The basis of these requirements currently exists in different parts of the FAA's regulations and in advisory circulars. The proposed changes would consolidate and update flight simulation device requirements.

Use of: This proposal would support the information needs of the following initiatives under the FAA's Corporate Project, Safer Skies:

a. AFS Strategic Plan—Goal 1: Evolve to a Systems Approach for Safety Oversight.
b. AFS Business Plan Initiative 2.9: Improve the Requirements Process.
c. AFS Strategic Plan—Goal 4: Promote Positive, Responsive, and Focused Customer Relations.
d. AFS Business Plan Initiative 2.13: Continue Efforts Associated with Safer Skies—Commercial Aviation.

Respondents (including number of): The likely respondents to this proposed information requirement are sponsors of Flight Simulation Devices. At this time, the likely number of respondents is 66.

Frequency: The FAA estimates the 66 sponsors would have a total of 450 responses annually in the first year.

Annual Burden Estimate: This proposal would result in an annual recordkeeping and reporting burden of 201,653 hours for the industry at a cost of $6,108,590. Out of that annual burden, however, the FAA believes that only 1,898 hours and $74,010 would be truly new; although not currently required by regulation, the industry is already doing much of what is proposed in this action. In addition to the burden stated above, there would be a one-time burden of 31,680 hours and $891,504. The recordkeeping and reporting burden is broken down into more detail as follows:

Section 60.5, Quality Assurance Program, would call for a sponsor to develop, review, and have approved by the FAA, a quality assurance program (or QAP) applicable for each flight simulation device. However, the FAA assumes that the sponsor will provide the same QAP for each FSD it sponsors. Therefore, a calculation of the time involved is on a ''per sponsor'' basis, rather than on a ''per FSD'' basis, is appropriate. The purpose of this QA program is to require the sponsor to systematically plan for and implement the requirements of part 60 and the associated QPS.

The quality assurance program would impose two types of cost on the industry and the FAA: a set-up, or one-time cost, and an annually recurring cost.

For the one-time cost on the industry side:

(1) an FSD technician and a pilot instructor would spend approximately 320 hours and 64 hours, respectively, to develop a quality assurance program:

(2) an FSD technician and a pilot instructor would spend approximately 16 hours each to work on the technical coordination of metrics for a QA program;

(3) a clerk would spend approximately 64 hours to do the paperwork associated with a QA program.

This yields a total of 31,680 hours and $891,504 for the one-time expense.

For the continuing, annual cost on the industry side:

(1) To maintain the QA program the Management Representative would spend 12 hours to do the paperwork:

(2) To maintain the QA program a clerk would spend approximately 2 hours to do the paperwork;

This yields a total of 924 hours and $33,984 for the continuing, annual expense.

Section 60.9(b)(3), Additional Responsibilities of the Sponsor, sets out a requirement for each sponsor to maintain a liaison with the manufacturer of the aircraft being simulated by the FSD. The time and costs involved would be as follows:

The Management Representative would spend 0.5 hours in drafting a letter to the manufacturer each quarter (*i.e.*, each 3 months or 4 times each year) and a clerk would spend 0.5 hours each quarter preparing the letter for mailing, for a total of 264 hours and $6,324.

Section 60.15(b), Initial Qualification Requirements, sets out the requirements for the contents of the request for evaluation and is broken into the following parts.

The request for an evaluation is a one-time event for each new FSD the sponsor wishes to include in the approved training program. Time and costs will be as follows:

(a) For the letter of request: The Management Representative, or a Pilot Instructor, would spend 0.5 hours in drafting a letter to the NSPM and a clerk

would spend 0.5 preparing the letter for mailing.

This yields 1 hour and $50.50 for each new FSD entering service with a given sponsor.

Estimates now are that approximately 70 new FSDs will enter service each year. This estimate would yield 70 hours and $3,535 each year.

(b) For the list of all operations tasks or simulated systems for which the sponsor is seeking or is not seeking qualification, the Management Representative, or a Pilot Instructor, would spend 1 hour developing the list and a clerk would spend 1.5 hours in preparing the list for attachment to the letter of request for evaluation.

This yields 2.5 hours and $108.50 for each new FSD entering service with a given sponsor. Estimates now are that approximately 70 new FSDs will enter service each year. This estimate would yield 175 hours and $7,595 each year.

(c) For the qualification test guide, an FSD technician would spend 40 hours developing the technical aspects of the qualification test guide and inserting the appropriate test results; the Management Representative or a Pilot Instructor, would spend 40 hours developing the operational aspects of the qualification test guide.

This yields 80 hours and $4,600 for each new FSD entering service with a given sponsor.

Estimates now are that approximately 70 new FSDs will enter service each year. This estimate would yield 5,600 hours and $322,000 each year.

Section 60.16, Additional Qualifications for a Currently Qualified FSD, sets out the requirements for the sponsor to submit to the NSPM a summary of all modifications to a qualified FSD if that FSD is going to be used by an additional user (other than the sponsor) for tasks not originally qualified. While it is not possible to predict with any accuracy what additional tasks might be needed beyond the qualified tasks for any FSD, the following is offered for consideration:

(a) For all additional tasks (beyond those originally qualified) that require no qualification test guide modification, the Management Representative or a pilot instructor would spend 0.5 hours in drafting a letter to the NSPM and a clerk would spend 0.5 preparing the letter for mailing. Assuming the following:

(1) That additional tasks (beyond those originally qualified) will be requested of 25% of all new FSDs and

(2) That 70 new FSDs will enter service each year.

(b) For each additional task (beyond those originally qualified) that requires qualification test guide modification, the FSD technician would spend 2.5 hours in developing an appropriate change, a clerk would spend 0.5 hours preparing the proposed change, the Management Representative or a pilot instructor would spend 0.5 hours drafting a letter to the NSPM, and a clerk would spend 0.5 hours preparing the letter for mailing. Assuming the following:

(1) That 2 additional tasks (beyond those originally qualified) will be requested on 5% of new FSDs;

(2) That 1 additional task will be requested on 20% of new FSDs and;

(3) That 70 new FSDs will enter service each year—

This yields 32 hours and $1,044.70×20%=14 FSDs with additional tasks; this yields 51 hours and $1,824.

Section 60.19, Inspection, Maintenance, and Recurrent Evaluation Requirements, requires sponsors to conduct inspections of each FSD each calendar quarter, with each such inspection addressing approximately one-fourth of the performance demonstrations and one-fourth of the objective tests required in the appropriate Qualification Performance Standard document. This inspection, conducted automatically, on modern FSDs would take an FSD technician 2 hours; and on older FSDs with more manually controlled functions, this inspection would take an FSD technician 6 hours to complete. Approximately 60% of the current 500 FSD inventory are modern FSDs and 40% are older FSDs. This yields 7,200 hours and $208,800.

This section also requires that a functional preflight check be completed prior to use each day and at least once each week when not regularly used. This preflight check would take an FSD technician 0.5 hours to complete. While it is not possible to predict with any accuracy what the frequency of use might be for any given FSD, the following is offered for consideration: Assume the following:

(1) That 70% of the qualified FSDs are used an average of 4 days each week for 42 weeks of the year and are used not more than once each week for the remainder of the 10 weeks each year;

(2) That 30% of the qualified FSDs are used an average of 6 days each week for 26 weeks, 3 days each week for 13 weeks, and not more than once each week for the remainder of the 13 weeks each year.

This yields 30,960 hours and $897,840.

This Sub-Section also requires that when a discrepancy is discovered at any time, the discrepancy and the corrective action taken must remain in the discrepancy log for at least 30 days after the discrepancy has been corrected. While it is not possible to predict accurately the frequency with which discrepancies might occur and the amount of time required to repair any given discrepancy would be directly dependent on the nature of that discrepancy, the following is offered for consideration: Assume the following:

(1) That there are an average of 2 discrepancies each week on each qualified FSD, for an average of 104 discrepancies each year on each qualified FSD;

(2) That 80% of these discrepancies is a minor discrepancy and will take an FSD technician an average of one hour to repair;

(3) That 15% of these discrepancies is moderate and will take an FSD technician an average of 4 hours to repair; and

(4) That 5% of these discrepancies is major and will take an FSD technician an average of 24 hours to repair.

It will take an FSD technician 0.25 hours to record each correction in the discrepancy log. This yields a total of 148,000 hours and $4,292,000.

This section also requires that each FSD be recurrently evaluated by the NSPM not less than once each year. This evaluation will require the time of a sponsor FSD technician and a sponsor pilot instructor. Each evaluation will require approximately 4 hours of time from both participants (time spent in the FSD) and approximately 2 additional hours of time from the sponsor's FSD technician. The FAA estimates that of the 500 FSDs currently qualified, approximately 30% are sponsored by 10% of the sponsors (large sponsor) and 70% are sponsored by 90% of the sponsors (small sponsor).

This yields a sub-total of 10 hours and $518 per FSD for each of the 30% of 500 FSDs, or a total of 10×150=1,500 hours and $518×150=$77,700.

For 90% of the sponsors (*i.e.*, small sponsors) representing 70% of the qualified FSDs: This yields a sub-total of 10 hours and $290 per FSD for each of the 70% of 500 FSDs, or a total of 10×350=3,500 hours and $290×350=$101,500. The total of the above is 5,000 hours and $179,200.

This section also requires the sponsor to contact the NSPM to schedule the FSD for the recurrent evaluation. This contact and schedule will require a clerk for the sponsor to write, fax, or e-mail the NSPM and will take 0.5 hours to gather the necessary data, complete

the contact, and arrange for the recurrent evaluation. A clerk for the NSPM will take 0.5 hours to complete the compatible schedule. With 500 FSDs this yields 0.5 hours × 500=250 hours and $ $7.50×500=$3,750.

Section 60.20, Logging FSD Discrepancies, requires that when a discrepancy is discovered at any time, the discrepancy must be written into the discrepancy log. While it is not possible to predict accurately the frequency with which discrepancies might occur, the following is offered for consideration: Assume the following:

(1) That there are an average of 2 discrepancies each week on each qualified FSD, for an average of 104 discrepancies each year on each qualified FSD.

(2) That 80% of these discrepancies are recognized by a pilot instructor and

(3) That 20% of these discrepancies are recognized by an FSD technician.

The entry of the discrepancy into the log would take 0.05 hour per entry.

The FAA estimates that of the 500 FSDs currently qualified, approximately 30% are sponsored by 10% of the sponsors (large sponsor) and 70% are sponsored by 90% of the sponsors (small sponsor). Together, this yields a total of 2600 hours and $119,860.

Section 60.23, Modifications to FSDs, describes what must be done in order to modify a qualified FSD. While it is not possible to predict accurately the frequency with which modifications might occur and the amount of time required to make any given modification would be directly dependent on the nature of that modification, the following is offered for consideration: Assume the following:

(1) There is an average of three modifications per year to 40% of the currently qualified FSDs;

(2) Two of these three modifications are minor in nature requiring review by, but not requiring written approval from, the NSPM;

(3) One of these modifications is major and requires both review and written approval from the NSPM; and

(4) One-quarter of the major modifications require NSPM on-site evaluation prior to returning the FSD to service.

The sponsor's FSD technician would take 2 hours to research and develop each required modification, followed by 0.5 hours to draft the notification the NSPM/TPAA. It would take a clerk 0.5 hours to prepare the notification for mailing. After the appropriate time or after receiving approval, it would take an FSD technician an average of 2 hours to complete each minor modification, and it would take the technician an average of 16 hours to complete each major modification.

This yields a total of 5,900 hours and $165,400.

Section 60.25, Operation with Missing, Malfunctioning, or Inoperative Components, requires that each missing, malfunctioning, or inoperative component in an FSD be placarded. While it is not possible to predict accurately the frequency with which components might become missing, might malfunction, or might not operate correctly, the following is offered for consideration: Assume the following:

(1) That an average of 2 components become missing, malfunctioning, or inoperative on each FSD each month;

(2) That it will take an FSD technician an average of 0.05 hours to placard each such component.

This yields a total of 50 hours and $1,450.

Section 60.31, Recordkeeping and Reporting, requires the sponsor to keep a record of each certificate holder using the FSD and to provide the NSPM with a copy of this record semiannually. This would take the Management Representative an average of 1.0 hour each six months (2.0 hours annually) to record this list and it would take a clerk an average of 0.5 hours to prepare this list for mailing. This yields a total of 132 hours and $5,334.

The agency is soliciting comments to—

(1) Evaluate whether the proposed information requirement is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;

(2) Evaluate the accuracy of the agency's estimate of the burden;

(3) Enhance the quality, utility, and clarity of the information to be collected; and

(4) Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology.

Individuals and organizations may submit comments on the information collection requirement by November 25, 2002, and should direct them to the address listed in the **ADDRESSES** section of this document.

According to the regulations implementing the Paperwork Reduction Act of 1995, (5 CFR 1320.8(b)(2)(vi)), an agency may not conduct or sponsor, a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control number for this information collection will be published in the **Federal Register**, after the Office of Management and Budget approves it.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified no differences with these proposed regulations.

Regulatory Evaluation Summary

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs each Federal agency proposing or adopting a regulation to first make a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this act requires agencies to consider international standards, and use them where appropriate as the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 requires agencies to prepare a written assessment of the costs and benefits and other effects of proposed and final rules. An assessment must be prepared only for rules that impose a Federal mandate on State, local or tribal governments, or on the private sector, likely to result in a total expenditure of $100 million or more in any one year (adjusted for inflation.)

In conducting these analyses, the FAA has determined:

(1) This rule has benefits that justify its costs. This rulemaking does not impose costs sufficient to be considered ''significant'' under the economic standards for significance under Executive Order 12866 or under DOT's Regulatory Policies and Procedures. Due to public interest, however, it is considered significant under the Executive Order and DOT policy.

(2) This rule will not have a significant impact on a substantial number of small entities.

(3) This rule has no affect on any trade-sensitive activity.

(4) This rule does not impose an unfunded mandate on state, local, or

tribal governments, or on the private sector.

The FAA has placed these analyses in the docket and summarized them below.

The proposed rule for a new part 60 would contain the requirements for the evaluation, qualification, inspection, and maintenance of Flight Simulator Devices (FSDs) used for training, evaluating, or obtaining flight experience for flight crewmember certification or qualification. The proposed requirements are based on requirements in appendix H of part 121 and in the current § 121.407 as well as advisory circulars.

The estimated 10-year cost of this proposed rule would be approximately $1.9 million ($1.6 million, discounted) due to the development, review, and approval of a Quality Assurance (QA) program. The majority of the cost impact, estimated at approximately $1.3 million ($1.1 million, discounted) over a 10-year period, would be imposed on the industry. The FAA 10-year cost is estimated at approximately $571,000 ($413,000, discounted).

Based on safety considerations, the proposed rule would also eliminate the use of Level A simulators to meet flight crewmember training, evaluation, or flight experience for purposes of certification or qualification. The Level A simulator is the least sophisticated of today's simulator levels and the requirements for data applicable to simulators of this vintage are very elementary and relatively primitive when compared to today's standards for simulators. The FAA believes that all sponsors, as a result of this proposed rule, would either retire their Level A simulators or downgrade them to Level 6 Flight Training Devices at a minimal cost to the industry. The FAA believes that to upgrade to a Level B simulator would be an alternative the industry would reject because the costs ($350,000–$500,000 per simulator) to do so could not be recovered. The FAA has requested comments from the industry regarding this matter.

There are five types of safety and economic benefits of incorporating a QA program for each FSD sponsor. First, aviation safety would be better maintained because a QA program would identify, for the user and the FAA, flightcrew training problems that could or would arise due to problems with the maintenance and operation of the FSD. Second, when training is interrupted due to maintenance problems, those problems would be quickly and accurately corrected to allow the training process to resume. Third, sponsors would see cost savings due to a reduction of mistakes . Fourth, sponsors could see cost savings by having to support less frequent evaluations by NSP staff. And fifth, the FAA (and the tax payers) would realize cost savings by requiring less frequent on-site FSD evaluations; by not requiring commensurate growth of FAA personnel committed to individual evaluations of an ever-expanding fleet of FSDs; and by providing the ability to focus a more constant personnel resource on safety areas more deserving of individualized scrutiny.

Lastly, the proposed new part 60 would consolidate and update the existing FSD qualification requirements. Currently, regulations regarding advanced simulators are located in appendix H. Those who operate airplanes under other parts of the regulations and wish to use appendix H authorizations have to obtain exemptions from the certificate holding requirements of part 121 and have the appropriate simulator authorizations incorporated into their exemptions or would have to obtain a part 142 certificate. The proposed new part 60 would establish FSD requirements that could be used by any certificate holder as defined under part 60 who conducts training and evaluation, or intends to meet recent flight experience requirements. Its application, therefore, would be expanded beyond just those who operate under part 121.

Initial Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation.'' To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide-range of small entities, including small businesses, not-for-profit organizations and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination is that it will, the agency must prepare a regulatory flexibility analysis as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 act provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The adoption of this proposal would impose an estimated 10-year cost of approximately $114,000 ($98,000, discounted) on approximately six small entities. Each of these sponsors would incur a one-time cost of approximately $13,000 to develop a QA program and an annual cost of approximately $600 to maintain the program. To determine the impact of the cost on these small entities, the FAA examined the relation of a small entity's annualized cost to its potential annual revenue. The FAA estimated that each flight simulation device, on average, is in use for training about 4,800 hours a year. Also, according to industry sources, most sponsors charge a minimum of $250 an hour for training in a Level B simulator. As a result, a sponsor's potential annual revenue from one Level B simulator is estimated at $1.2 million. Therefore, the annualized cost of this proposed rule for each small entity, approximately $2,300, would be considerably less than one percent of the estimated potential annual revenue ($1.2 million) for a small entity with only one Level B simulator. The FAA contends that these small entities would not be significantly impacted by the cost of this proposed rule.

Accordingly, pursuant to the Regulatory Flexibility Act, 5 U.S.C. 605(b), the Federal Aviation Administration certifies that this rule would not have a significant economic impact on a substantial number of small entities. The FAA solicits comments from affected entities with respect to this finding and determination and requests that all comments be accompanied by clear documentation.

International Trade Impact Assessment

The Trade Agreement Act of 1979 prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and where appropriate, that they be the basis for U.S. standards.

In accordance with the above statute, the FAA has assessed the potential effect of this proposed rule and has determined that it would have only a domestic impact and therefore create no

obstacles to the foreign commerce of the United States.

Unfunded Mandates Assessment

The Unfunded Mandates Reform Act of 1995 (the Act), enacted as Public Law 104–4 on March 22, 1995, is intended, among other things, to curb the practice of imposing unfunded Federal mandates on State, local, and tribal governments.

Title II of the Act requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in a $100 million or more expenditure (adjusted annually for inflation) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.''

This proposed rule does not contain such a mandate. Therefore, the requirements of Title II of the Unfunded Mandates Reform Act of 1995 do not apply.

Executive Order 13132, Federalism

The FAA has analyzed this proposed rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action would not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, we determined that this notice of proposed rulemaking would not have federalism implications.

Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental impact statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this proposed rulemaking action qualifies for a categorical exclusion.

Energy Impact

The energy impact of this notice of proposed rulemaking has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) Public Law 94–163, as amended (42 U.S.C. 6362) and FAA Order 1053.1. It has been determined that this notice of proposed rulemaking is not a major regulatory action under the provisions of the EPCA.

List of Subjects

14 CFR Part 1

Air transportation.

14 CFR Part 60

Airmen, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 61

Aircraft, Airmen, Recreation and recreation areas, Reporting and recordkeeping requirements, Teachers.

14 CFR Part 63

Aircraft, Airmen, Navigation (air), Reporting and recordkeeping requirements.

14 CFR Part 141

Airmen, Educational facilities, Reporting and recordkeeping requirements, Schools.

14 CFR Part 142

Administrative practice and procedure, Airmen, Educational facilities, Reporting and recordkeeping requirements, Schools, Teachers.

The Proposed Amendment

The Federal Aviation Administration proposes to amend parts 1, 11, 61, 63, 141 and 142 and to add part 60 to 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 device (FSD) means a flight simulator or a flight training device.

Flight simulator means a full size replica of a specific type or make, model, and series aircraft cockpit. It includes the assemblage of equipment and computer programs necessary to represent the aircraft in ground and flight operations, 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 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 standards (QPS) for a specific qualification level.

* * * * *

Flight training device (FTD) means a full size 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 the aircraft or set of aircraft 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 part and the qualification performance standard (QPS) for a specific qualification level.

* * * * *

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

§ 1.2 Abbreviations and symbols.

* * * * *

FSD means flight simulation device.

FTD means flight training device.

* * * * *

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

PART 60—FLIGHT SIMULATION 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 (FSD) 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 FSD to meet any requirement of this chapter.

(c) The requirements of § 60.31 regarding falsification of applications, records, or reports also apply to each person who uses an FSD 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 FSD, also apply to any person who uses or causes the use of an FSD when—

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

(2) The use of the FSD 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 credits use of the FSD 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 FSD and merely represented to the purchaser or lessee that the FSD 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 FSD;

(3) The person does not falsely make representations that someone else is the FAA-approved sponsor of the FSD at a time when that other person is not the FAA-approved sponsor of the FSD; 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 FSD is FAA-approved and qualified under this part at the time the FSD 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 FSD, the qualification activities (objective and subjective tests, inspections, recurrent evaluation, etc.) associated with the requirements of this part.

Flight experience. For purposes of this part, *flight experience* means recency of flight experience for landing credit purposes.

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

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

Master Qualification Test Guide (MQTG). The FAA-approved Qualification Test Guide with the addition of the FAA-witnessed test, performance, or demonstration results, applicable to each individual FSD.

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 comparison of simulator performance data to actual or predicted aircraft performance data to ensure that FSD performance is within the tolerances prescribed in the QPS.

Predicted data. Aircraft performance data derived from sources other than direct physical measurement of, or flight tests on, the subject aircraft. Predicted data may include engineering analysis and simulation, design data, wind tunnel data, estimations or extrapolations based on existing flight test data, or data from other models.

Qualification level. The categorization of the FSD, based on its demonstrated technical and operational capability as set out in the QPS.

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 FSD requirements, for establishing FSD qualification levels. The QPS are set forth in the following appendices: Appendix A, for Airplane Simulators; Appendix C, for Helicopter Simulators; Appendix B, for Airplane Flight Training Devices; and Appendix D, for Helicopter Flight Training Devices.

Qualification Test Guide (QTG). The primary reference document used for evaluating an aircraft FSD. It contains test results, performance or demonstration results, statements of compliance and capability, the configuration of the aircraft simulated, and other information for the evaluator to assess the FSD against the applicable regulatory criteria.

Set of aircraft. Aircraft that share similar handling and operating characteristics and 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 FSD qualification and is responsible for the prescribed actions as set out in this part and the QPS for the appropriate FSD and qualification level.

Subjective test. A qualitative comparison to determine the extent to which the FSD performs and handles like the aircraft being simulated.

Training Program Approval Authority (TPAA). A person authorized by the Administrator to approve the aircraft flight training program in which the FSD will be used.

Upgrade. The improvement or enhancement of an FSD 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.

§ 60.5 Quality assurance program.

(a) After [date 6 months after effective date of the final rule], no sponsor may use or allow the use of or offer the use of an FSD 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 assurance (QA) program, approved by the NSPM, for the continuing surveillance and analysis of the sponsor's performance and effectiveness in providing a satisfactory FSD for use on a regular basis as described in the appropriate QPS.

(b) The QA 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 QA 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.

(d) Each sponsor of an FSD must identify to the NSPM and to the TPAA, by name, one individual, who is an employee of the sponsor, to be the management representative (MR) and the primary contact point for all matters between the sponsor and the FAA regarding the qualification of that FSD as provided for in this part.

§ 60.7 Sponsor qualification requirements.

(a) A person is eligible to apply to be a sponsor of an FSD 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 FSD 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 through the TPAA.

(b) A person is a sponsor of the FSD 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 operations specifications authorizing the use of the aircraft type or set of aircraft being simulated by the FSD or has training specifications or a course of training authorizing the use of an FSD for that aircraft type or set of aircraft.

(3) The person has an approved quality assurance program in accordance with § 60.5.

(4) The NSPM has approved the person as the sponsor of the FSD and that approval has not been withdrawn by the FAA.

(c) A person continues to be a sponsor of an FSD, if the following conditions are met:

(1) Beginning 12 calendar months after the initial qualification of the FSD and every 12 calendar months thereafter, the FSD must have been used within the sponsor's FAA-approved flight training program for the aircraft type or set of aircraft for a minimum of 600 hours.

(2) The use of the FSD described in paragraph (c)(1) of this section must be dedicated to meeting the requirements of parts 61, 63, 91, 121, or 135 of this chapter.

(3) If the use requirements of paragraphs (c)(1) and (2) of this section are not met, the person will continue to sponsor the FSD on a provisional basis for an additional period not longer than 12 calendar months; and—

(i) If the FSD is used as described in paragraphs (c)(1) and (2) of this section within this additional 12 calendar month period, the provisional status will be removed and regular sponsorship resumed; or

(ii) If the FSD is not used as described in paragraphs (c)(1) and (2) of this section within the additional 12 calendar month period, the FSD is not qualified and the sponsor will not be eligible to apply to sponsor that FSD for at least 12 calendar months.

§ 60.9 Additional responsibilities of the sponsor.

(a) The sponsor must allow the NSPM upon request to inspect immediately the FSD, including all records and documents relating to the FSD, to determine its compliance with this part. If the sponsor fails to allow the NSPM to inspect the FSD, and all records and documents relating to the FSD, the sponsor may not allow the FSD to be used for flightcrew member training or evaluation or for obtaining flight experience to meet any of the requirements under this chapter.

(b) The sponsor must, for each FSD—

(1) Establish a mechanism for the following persons to provide comments regarding the FSD and its operation and provide for receipt of those comments:

(i) Flightcrew members recently completing training or evaluation or recently obtaining flight experience in the FSD;

(ii) Instructors and check airmen using the FSD for training, evaluation, or flight experience sessions; and

(iii) Simulator technicians and maintenance personnel performing work on the FSD.

(2) Examine each comment received under paragraph (b)(1) of this section for content and importance and take appropriate action.

(3) Maintain a liaison with the manufacturer of the aircraft, or the holder of the aircraft type certificate for the aircraft if the manufacturer is out of business, being simulated by the FSD to facilitate compliance with § 60.13(f) when necessary.

(4) Post in or adjacent to the FSD the Statement of Qualification issued by the NSPM.

§ 60.11 FSD use.

No person may use or allow the use of or offer the use of an FSD 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 FSD—

(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 FSD 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 that is required to be posted pursuant to § 60.9(b)(4)—

(1) For the make, model, and series of aircraft or set of aircraft; and

(2) For all tasks and configurations.

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

(d) Functions during the training, evaluation, or flight experience with the same software and active programming that was evaluated by the NSPM.

§ 60.13 FSD objective data requirements.

(a) Except as provided in paragraphs (b) and (c) of this section, for the purposes of validating FSD performance and handling qualities during evaluation for qualification, the sponsor must submit to the NSPM the aircraft manufacturer's flight test data including all 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 sponsor may submit flight test data from a source in addition to or independent of the aircraft manufacturer's data to the NSPM in support of an FSD 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 sponsor may submit predicted data, data from pilot owner or pilot operating manuals, or data from public domain sources acceptable to the NSPM for consideration, approval and possible use in particular applications for FSD 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 flight testing to support certain FSD qualification requirements.

(f) When an FSD sponsor learns, or is advised by an aircraft manufacturer or supplemental type certificate (STC) holder, that an addition to, an amendment to, or a revision of the data used to program and operate an FSD used in the sponsor's training program is available, the sponsor must immediately notify the NSPM.

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

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

§ 60.15 Initial qualification requirements.

(a) For each FSD, the sponsor must submit a request through the TPAA to have the NSPM evaluate the FSD for initial qualification at a specific level. The request must be submitted in the form and manner described in the appropriate QPS.

(b) The request must include all of the following:

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

(2) A statement that the sponsor has established a procedure to verify that the configuration of hardware and software present during the evaluation for initial qualification will be maintained, except where modified as authorized in § 60.23. The statement must include a description of the procedure.

(3) A statement signed by at least one pilot who meets the requirements of paragraph (c) of this section asserting that each pilot so approved has determined that the following requirements have been met:

(i) The FSD systems and sub-systems function equivalently to those in the aircraft or set of aircraft.

(ii) The performance and flying qualities of the FSD are equivalent to those of the aircraft or set of aircraft.

(iii) For type specific FSD's, the cockpit configuration conforms to the configuration of the aircraft make, model, and series being simulated.

(4) A list of all of the operations tasks or simulator systems in the subjective test appendix of the appropriate QPS for which the FSD has not been subjectively tested (*e.g.*, circling approaches, windshear training, etc.) and for which qualification is not sought.

(5) A qualification test guide (QTG) 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 FSD as prescribed in the appropriate QPS.

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

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

(c) Except for those FSD's previously qualified and described in § 60.17, each FSD 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 FSD 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 FSD has been ordered;

(ii) 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 FSD; the anticipated qualification level of the FSD; the make, model, and series of aircraft simulated; and any other pertinent information.

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

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

(d) The pilot or pilots who make the statement required by paragraph (b)(3) of this section must—

(1) Be designated by the sponsor;

(2) Be approved by the TPAA; and

(3) Be qualified in—

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

(ii) For aircraft types not yet issued a type certificate, an aircraft type similar in size and configuration.

(e) The subjective tests that form the basis for the statements described in paragraph (b)(3) of this section and the objective tests referenced in paragraph (b)(5) 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 FSD must provide the NSPM access to the FSD for the length of time necessary for the NSPM to complete the required evaluation of the FSD for initial qualification, which includes the conduct and evaluation of objective and subjective tests, including general FSD requirements, as described in the appropriate QPS, to determine that the FSD meets the standards in that QPS.

(g) When the FSD 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 of set or aircraft being simulated (*e.g.*, engine model or models, flight instruments, navigation or other systems, etc.).

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

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

(6) A list of all of the operations tasks or simulator systems in the subjective test appendix of the appropriate QPS for which the FSD has not been subjectively

tested and for which the FSD is not qualified (*e.g.*, circling approaches, windshear training, etc.).

(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 FAA upon request.

§ 60.16 Additional qualifications for a currently qualified FSD.

(a) A currently qualified FSD is required to undergo an additional qualification process if a user intends to use the FSD for meeting training, evaluation, or flight experience requirements of this chapter beyond the qualification issued to the sponsor. 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 FSD that are required to support the additional qualification.

(iii) Must submit a statement to the NSPM that a pilot, designated by the sponsor in accordance with § 60.15(c) and approved by the TPAA for the user, has subjectively evaluated the FSD in those areas not previously evaluated.

(2) The FSD must successfully pass an evaluation—

(i) For initial qualification, in accordance with § 60.15, 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 (*e.g.*, objective tests, performance demonstrations, 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 FSD, any modifications to the FSD hardware or software that are involved, and any additions or modifications to the MQTG.

(c) The FSD is qualified for the additional uses when the NSPM issues an amended Statement of Qualification in accordance with § 60.15(f).

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

§ 60.17 Previously qualified FSD's.

(a) Unless otherwise specified by an FSD Directive, further referenced in the appropriate QPS, or as specified in paragraph (e) of this section, an FSD qualified before [effective date of final rule] will retain its qualification basis as long as it continues to meet the standards, including the performance demonstrations and the objective test results recorded in the MQTG, under which it was originally evaluated, regardless of sponsor. The sponsor of such an FSD must comply with the other applicable provisions of this part.

(b) For each FSD qualified before [effective date of the final rule], no sponsor may use or allow the use of or offer the use of such an FSD after [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 FSD 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 FSD qualification is lost under § 60.27 and not restored under § 60.27 for two (2) years or more, the qualification basis (in terms of objective tests and performance demonstrations) 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 FSD qualification level initiated on or after [the effective date of this rule] requires an evaluation for initial qualification in accordance with this part.

(e) A sponsor may request that an FSD be downgraded. In such a case, the NSPM may downgrade a qualified FSD without requiring and without conducting an initial evaluation for the new qualification level. Subsequent recurrent 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 FSD. The updated test(s) and tolerance(s) must be made a permanent part of the MQTG.

§ 60.19 Inspection, recurrent evaluation, and maintenance requirements.

(a) *Inspection.* No sponsor may use or allow the use of or offer the use of an FSD 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 1 performance demonstrations and all appropriate QPS Attachment 2 objective tests each year. To do this, the sponsor must conduct a minimum of four evenly spaced inspections throughout the year, as approved by the NSPM. The performance demonstrations and objective test sequence and content of each inspection in this sequence will be developed by the sponsor and submitted to the NSPM for approval. In deciding whether to approve the test sequence and the content of each inspection, the NSPM looks for a balance and a mix from the performance demonstrations and objective test requirement areas listed as follows:

(i) Performance.

(ii) Handling qualities.

(iii) Motion system (where appropriate).

(iv) Visual system (where appropriate).

(v) Sound system (where appropriate).

(vi) Other FSD systems.

(2) Completes a functional preflight check in accordance with the appropriate QPS each calendar day prior to the start of the first FSD period of use that begins in that calendar day.

(3) Completes at least one functional preflight check in accordance with the appropriate QPS in every 7 consecutive calendar days.

(4) Maintains a discrepancy log.

(5) 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 30 days after the discrepancy is corrected as specified in § 60.25(b).

(ii) A description of the corrective action taken for each discrepancy and the date that action is taken must be entered in the log. This entry concerning the corrective action is maintained for at least 30 days.

(iii) The discrepancy log is kept in a form and manner acceptable to the Administrator and is kept in or immediately adjacent to the FSD.

(b) *Recurrent evaluation.* (1) This evaluation consists of performance demonstrations, objective tests, and subjective tests, including general FSD requirements, as described in the appropriate QPS or as may be amended by an FSD Directive.

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

(3) The sponsor must provide the NSPM access to the objective test results

and FSD performance demonstration results in the MQTG, and access to the FSD for the length of time necessary for the NSPM to complete the required recurrent evaluations, weekdays between 6 o'clock AM (local time) and 6 o'clock PM (local time).

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

(5) Recurrent evaluations conducted in the calendar month before or after the calendar month in which these recurrent 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 FSD for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet any requirement of this chapter unless the FSD has passed an NSPM-conducted recurrent evaluation within the timeframe specified in the MQTG.

(c) *Maintenance.* The sponsor is responsible for continuing corrective and preventive maintenance on the FSD to ensure that it continues to meet the requirements of § 60.15(b).

§ 60.20 Logging FSD discrepancies.

Each instructor, check airman, or representative of the Administrator conducting training or evaluation, or observing flight experience for flightcrew member certification or qualification, and each person conducting the preflight inspection (§ 60.19(a)(2), (3), and (4)), who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the FSD, must write or cause to be written a description of that discrepancy into the discrepancy log at the end of the FSD preflight or FSD use session.

§ 60.21 Interim qualification of FSD's for new aircraft types or models.

(a) A sponsor may apply for and the NSPM may issue an interim qualification level for an FSD for a new type or model of aircraft, even though the flight test data used has not received final approval by the aircraft manufacturer, if the sponsor provides the following to the satisfaction of the NSPM—

(1) The aircraft manufacturer's 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 FSD that has been issued interim qualification will be deemed to have been issued initial qualification unless the NSPM rescinds the qualification. Interim qualification terminates one year after its issuance, unless the NSPM determines that specific conditions warrant otherwise.

(c) Within six months of the release of the final flight test data package by the aircraft manufacturer but no later than one year after the issuance of the interim qualification status the sponsor must apply for initial qualification in accordance with § 60.15 based on the final flight test data package approved by the aircraft manufacturer, unless the NSPM determines that specific conditions warrant otherwise.

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

§ 60.23 Modifications to FSD's.

(a) When the sponsor or the FAA determines that any of the following circumstances exist and the FAA determines that the FSD cannot be used adequately to train, evaluate, or provide flight experience for flightcrew members, the sponsor must modify the FSD accordingly.

(1) The aircraft manufacturer or another approved source develops new data regarding the performance, functions, or other characteristics of the aircraft being simulated;

(2) A change in aircraft performance, functions, or other characteristics occurs;

(3) A change in operational procedures or requirements occurs; or

(4) Other circumstances as determined by the NSPM.

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

(c) Before modifying a qualified FSD, the sponsor must notify the NSPM and the TPAA as follows:

(1) The notification must include a complete description of the planned modification, including a description of the operational and engineering effect the proposed modification will have on the operation of the FSD.

(2) The notification must be submitted in a form and manner as specified in the appropriate QPS.

(d) If the sponsor intends to add additional equipment or devices intended to simulate aircraft appliances; modify hardware or software that would affect flight or ground dynamics, including revising FSD programming or replacing or modifying the host computer; or if the sponsor is changing or modifying the motion, visual, or control loading systems (or sound system for FSD levels requiring sound tests and measurements), the following applies:

(1) The sponsor must meet the notification requirements of paragraph (c) of this section and must include in the notification the results of all objective tests that have been re-run with the modification incorporated, including any necessary updates to the MQTG.

(2) However, the sponsor may not use, or allow the use of, or offer the use of, the FSD 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 or until the sponsor receives written notification from the NSPM approving the proposed modification. Prior to approval, the NSPM may require that the modified FSD be evaluated in accordance with the standards for an evaluation for initial qualification or any part thereof before it is placed in service.

(e) The sponsor may not modify a qualified FSD until one of the following has occurred:

(1) For circumstances described in paragraph (b) or (d) of this section, the sponsor receives written approval from the NSPM that the modification is authorized.

(2) For circumstances other than those described in paragraph (b) or (d) of this section, either:

(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 the NSPM or TPAA; or

(ii) The NSPM or TPAA approves the proposed modification in fewer than 21 days since the sponsor notified the NSPM and the TPAA of the proposed modification.

(f) When a modification is made to an FSD, the sponsor must notify each certificate holder planning to use that FSD of that modification prior to that certificate holder using that FSD the first time after the modification is complete.

(g) The MQTG must be updated with current objective test results in accordance with § 60.15(b)(5) and appropriate flight test data in accordance with § 60.13, each time an FSD is modified and an objective test is affected by the modification. If this update is initiated by an FSD Directive, 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 use or allow the use of or offer the use of an FSD with a missing, malfunctioning, or inoperative component for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification during maneuvers, procedures, or tasks that require the use of the correctly operating component.

(b) Each missing, malfunctioning, or inoperative component must be repaired or replaced within 7 calendar days unless otherwise required or authorized by the NSPM. Failure to repair or replace this component within the prescribed time may result in loss of FSD qualification.

(c) Each missing, malfunctioning, or inoperative component must be placarded as such on or adjacent to that component or the control for that component in the FSD and a list of the currently missing, malfunctioning, or inoperative components must be readily available in or immediately adjacent to the FSD for review by users of the device.

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

(a) An FSD is not qualified if any of the following occurs:

(1) The FSD is not used in the sponsor's FAA-approved flight training program in accordance with § 60.9(b)(4).

(2) The FSD is not maintained and inspected in accordance with § 60.19.

(3) The FSD is physically moved from one location to another, regardless of distance.

(4) The FSD is disassembled (*e.g.*, for repair or modification) to such an extent that it cannot be used for training, evaluation, or experience activities.

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

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

(1) The FSD successfully passes an evaluation:

(i) For initial qualification, in accordance with § 60.15 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 approved as necessary by the NSPM.

(2) The NSPM or the TPAA 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 inspections and recurrent evaluations missed, the amount of disassembly and re-assembly of the FSD that was accomplished, 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 or the TPAA notifies the sponsor that the FSD no longer meets qualification standards, the following procedure applies:

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

(2) The NSPM or the TPAA sets a reasonable period (but not less than 7 days) within which the sponsor may submit written information, views, and arguments on the FSD qualification.

(3) After considering all material presented, the NSPM or the TPAA notifies the sponsor about the NSPM's or TPAA's determination with regard to the qualification of the FSD.

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

(i) The NSPM or the TPAA find under paragraph (c) of this section that there is an emergency requiring immediate action with respect to safety in air transportation or air commerce; or

(ii) The sponsor petitions the Director of Flight Standards Service for reconsideration of the NSPM or the TPAA finding under paragraph (b) of this section.

(b) When a sponsor seeks reconsideration of a decision from the NSPM or the TPAA concerning the FSD 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 FSD 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 or the TPAA that the FSD is no longer qualified unless the NSPM or the TPAA has found, under paragraph (c) of this section, that an emergency exists requiring immediate action with respect to safety in air transportation or air commerce.

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

(1) The NSPM or the TPAA withdraws qualification of some or all of the FSD 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 or the TPAA 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.

§ 60.31 Recordkeeping and reporting.

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

(1) The MQTG and each amendment thereto.

(2) A copy of the programming used during the evaluation of the FSD for initial qualification and for any subsequent upgrade qualification, and a copy of all programming changes made since the evaluation for initial qualification.

(3) A copy of all of the following:

(i) Results of the evaluations for the initial and each upgrade qualification.

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

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

(iv) Comments obtained in accordance with § 60.9(b)(1) for a period of at least 18 months.

(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.

(5) A record of all modifications to FSD hardware configurations made since initial qualification.

(b) The FSD sponsor must keep a current record of each certificate holder

using the FSD. The sponsor must provide a copy of this list to the NSPM at least semiannually.

(c) 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.

(d) The sponsor must submit an annual report, in the form of a comprehensive statement signed by the management representative, certifying that the FSD continues to perform and handle as qualified by 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 or the QPS.

(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 the QPS, 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 or the QPS.

(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 FSD qualification and approval for use in a training program.

(c) The following may serve as a basis for removal of qualification of an FSD including the withdrawal of authorization for use of an FSD; 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 FSD qualification or an approval for use.

§ 60.35 Specific simulator compliance requirements.

(a) After [date 18 months from the effective date of this rule], no simulator will be eligible for initial or upgrade qualification under this part unless it simulates the operation of all equipment and appliances installed and operating on the aircraft being simulated, if such equipment or appliances have controls or indications that are located in the aircraft cockpit.

(b) After [date 2 years from the effective date of this rule], any flight simulator used for meeting flightcrew member training, evaluation, or flight experience requirements of this chapter for certification or qualification that cannot perform satisfactorily in the following areas will no longer be qualified as a simulator.

(1) Ground operations;

(2) The takeoff, climb, cruise, descent, and approach portions of the simulated aircraft's operating envelope, including abnormal and emergency operations; and

(3) The landing maneuver, including normal, abnormal, and emergency landings.

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

(a) The evaluation and qualification of an airplane simulator by a contracting State to the Convention on International Civil Aviation for the sponsor of an aircraft simulator located in that contracting State may be used as the basis for issuing a U.S. statement of qualification (see appropriate QPS, attachment 5, figure 4) by the NSPM to the sponsor of that simulator 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 Flight Simulators

Begin Information

This appendix establishes the standards for Airplane 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 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 flight simulator evaluations.

Table of Contents

1. Introduction

a. This appendix contains background information as well as information that is either directive or guiding in nature. Information considered directive is described in this appendix in terms such as ''will,'' ''shall,'' and ''must,'' and means that the actions are mandatory. Guidance information is described in terms such as ''should,'' or ''may,'' and indicate actions that are desirable, permissive, or not mandatory and provide for flexibility.

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 sections, separated by horizontal lines; headings associated with these horizontal lines will indicated that a particular section begins or ends. All of the text falls into one of three sections: a direct quote or a paraphrasing of the Part 60 rule language; additional requirements that are also regulatory but are found only in this appendix; and advisory or informative material.

(2) The text presented between horizontal lines beginning with the heading ''Begin Rule Language'' and ending with the heading ''End Rule Language,'' is a direct quote or is paraphrased from Part 60 of the regulations. For example: the rule uses the terms ''flight simulation device (FSD)'' and ''aircraft;'' however, in this appendix the rule is paraphrased and the term ''simulator'' is used instead of FSD, and ''airplane'' is used instead of aircraft. Additionally, the rule uses the terms ''this part'' and ''appropriate QPS;'' however, in this appendix the rule is paraphrased and the terms ''Part 60'' and ''this appendix,'' respectively, are used instead. (Definitions are not paraphrased or modified in any way.) For ease of referral, the Part 60 reference is noted at the beginning and end of the bordered area.

(3) The text presented between horizontal lines beginning with the heading ''Begin QPS Requirements'' and ending with the heading ''End QPS Requirements,'' is also regulatory but is found only in this appendix.

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

(5) 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.

Important Note: While this appendix contains quotes and paraphrasing directly from the rule, the reader is cautioned *not* to rely solely on this appendix for regulatory requirements regarding flight simulators. For regulatory references for airplane flight simulators, the reader is referred to paragraphs 3. a through i of this appendix.

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.

End Information

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2. Definitions

Begin Information

See Attachment 4 for a list of definitions and abbreviations. Attachment 4 contains definitions directly quoted from Part 1 or Part 60, presented between horizontal lines beginning with the heading ''Begin Rule Language'' and ending with the heading ''End Rule Language,'' and are a direct quote or are paraphrased from Part 1 or Part 60. These definitions are regulatory. Additional definitions and abbreviations used in reading and understanding this appendix are presented between horizontal lines beginning with the heading ''Begin QPS Requirements'' and ending with the heading ''End QPS Requirements.'' These definitions are also regulatory but are found only in this appendix. For purposes of accuracy, the definitions listed are directly quoted, and are not paraphrased.

End Information

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3. Related Reading References

Begin Information

a. 14 CFR part 60.
b. 14 CFR part 61.
c. 14 CFR part 63.
d. 14 CFR part 119.
e. 14 CFR part 121.
f. 14 CFR part 125.
g. 14 CFR part 135.
h. 14 CFR part 141.
i. 14 CFR part 142.
j. Advisory Circular (AC) 120–28C, Criteria for Approval of Category III Landing Weather Minima.
k. AC 120–29, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.
l. AC 120–35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.
m. AC 120–41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.
n. AC 120–57A, Surface Movement Guidance and Control System (SMGS).
o. AC 150/5300–13, Airport Design.
p. AC 150/5340–1G, Standards for Airport Markings.
q. AC 150/5340–4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.
r. AC 150/5340–19, Taxiway Centerline Lighting System.
s. AC 150/5340–24, Runway and Taxiway Edge Lighting System.
t. AC 150/5345–28D, Precision Approach Path Indicator (PAPI) Systems.
u. International Air Transport Association document, ''Flight Simulator Design and Performance Data Requirements,'' Fifth Edition (1996).
v. AC 25–7, Flight Test Guide for Certification of Transport Category Airplanes.
w. AC 23–8A, Flight Test Guide for Certification of Part 23 Airplanes.
x. International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, First Edition, 1994 Doc 9625–AN/938.
y. Airplane Flight Simulator Evaluation Handbook, Volume I (February, 1995) and Volume II (July, 1996), The Royal Aeronautical Society, London, UK.
z. FAA Publication FAA–S–8081 series (Practical Test Standards for Airline Transport Pilot Certificate, Type Ratings, Commercial Pilot, and Instrument Ratings).

End Information

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4. Background

Begin Information

a. 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 flight simulators as applicable under their respective country's rules, regulations, and/or policies. As a result, those who used airplane flight simulators 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 authority's 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 simulator evaluation criteria that was acceptable to all parties involved.

b. 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 flight

simulator 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.

c. As a primary participant in the development of the information forwarded to the ICAO by the RAeS, the FAA had planned to modify the criteria and standards used for simulator evaluation conducted under U.S. authority to match this set of internationally developed information. The requirements in this appendix match the ICAO requirements for the evaluation and qualification of the highest two levels of airplane simulators addressed herein: *i.e.*, the requirements for Level C and Level D simulators set out in this appendix match the requirements for ICAO simulators at Level I and Level II, respectively.

d. For information purposes, the following is a chronological listing of the documents preceding this appendix that have addressed the qualification criteria for airplane simulator 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)

End Information

5. Quality Assurance Program

Begin Rule Language (§ 60.5)

a. After [date 6 months after the effective date of the final rule], no sponsor may use or allow the use of or offer the use of a simulator for flightcrew member training or evaluation or for obtaining flight experience to meet any requirement of 14 CFR chapter I unless the sponsor has established and follows a quality assurance (QA) program, acceptable to the NSPM, for the continuing surveillance and analysis of the sponsor's performance and effectiveness in providing a satisfactory simulator for use on a regular basis as described in this QPS appendix.

b. The QA 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 QA program does not adequately address the procedures necessary to meet the requirements of 14 CFR part 60, the sponsor must, after notification by the NSPM, change the program so the procedures meet the requirements of part 60.

d. Each sponsor of a simulator must identify to the NSPM and to the TPAA, by name, one individual, who is an employee of the sponsor, to be the management representative (MR) and the primary contact point for all matters between the sponsor and the FAA regarding the qualification of that simulator as provided for in part 60.

End Rule Language (§ 60.5)

Begin QPS Requirements

e. 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 QA program for the recurring qualification of, and the day-to-day use of, each simulator.

f. An acceptable Quality Assurance (QA) Program must contain a complete, accurate, and clearly defined 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 QA Program as defined in this paragraph f.

(2) The method(s) used by management to determine that the regulatory standards and the QA 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 simulator.

(4) The criteria for and a definition or description of the workmanship expected for normal upkeep, repair, parts replacement, modification, *etc.*, on the simulator and how, when, and by whom such workmanship is determined to be satisfactorily accomplished.

(5) The method used to maintain and control appropriate technical and reference documents, appropriate training records, and other documents for—

(a) continuing simulator qualification; and

(b) the QA program.

(6) The criteria the sponsor uses (*e.g.*, training, experience, *etc.*) to determine who may be assigned to duties of inspection, testing, and maintenance (preventive and corrective) on simulators.

(7) The method used to track inspection, testing, and maintenance (preventive and corrective) on each simulator.

(8) The method used by the sponsor to inform the TPAA in advance of each scheduled NSPM-conducted evaluation and after the completion, the results of each such evaluation.

(9) The method used to ensure that instructors, check airmen, and those who conduct the daily preflight, are capable of determining what circumstance(s) constitute(s) a discrepancy regarding the simulator and its operation.

(10) The method used to ensure that instructors, check airmen, and those who conduct the daily preflight, record in the simulator discrepancy log each simulator discrepancy and each missing, malfunctioning, or inoperative simulator component.

(11) The method used to ensure that instructors and check airmen are completely and accurately logging the number of disruptions and time not available for training, testing, checking, or for obtaining flight experience during a scheduled simulator use-period, including the cause(s) of the disruption.

(12) The method used by the sponsor to notify users of the simulator of missing, malfunctioning, or inoperative components that restrict the use of the simulator.

(13) The method of recording NSPM-conducted evaluations and other inspections (*e.g.*, daily preflight inspections, NASIP inspections, sponsor conducted quarterly inspections, *etc.*), including the evaluation or inspection date, test results, discrepancies and recommendations, and all corrective actions taken.

(14) The method for ensuring that the simulator is configured the way the airplane it represents is configured and that if the configuration is authorized to be changed that the newly configured system(s) function(s) correctly.

(15) The method(s) for:

(a) Determining whether or not proposed modifications of the airplane will affect the performance, handling, or other functions or characteristics of the airplane; and

(b) Determining whether or not proposed modifications of the simulator will affect the performance, handling, or other functions or characteristics of the simulator; and

(c) Coordinating and communicating items 5. f. (15)(a) and (b) of this appendix, as appropriate, with the sponsor's training organization, other users (*e.g.*, lease or service contract users), the TPAA, and the NSPM.

(16) How information found in the discrepancy log is used to correct discrepancies and how this information is used to review and, if necessary, modify existing procedures for simulator maintenance.

(17) The method for how and when software or hardware modifications are accomplished and tracked, documenting all changes made from the initial submission.

(18) The method used for determining that the simulator meets appropriate standards each day that it is used.

(19) The method for acquiring independent feedback regarding simulator operation (from persons recently completing training, evaluation, or obtaining flight experience; instructors and check airmen using the simulator for training, evaluation or flight experience sessions; and simulator technicians and maintenance personnel) including a description of the process for addressing these comments.

(20) How devices used to test, measure, and monitor correct simulator 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.

(21) How, by whom, and how frequently internal audits of the QA 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

g. Additional Information.

(1) In addition to specifically designated QA evaluations, the NSPM will evaluate the sponsor's QA program as part of regularly scheduled recurrent simulator evaluations and no-notice simulator evaluations, focusing in part on the effectiveness and viability of the QA program and its contribution to the overall capability of the simulator to meeting the requirements of 14 CFR part 60.

(2) The sponsor, through the MR, may delegate duties associated with maintaining the qualification of the simulator (*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 simulator. One person may serve in this capacity for more than one simulator, but one simulator would not have more than one person serving in this capacity.

(3) Should a sponsor include a ''foreign simulator'' (*i.e.*, one maintained by a non-US certificate holder) under their sponsorship, the sponsor remains responsible for the QA program for that simulator. However, if that foreign simulator is maintained under a QA program accepted by that foreign regulatory authority and that authority and the NSPM have agreed to accept each other's QA programs (*e.g.*, the Joint Aviation Authorities, JAA, of Europe), the sponsor will be required only to perform an ''external audit'' of the non-US certificate holder's compliance with the accepted foreign QA program, with the results of that audit submitted to and accepted by the NSPM.

End Information

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6. Sponsor Qualification Requirements

Begin Rule Language (§ 60.7)

a. A person is eligible to apply to be a sponsor of a simulator if the following conditions are met:

(1) The person holds, or is an applicant for, a certificate under part 119, 141, or 142 of 14 CFR chapter I; or holds, or is an applicant for, an approved flight engineer course in accordance with part 63 of 14 CFR chapter I.

(2) The simulator will be used, or will be offered for use, in the sponsor's FAA-approved flight training program for the airplane being simulated as evidenced in a request for evaluation submitted to the NSPM through the TPAA.

b. A person is a sponsor of the simulator if the following conditions are met:

(1) The person is a certificate holder under part 119, 141, or 142 of 14 CFR chapter I or has an approved flight engineer course in accordance with part 63 of 14 CFR chapter I.

(2) The person has operations specifications authorizing the use of the airplane type being simulated by the simulator or has training specifications or a course of training authorizing the use of a simulator for that airplane type.

(3) The person has an approved quality assurance program in accordance with § 60.5.

(4) The NSPM has approved the person as the sponsor of the simulator and that approval has not been withdrawn by the FAA.

c. A person continues to be a sponsor of a simulator, if the following conditions are met:

(1) Beginning 12 calendar months after the initial qualification and every 12 calendar months thereafter, the simulator must have been used within the sponsor's FAA-approved flight training program for the airplane type for a minimum of 600 hours.

(2) The use of the simulator described in paragraph (c)(1) of this section must be dedicated to meeting the requirements of parts 61, 63, 91, 121, or 135 of 14 CFR chapter I.

(3) If the use requirements of paragraphs (c)(1) and (2) of this section are not met, the person will continue to sponsor the simulator on a provisional basis for a period not longer than 12 calendar months; and—

(a) If the simulator is used as described in paragraphs (c)(1) and (2) of this section within this additional 12 calendar month period, the provisional status will be removed and regular sponsorship resumed; or

(b) If the simulator is not used as described in paragraphs (c)(1) and (2) of this section within the additional 12 calendar month period, the simulator is not qualified and the sponsor will not be eligible to apply to sponsor that simulator for at least 12 calendar months.

End Rule Language (§ 60.7)

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7. Additional Responsibilities of the Sponsor

Begin Rule Language (§ 60.9)

a. The sponsor must not allow the simulator to be used for flightcrew member training or evaluation or for attaining flight experience for the flightcrew member to meet any of the requirements under 14 CFR chapter I unless the sponsor, upon request, allows the NSPM to inspect immediately the simulator, including all records and documents relating to the simulator, to determine its compliance with 14 CFR part 60.

b. The sponsor must, for each simulator—

(1) Establish a mechanism for the following persons to provide comments regarding the simulator and its operation and provide for receipt of those comments:

(a) Flightcrew members recently completing training or evaluation or recently obtaining flight experience in the simulator;

(b) Instructors and check airmen using the simulator for training, evaluation, or flight experience sessions; and

(c) Simulator technicians and maintenance personnel performing work on the simulator.

(2) Examine each comment received under paragraph (b)(1) of this section for content and importance and take appropriate action.

(3) Maintain a liaison with the manufacturer of the airplane being simulated by the simulator to facilitate compliance with § 60.13(f) when necessary.

(4) Post in or adjacent to the simulator the Statement of Qualification issued by the NSPM.

End Rule Language (§ 60.9)

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8. Simulator Use

Begin Rule Language (§ 60.11)

No person may use or allow the use of or offer the use of a simulator for meeting training, evaluation, or flight experience requirements of 14 CFR chapter I for flightcrew member certification or qualification unless, in accordance with the QPS for the specific device ''-a. It has a single sponsor who is qualified under § 60.9. The sponsor may arrange with another person for services of document preparation and presentation, as well as simulator 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 14 CFR part 60. b. It is qualified as described in the Statement of Qualification that is required to be posted pursuant to § 60.9(b)(4) —

(1) For the make, model, and series of airplane; and

(2) For all tasks and configurations. c. It remains qualified, through satisfactory inspection, recurrent evaluations, appropriate maintenance, and use requirements in accordance with 14 CFR part 60 and the appropriate QPS. d. Its software and active programming used during the training, evaluation, or flight experience is the same as the software and active programming that was evaluated by the NSPM.

End Rule Language (§ 60.11)

Begin QPS Requirements

e. Only those simulators that are used 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.

End QPS Requirements

Begin Information

f. Each simulator must be evaluated as completely as possible. To ensure a thorough and uniform evaluation, each simulator is subjected to the 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 in this paragraph f will include, but not necessarily be limited to the following, as appropriate, for the qualification level of the simulator:

(1) Aerodynamic 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 suitable to the NSPM in the areas of ground operations, takeoff, climb, cruise, descent, approach, and landing as well as abnormal and emergency operations (see paragraph 23 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) Simulator systems and sub-systems, including force cueing (motion), visual, and aural (sound) systems, as appropriate (see attachment 1 and attachment 2); 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.

g. 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 are used to compare simulator and airplane data objectively to ensure that the simulator performance and handling qualities are within specified tolerances.

(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 meets the appropriate training/testing/checking objectives and competently simulates each required maneuver, procedure, or task; and

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

h. 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.

i. In addition to the scheduled recurrent evaluation (see paragraph 14), 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. While the intent is to observe the operation and interaction of the device and not the check airman, instructor, APD, FAA inspector, or student(s), the simulator evaluator is a qualified FAA operations inspector and must, without question, report any obvious lack of proficiency to the appropriate POI or TCPM.

End Information

9. Simulator Objective Data Requirements

Begin Rule Language (§ 60.13)

a. Except as provided in paragraphs (b) and (c) of this section, for the purposes of validating simulator performance and handling qualities during evaluation for qualification, the sponsor must submit the airplane manufacturer's flight test data to the NSPM.

b. The sponsor may submit flight test data from a source in addition to or independent of the airplane manufacturer's data to the NSPM in support of a simulator 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 sponsor may submit alternative data acceptable to the NSPM for consideration, approval and possible use in particular applications for simulator 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 flight testing to support certain simulator qualification requirements.

f. When a simulator sponsor learns, or is advised by an airplane manufacturer or supplemental type certificate (STC) holder, that an addition to, an amendment to, or a revision of the data used to program and operate a simulator used in the sponsor's training program is available, the sponsor must immediately notify the NSPM.

End Rule Language (§ 60.13)

Begin QPS Requirements

g. 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 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.

(31) 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.

h. The data presented, 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.

i. After completion of any additional flight test, a flight test report must be submitted in support of the objective data. The report must contain sufficient data and rationale to

support qualification of the simulator at the level requested.

End QPS Requirements

Begin Information

j. Any necessary data and the flight test plan should be reviewed with the NSP staff well in advance of commencing the flight test.

End Information

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10. Special Equipment and Personnel Requirements for Qualification of the Simulator

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Begin Rule Language (§ 60.14)

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

End Rule Language (§ 60.14)

Begin Information

b. Examples of a special evaluation would be an evaluation conducted at the request of the TPAA or 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.

c. The NSPM will notify the sponsor at least 24 hours in advance of the evaluation if special equipment or personnel will be required to conduct the evaluation. Examples of special equipment include spot photometers, flight control measurement devices, sound analyzer, *etc.* Examples of special personnel would be those specifically qualified to install or use any special equipment when its use is required.

End Information

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11. Initial (and Upgrade) Qualification Requirements

Begin Rule Language (§ 60.15)

a. For each simulator, the sponsor must submit a request through the TPAA to have the NSPM evaluate the simulator for initial qualification at a specific level. The request must be submitted in the form and manner described in the appropriate QPS.

b. The request must include all of the following:

(1) A statement that the simulator meets all of the applicable provisions of 14CFR, part 60.

(2) A statement that the sponsor has established a procedure to verify that the configuration of hardware and software present during the evaluation for initial qualification will be maintained, except where modified as authorized in § 60.23. The statement must include a description of the procedure.

(3) A statement signed by at least one pilot who meets the requirements of paragraph c of this section asserting that each pilot so approved has determined that the following requirements have been met:

(a) The simulator systems and sub-systems function equivalently to those in the airplane.

(b) The performance and flying qualities of the simulator are equivalent to those of the airplane.

(c) The cockpit configuration conforms to the configuration of the airplane make, model, and series being simulated.

(4) A list of all of the operations tasks or simulator systems in the subjective test attachment of the appropriate QPS for which the simulator has not been subjectively tested (*e.g.*, circling approaches, windshear training, *etc.*) and for which qualification is not sought.

(5) A qualification test guide (QTG) that includes all of the following:

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

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

(c) The general simulator performance or demonstration results prescribed in the appropriate QPS.

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

c. The pilot or pilots who make the statement required by paragraph (b)(3) of this section must—

(1) Be designated by the sponsor;

(2) Be approved by the TPAA; and

(3) Be qualified in—

(a) The airplane being simulated; or

(b) For airplane types not yet issued a type certificate, an airplane type similar in size and configuration.

d. The subjective tests that form the basis for the statements described in paragraph (b)(3) of this section and the objective tests referenced in paragraph (b)(5) of this section must be accomplished at the sponsor's training facility except as provided for in the appropriate QPS.

e. The person seeking to qualify the simulator must provide the NSPM access to the simulator for the length of time necessary for the NSPM to complete the required evaluation of the simulator for initial qualification, which includes the conduct and evaluation of objective and subjective tests, including general simulator requirements, as described in the appropriate QPS, to determine that the simulator meets the standards in that QPS.

f. When the simulator 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 airplane being simulated.

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

(4) A statement that the simulator is qualified.

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

(6) A list of all of the operations tasks or simulator systems in the subjective test attachment of the appropriate QPS for which the simulator has not been subjectively tested and for which the simulator is not qualified (*e.g.*, circling approaches, windshear training, *etc.*).

g. 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.

h. Upon issuance of the Statement of Qualification the updated QTG becomes the MQTG and must then be made available to the FAA upon request.

End Rule Language (§ 60.15)

Begin QPS Requirements

i. The QTG described in paragraph 11.b.(4) of this appendix, must provide the documented proof of compliance with the simulator objective tests in attachment 2 of this appendix.

j. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, through the TPAA 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) Statements of how a particular test was accomplished or that certain requirements have been met (see attachments to this appendix for additional information);

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

k. The QTG described in paragraph 11.b.(4) of this appendix, must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see Attachment 5, Figure 2, for a sample QTG cover page).

(2) A recurrent evaluation schedule requirements page—to be used by the NSPM to establish and record the frequency with which recurrent evaluations must be conducted and any subsequent changes that may be determined by the NSPM. See Attachment 5, Figure 4, for a sample Recurrent Evaluation Schedule Requirements page.

(3) A simulator information page that provides the information listed in this paragraph k.(3) (see Attachment 5, 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 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 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) The source data.

(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 parameters driven or constrained during the automatically conducted test(s).

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

(i) Tolerances for relevant parameters.

(j) Source of Airplane Test Data (document and page number).

(k) Copy of the Airplane Test 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.

l. 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 airplane test data (*e.g.,* use of a multi-channel recorder, line printer, cross plotting, overlays, transpariencies, *etc.*).

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

(3) Airplane 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, flight test 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 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.

m. 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.

n. 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 and submit a statement to the NSPM that the simulator has not changed from the original determination. The report must clearly indicate when and where these repeated tests were completed, but need not take more than one normal simulator period (*e.g.*, 4 to 8 hours) to complete.

o. The sponsor must maintain a copy of the MQTG at the simulator location. After [date 6 years from the effective date of the final rule] all MQTG's, regardless of initial qualification date of the simulator, must be available in an electronic format, acceptable to the NSPM. The electronic MQTG must include 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 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 recurrent evaluations for continuing qualification. This electronic MQTG must include the original airplane flight test 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 flight test time-history plots that were provided by the data supplier. An electronic copy of MQTG must be provided to the NSPM.

End QPS Requirements

Begin Information

p. 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.

q. 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 airplane flight training program.

r. 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 5, figure 5, Sample Request for Initial Evaluation Date.

s. A convertible simulator is addressed as a separate simulator 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 simulator, two QTG's, or a supplemented QTG, and two evaluations are required.

t. 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.

End Information

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12. Additional Qualifications for a Currently Qualified Simulator

Begin Rule Language (§ 60.16)

a. A currently qualified simulator is required to undergo an additional qualification process if a user intends to use the simulator for meeting training, evaluation, or flight experience requirements of 14 CFR chapter I beyond the qualification issued to the sponsor. This process consists of the following—

(1) The sponsor:

(a) Must submit to the NSPM all modifications to the MQTG that are required to support the additional qualification.

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

(c) Must submit a statement to the NSPM that a pilot, designated by the sponsor in accordance with § 60.15(c) and approved by the TPAA for the user, has subjectively evaluated the simulator in those areas not previously evaluated.

(2) The simulator must successfully pass an evaluation—

(a) For initial qualification, in accordance with § 60.15, in those circumstances where the NSPM has determined that a full evaluation for initial qualification is necessary; or

(b) For those elements of an evaluation for initial qualification (*e.g.*, objective tests, performance demonstrations, 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 simulator, any modifications to the simulator hardware or software that are involved, and any additions or modifications to the MQTG.

c. The simulator is qualified for the additional uses when the NSPM issues an amended Statement of Qualification in accordance with § 60.15(f).

d. The sponsor may not modify the simulator except as described in § 60.23.

End Rule Language (§ 60.16)

13. Previously Qualified Simulators

Begin Rule Language (§ 60.17)

a. Unless otherwise specified by an FSD Directive, further referenced in the appropriate QPS, or as specified in paragraph (e) of this section, a simulator qualified before [the effective date of this rule] will retain its qualification as long as it continues to meet the standards, including the performance demonstrations and the objective test results recorded in the MQTG, under which it was originally evaluated, regardless of sponsor, and as long as the sponsor complies with the applicable provisions of 14 CFR part 60.

b. If the simulator qualification is lost under § 60.27 and not restored under § 60.27 for two (2) years or more, the qualification basis for the re-qualification will be those standards in effect and current at the time of re-qualification application.

c. Except as provided in paragraph (d) of this section, any change in simulator qualification level initiated on or after [the effective date of the final rule] requires an evaluation for initial qualification in accordance with 14 CFR part 60.

d. The NSPM may downgrade a qualified simulator without requiring and without conducting an initial evaluation for the new qualification level. Subsequent recurrent evaluations will use the existing MQTG, modified as necessary to reflect the new qualification level.

e. 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 simulator. The updated test(s) and tolerance(s) must be made a permanent part of the MQTG.

End Rule Language (§ 60.17)

Begin Information

f. 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 an airplane 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 12 of this appendix.

Note: The reader is reminded of the requirement that each simulator user must obtain approval from the appropriate TPAA to use any simulator in an FAA-approved flight training program.

End Information

14. Inspection, Maintenance, and Recurrent Evaluation Requirements

Begin Rule Language (§ 60.19)

a. Inspection. No sponsor may use or allow the use of or offer the use of a simulator for meeting training, evaluation, or flight experience requirements of 14 CFR, Chapter I for flightcrew member certification or qualification unless the sponsor does the following:

(1) Accomplishes all appropriate QPS Attachment 1 performance demonstrations and all appropriate QPS Attachment 2 objective tests each year. To do this, the sponsor must conduct a minimum of four evenly spaced inspections throughout the year, as approved by the NSPM. The performance demonstrations and objective test sequence and content of each inspection in this sequence will be developed by the sponsor and submitted to the NSPM for approval. In deciding whether to approve the test sequence and the content of each inspection, the NSPM looks for a balance and a mix from the performance demonstrations and objective test requirement areas listed as follows:

(a) Performance.

(b) Handling qualities.

(c) Motion system.

(d) Visual system.

(e) Sound system (where appropriate).

(f) Other simulator systems.

(2) Completes a functional preflight check in accordance with the appropriate QPS each calendar day prior to the start of the first simulator period of use that begins in that calendar day.

(3) Completes at least one functional preflight check in accordance with the appropriate QPS in every seven (7) consecutive calendar days.

(4) Maintains a discrepancy log.

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

(a) Each discrepancy entry must be maintained in the log until the discrepancy is corrected as specified in § 60.25(b) and for at least 30 days thereafter.

(b) The corrective action taken for each discrepancy and the date that action is taken must be entered in the log. This entry concerning the corrective action must be maintained for at least 30 days thereafter.

(c) The discrepancy log is kept in a form and manner acceptable to the Administrator and is kept in or immediately adjacent to the simulator.

b. Recurrent evaluation.

(1) This evaluation consists of performance demonstrations, objective tests, and subjective tests, including general simulator requirements, as described in the appropriate QPS or as may be amended by an FSD Directive.

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

(3) The sponsor must provide the NSPM access to the objective test results and general simulator performance or demonstration results in the MQTG, and access to the simulator for the length of time necessary for the NSPM to complete the required recurrent evaluations, weekdays between 6 o'clock a.m. (local time) and 6 o'clock p.m. (local time).

(4) No sponsor may use, or allow the use of, or offer the use of, a simulator for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of 14 CFR chapter I unless the simulator has passed an NSPM-conducted recurrent evaluation within the previous 12 calendar months or as otherwise provided for in the MQTG.

(5) Recurrent evaluations conducted in the calendar month before or after the calendar month in which these recurrent evaluations are required will be considered to have been conducted in the calendar month in which they were required.

c. Maintenance. The sponsor is responsible for continuing corrective and preventive maintenance on the simulator to ensure that it continues to meet the requirements of § 60.15(b).

End Rule Language (§ 60.19)

Begin QPS Requirements

d. The preflight inspections described in paragraphs 14.a.(2) and (3) of this appendix, must consist of, as a minimum—

(1) An exterior inspection of the simulator for appropriate hydraulic, pneumatic, and electrical connections (*e.g.*, in place, not leaking, appear serviceable);

(2) A check that the area around the simulator is free of potential obstacles throughout the motion system range;

(3) A review of the simulator discrepancy log;

(4) A functional check of the major simulator systems and simulated airplane systems (*e.g.*, visual, motion, sound, cockpit instrumentation, and control loading, including adequate air flow for equipment cooling) by doing the following:

(a) Turn on main power, including motion system, and allow to stabilize.

(b) Connect airplane power. This may be connected through ''quick start'' of airplane engines, auxiliary power unit, or ground power. Airplane operations will require operating engines.

(c) A general look for light bulb function, lighted instruments and switches, *etc.,* as well as inoperative ''flags'' or other such indications.

(d) Check Flight Management System(s) (and other date-critical information) for proper date range.

(e) Select takeoff position and from either pilot position, observe the visual system, for proper operation; *e.g.*, light-point color balance and convergence, edge-matching and blending, *etc.*

(f) Adjust visibility value to inside of the far end of the runway and release ''position freeze or flight freeze.'' From either pilot position, advance power to taxi down the runway (observe visual system, check sound system and engine instrument response) and apply spoiler/speed brake, if appropriate, and wheel brakes (to check spoiler/speed brake and wheel brake operation as applicable and to exercise simulator motion system); select reverse thrust, if applicable, to check normal operation and continued deceleration.

(g) Select position on final approach, at least five (5) miles out (observe visual scene). From either pilot position, adjust airplane configuration appropriately (check for normal gear and flap operation). Adjust visibility to see entire airport. Release ''position freeze'' or ''flight freeze.'' Make a rapid left and right bank (check control feel and freedom; observe proper airplane response; and exercise motion system). Observe visual system and simulated airplane systems operation.

(h) Extend gear and flaps,

(i) Fly to and land at airport, or select takeoff position.

(j) Shut down engines, turn off lights, turn off main power supply and motion system.

(k) Record ''functional preflight'' in the simulator discrepancy log book, including any item found to be missing, malfunctioning, or inoperative.

End QPS Requirements

Begin Information

e. If the NSP evaluator plans to accomplish specific tests during a normal recurrent evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; usually not less than 24 hours. These tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests.

f. The recurrent evaluations described in paragraph 13.a.(7) of this appendix, require approximately eight (8) hours of simulator time and consist of the following:

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

(2) At the discretion of the evaluator, a selection of approximately 20 percent of those objective tests conducted since the last scheduled recurrent evaluation and a selection of approximately 10 percent of the remaining objective tests in the MQTG. The tests chosen will be performed either automatically or manually, at the discretion of the evaluator.

(3) Subjective test 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.

(4) An examination of the functions of the simulator, including, but not necessarily limited to the motion system, visual system, sound system, instructor operating station, and the normal and simulated malfunctions of the simulated airplane systems.

End Information

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15. Logging Simulator Discrepancies

Begin Rule Language (§ 60.20)

Each instructor, check airman, or representative of the Administrator conducting training or evaluation, or observing flight experience for flightcrew member certification or qualification, and each person conducting the preflight inspection (§ 60.19(a)(2), (3), and (4)), who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the simulator, must write or cause to be written a description of that discrepancy into the discrepancy log at the end of the simulator preflight or simulator use session.

End Rule Language (§ 60.20)

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16. Interim Qualification of Simulators for New Airplane Types or Models

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Begin Rule Language (§ 60.21)

a. A sponsor may apply for and the NSPM may issue an interim qualification level for a simulator for a new type or model of airplane, even though the flight test data used has not received final approval by the airplane manufacturer, if the sponsor provides the following to the satisfaction of the NSPM—

(1) The airplane manufacturer's predicted data, validated by a limited set of flight test data;

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

(3) The QTG test results.

b. A simulator that has been issued interim qualification will be deemed to have been issued initial qualification unless the NSPM rescinds the qualification. Interim qualification terminates one year after its issuance, unless the NSPM determines that specific conditions warrant otherwise.

c. Within six months of the release of the final flight test data package by the airplane manufacturer but no later than one year after the issuance of the interim qualification status the sponsor must apply for initial qualification in accordance with § 60.15 based on the final flight test data package approved by the airplane manufacturer, unless the NSPM determines that specific conditions warrant otherwise.

d. A simulator with interim qualification may be modified only in accordance with § 60.23.

End Rule Language (§ 60.21)

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17. Modifications to Simulators

Begin Rule Language (§ 60.23)

a. When the sponsor or the FAA determines that any of the following circumstances exist and the FAA determines that the simulator cannot be used adequately to train, evaluate, or provide flight experience for flightcrew members, the sponsor must modify the simulator accordingly.

(1) The airplane manufacturer or another approved source develops new data regarding the performance, functions, or other characteristics of the airplane being simulated;

(2) A change in airplane performance, functions, or other characteristics occurs;

(3) A change in operational procedures or requirements occurs; or

(4) Other circumstances as determined by the NSPM.

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

c. Before modifying a qualified simulator, the sponsor must notify the NSPM and the TPAA as follows:

(1) The notification must include a complete description of the planned modification, including a description of the operational and engineering effect the proposed modification will have on the operation of the simulator.

(2) The notification must be submitted in a form and manner as specified in the appropriate QPS.

d. If the sponsor intends to add additional equipment or devices intended to simulate airplane appliances; modify hardware or software which would affect flight or ground dynamics, including revising simulator programming or replacing or modifying the host computer; or if the sponsor is changing or modifying the motion, visual, or control loading systems (or sound system for simulator levels requiring sound tests and measurements), the following applies:

(1) The sponsor must meet the notification requirements of paragraph c of this section and must include in the notification the results of all objective tests that have been re-run with the modification incorporated, including any necessary updates to the MQTG.

(2) However, the sponsor may not use, or allow the use of, or offer the use of, the simulator with the proposed modification for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of 14CFR, Chapter I unless or until the sponsor receives written notification from the NSPM approving the proposed modification. Prior to approval, the NSPM may require that the modified simulator be evaluated in accordance with the standards for an evaluation for initial qualification or any part thereof before it is placed in service.

e. The sponsor may not modify a qualified simulator until one of the following has occurred:

(1) For circumstances described in paragraph b or d of this section, the sponsor receives written approval from the NSPM that the modification is authorized.

(2) For circumstances other than those described in paragraph b or d of this section, either:

(a) 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 the NSPM or TPAA; or

(b) The NSPM or TPAA approves the proposed modification in fewer than 21 days since the sponsor notified the NSPM and the TPAA of the proposed modification.

f. When a modification is made to a simulator, the sponsor must notify each certificate holder planning to use that simulator of that modification prior to that certificate holder using that simulator the first time after the modification is complete.

g. The MQTG must be updated with current objective test results in accordance with § 60.15(b)(5) and appropriate flight test data in accordance with § 60.13, each time a simulator is modified and an objective test is affected by the modification. If this update is initiated by an FSD Directive, the direction to make the modification and the record of the modification completion must be filed in the MQTG.

End Rule Language (§ 60.23)

Begin QPS Requirements

h. The notification described in paragraph 17.c.(1) of this appendix, will include a statement signed by a pilot, qualified in the airplane type being simulated and designated by the sponsor, that, with the modification proposed—

(1) The simulator systems and sub-systems function equivalently to those in the airplane being simulated;

(2) The performance and flying qualities of the simulator are equivalent to those of the airplane being simulated; and

(3) The cockpit configuration conforms to the configuration of the airplane being simulated.

End QPS Requirements

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18. Operation With Missing, Malfunctioning, or Inoperative Components

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Begin Rule Language (§ 60.25)

a. No person may use or allow the use of or offer the use of a simulator with a missing, malfunctioning, or inoperative component for meeting training, evaluation, or flight experience requirements of 14 CFR chapter I for flightcrew member certification or qualification during maneuvers, procedures, or tasks that require the use of the correctly operating component.

b. Each missing, malfunctioning, or inoperative component must be repaired or replaced within 30 calendar days unless otherwise authorized by the NSPM. Failure to repair or replace this component within the prescribed time may result in loss of simulator qualification.

c. Each missing, malfunctioning, or inoperative component must be placarded as such on or adjacent to that component in the simulator and a list of the currently missing, malfunctioning, or inoperative components must be readily available in or immediately adjacent to the simulator for review by users of the device.

End Rule Language (§ 60.25)

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19. Automatic Loss of Qualification and Procedures for Restoration of Qualification

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Begin Rule Language (§ 60.27)

a. A simulator is not qualified if any of the following occurs:

(1) The simulator is not used in the sponsor's FAA-approved flight training program in accordance with § 60.9(b)(4).

(2) The simulator is not maintained and inspected in accordance with § 60.19.

(3) The simulator is physically moved from one location to another, regardless of distance.

(4) The simulator is disassembled (*e.g.*, for repair or modification) to such an extent that it cannot be used for training, evaluation, or experience activities.

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

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

(1) The simulator successfully passes an evaluation:

(a) For initial qualification, in accordance with § 60.15 in those circumstances where the NSPM has determined that a full evaluation for initial qualification is necessary; or

(b) For those elements of an evaluation for initial qualification approved as necessary by the NSPM.

(2) The NSPM or the TPAA 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 inspections and recurrent evaluations missed, the amount of disassembly and re-assembly of the simulator that was accomplished, and the care that had been taken of the device since the last evaluation.

End Rule Language (§ 60.27)

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20. Other Losses of Qualification and Procedures for Restoration of Qualification

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Begin Rule Language (§ 60.29)

a. Except as provided in paragraph c of this section, when the NSPM or the TPAA notifies the sponsor that the simulator no longer meets qualification standards, the following procedure applies:

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

(2) The NSPM or the TPAA sets a reasonable period (but not less than 7 days) within which the sponsor may submit written information, views, and arguments on the simulator qualification.

(3) After considering all material presented, the NSPM or the TPAA notifies the sponsor of the simulator qualification.

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

(a) The NSPM or the TPAA find under paragraph c of this section that there is an emergency requiring immediate action with respect to safety in air transportation or air commerce; or

(b) The sponsor petitions for reconsideration of the NSPM or the TPAA finding under paragraph b of this section.

b. When a sponsor seeks reconsideration of a decision from the NSPM or the TPAA concerning the simulator 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 simulator is no longer qualified.

(2) The sponsor must address its petition to the Director, Flight Standards Service.

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

c. If the NSPM or the TPAA find that an emergency exists requiring immediate action

with respect to safety in air transportation or air commerce that makes the procedures set out in this section impracticable or contrary to the public interest:

(1) The NSPM or the TPAA withdraws qualification of some or all of the simulator 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 or the TPAA 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.

End Rule Language (§ 60.29)

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21. Recordkeeping and Reporting

Begin Rule Language (§ 60.31)

a. The simulator sponsor must maintain the following records for each simulator it sponsors:

(1) The MQTG and each amendment thereto.

(2) A copy of the programming used during the evaluation of the simulator for initial qualification and for any subsequent upgrade qualification and a copy of all programming changes made since the evaluation for initial qualification.

(3) A copy of all of the following:

(a) Results of the evaluations for the initial and each upgrade qualification.

(b) Results of the quarterly objective tests and the approved performance demonstrations conducted in accordance with § 60.19(a) for a period of 2 years.

(c) Results of the previous three recurrent evaluations, or the recurrent evaluations from the previous 2 years, whichever covers a longer period.

(d) Comments obtained in accordance with § 60.9(b)(1) for a period of at least 18 months.

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

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

(b) The action taken to correct the discrepancy.

(c) The date the corrective action was taken.

(5) A record of all modifications to simulator hardware configurations made since initial qualification.

b. The simulator sponsor must keep a current record of each certificate holder using the simulator. The sponsor must provide a copy of this list to the NSPM at least semiannually.

c. 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.

d. The sponsor must submit an annual report, in the form of a comprehensive statement signed by the quality assurance primary contact point, certifying that the simulator continues to perform and handle as qualified by the NSPM.

End Rule Language (§ 60.31)

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22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements

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Begin Rule Language (§ 60.33)

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 14 CFR part 60 or the QPS.

(2) A fraudulent or intentionally false statement in or omission from any record or report that is kept, made, or used to show compliance with 14 CFR part 60 or the QPS, or to exercise any privileges under 14 CFR chapter I.

(3) Any reproduction or alteration, for fraudulent purpose, of any report, record, or test result required under 14 CFR part 60 or the QPS.

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 14 CFR chapter I.

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

c. The following may serve as a basis for removal of qualification of a simulator including the withdrawal of authorization for use of a simulator; 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 a simulator qualification or an approval for use.

End Rule Language (§ 60.33)

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23. Specific Simulator Compliance Requirements

Begin Rule Language (§ 60.35)

a. After [date 18 months from the effective date of the final rule], no simulator will be eligible for initial or upgrade qualification under 14 CFR part 60 unless it simulates the operation of all equipment and appliances installed and operating on the airplane being simulated, if such equipment or appliances have controls or indications that are located in the airplane cockpit.

b. After [date 2 years from the effective date of this final rule], any flight simulator used for meeting flightcrew member training, evaluation, or flight experience requirements of 14 CFR chapter I for certification or qualification that cannot perform satisfactorily in the following areas will no longer be qualified as a simulator.

(1) Ground operations;

(2) The takeoff, climb, cruise, descent, and approach portions of the simulated airplane's operating envelope, including abnormal and emergency operations; and

(3) The landing maneuver, including normal, abnormal, and emergency landings.

End Rule Language (§ 60.35)

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24. [Reserved]

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

Begin Rule Language (§ 60.37)

a. The evaluation and qualification of an airplane simulator by a contracting State to the Convention on International Civil Aviation for the sponsor of an airplane simulator located in that contracting State may be used as the basis for issuing a U.S. statement of qualification (see attachment 5, figure 4) by the NSPM to a U.S. sponsor of that simulator 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.

End Rule Language (§ 60.37)

Attachment 1 to Appendix A to Part 60—General Simulator Requirements

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1. General

Begin QPS Requirements

a. Requirements. (1) Certain simulator and visual system requirements included in this attachment must be supported with a Statement of Compliance and Capability (SOC) and, in designated cases, simulator performance must be recorded and the results made part of the QTG. In the following tabular listing of simulator standards, requirements for SOC's are indicated in the ''Additional Details'' column.

(2) Airports represented in visual scenes required by this document must be representations of real-world, operational airports or representations of fictional airports, designed specifically for use in training, testing, and/or checking of flight crewmembers.

(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 set out in this document 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

Begin Information

b. Discussion.

(1) This attachment describes the minimum simulator requirements for qualifying airplane simulators. 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.

(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) Motion system.

(f) Visual system.

(g) Sound system.

End Information

TABLE OF MINIMUM SIMULATOR REQUIREMENTS

QPS requirements						Information notes
General simulator requirements	Simulator level				Additional details	
	A	B	C	D		
2. 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	Pilot seats must afford the capability for the occupant to be able to achieve the design ''eye position'' established for the airplane being simulated.	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 sets.
b. Those circuit breakers that affect procedures and/or results in observable cockpit indications must be properly located and functionally accurate.	X	X	X	X		
3. Programming						
a. The effect of aerodynamic changes 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, center of gravity location, and configuration.	X	X	X	X		
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. Simulator hardware and programming must be updated within 6 months of any airplane modifications or appropriate data releases unless, with prior coordination, the NSPM authorizes otherwise.	X	X	X	X		

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

QPS requirements						Information notes
General simulator requirements	Simulator level				Additional details	
	A	B	C	D		
d. Ground operations must be represented to the extent that allows turns within the confines of the runway and adequate controls of the landing and roll-out from a crosswind approach to a landing.	X					
e. Ground handling and aerodynamic programming must include the following:					An SOC is required. Simulator performance must be recorded and the results made part of the QTG.	
(1) Ground effect		X	X	X	This requires data on lift, drag, pitching moment, trim, and power while in ground effect.	Applicable areas include: roundout, flare, and touchdown.
(2) Ground reaction		X	X	X	This requires data on strut deflections, tire friction, side forces, etc.	This 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		
f. 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	Required only for turbo-jet powered, transport category airplanes. Simulator performance must be recorded and the results made part of the QTG; see 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 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.	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 means of compliance with simulator wind model requirements.
g. The simulator must include a means for quickly and effectively testing simulator programming and hardware.			X	X	An SOC is required	This may include an automated system, which could be used for conducting at least a portion of the tests in the QTG.

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

QPS requirements						Information notes
General simulator requirements	Simulator level				Additional details	
	A	B	C	D		
h. The simulator must provide for 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. Simulator test results must include simulator number, date, time, conditions, tolerances, and appropriate dependent variables portrayed in comparison to the airplane standard.	Automatic ''flagging'' of out-of-tolerance situations is encouraged.
i. Relative responses of the motion system, visual system, and cockpit instruments must be coupled closely to provide integrated sensory cues.	X				Response must be within 300 milliseconds of the airplane response.	
		X	X	X	Response must be within 150 milliseconds of the airplane response.	
(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. 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.					Simultaneously record: the analog output from the pilot's control column, wheel, and pedals; the output from an accelerometer attached to the motion system platform located at an acceptable location near the pilots' seats; the output signal to the visual system display (including visual system analog delays); and the output signal to the pilot's attitude indicator or an equivalent test approved by the Administrator. Simulator performance must be recorded. These results must be compared to airplane response data in the takeoff, cruise, and approach or landing configuration and 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 airplane responses. Acceleration in the appropriate 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.
(2) Transport Delay: (As an alternative to the Latency requirement, above, a transport delay demonstration may be used to demonstrate that the simulator system does not exceed the specified limit of 300 milliseconds for Level A simulators or 150 milliseconds for Level B, C, or D simulators. 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. While transport delay need only be measured once in each axis, independent of flight conditions, if this method is chosen, the sponsor must also demonstrate the latency of the simulator with respect to that of the aircraft 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.	The transport delay is the delay time between the control input and the individual hardware (*i.e.,* instruments, motion system, visual system) responses.
j. The simulator must accurately reproduce the stopping time and distances for at least the following runway conditions:.			X	X	An SOC is required. Simulator performance must be recorded and the results made part of the QTG.	Objective tests are described in Attachment 2 for dry, wet, and icy runway conditions.
(1) Patch Wet (2) Patch Icy						

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements				Additional details	Information notes
	Simulator level					
	A	B	C	D		
(3) Wet on Rubber Residue in Touchdown Zone						
k. The simulator must accurately simulate brake and tire failure dynamics (including antiskid failure) and decreased brake efficiency due to high brake temperatures.			X	X	An SOC is required. A demonstration is required for initial and recurrent evaluations. Simulator performance must be recorded for decreased braking efficiency due to brake temperature and the results made part of the QTG.	Simulator pitch, side loading, and directional control characteristics should be representatives of the airplane.
l. The simulator must replicate the effects of airframe icing.			X	X	A demonstration is required for initial and recurrent evaluations.	
m. The aerodynamic modeling in the simulator must include: (1) Low-altitude level-flight ground effect; (2) Match effect at high altitude; (3) Effects of airframe icing; (4) Normal and reverse dynamic thrust effect on control surfaces; and (5) Aeroelastic representations of nonlinearities due to sideslip.				X	An SOC is required and must include references to computations of aeroelastic representations and nonlinearities due to sideslip. A demonstration of icing effects is required for initial and recurrent evaluations. Simulator performance must be recorded and the results made a part of the QTG.	See Attachment 2, paragraph 4, for further information on ground effect.
n. The simulator must have a software and hardware control methodology that is supported by diagnostic analysis programs(s) and resulting printouts.				X	An SOC is required.	
4. 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 for U.S. operations.	For example, fuel in pounds, speed in knots, and altitude in feet.
b. Communications and navigation equipment must be installed and operate within the tolerances applicable for the airplane.	X	X	X	X	.....	See Attachment 3, paragraph 1c 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 gound and in flight.	X	X	X	X		
d. The simulator must provide pilot controls with control force and control travel that correspond to the simulated airplane. The simulator must be also react in the same manner as in the airplane under the same flight conditions.	X	X	X	X		
5. Instructor or Evaluator Facilities						

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements				Additional details	Information notes
	Simulator level					
	A	B	C	D		
a. In addition to the flight crew member stations, the simulator must have 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	X	All seats other than flight crew seats need not represent those found in the airplane but must be equipped with similar positive restraint devices.	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 described in the sponsor's pilot operating manual into the simulated airplane systems.	X	X	X	X		
c. The simulator must have instructor controls for wind speed and direction.	X	X	X	X		
d. The simulator must provide the instructor or evaluator the ability to present ground and air hazards.			X	X	.....	For example, another airplane crossing the active runway and converging airborne traffic; etc.
6. 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	.....	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 system with a minimum of three degrees of freedom.	X				An SOC is required.	
c. The simulator must have a motion system with a minimum of four degrees of freedom (at least pitch, roll, sway, and heave).		X			An SOC is required.	
d. 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.			X	X	An SOC is required.	
e. The simulator must provide special effects programming that includes the following: (1) Thrust effect with brakes set. (2) Runway rumble, oleo deflections, effects of ground speed and uneven runway characteristics. (3) Buffets on the ground due to spoiler/speedbrake extension and thrust reversal. (4) Bumps after lift-off of nose and main gear. (5) Buffet during extension and retraction of landing gear. (6) Buffet in the air due to flap and spoiler/speedbrake extension.		X	X	X	A qualitative assessment is required to determine that the effect is representative of the airplane simulated.	

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements: Simulator level A	B	C	D	Additional details	Information notes
(7) Stall buffet to, but not necessarily beyond, the FAA certificated stall speed, V_s, if applicable. (8) Representative touchdown cues for main and nose gear. (9) Nosewheel scuffing, if applicable. (10) Mach buffet.						
f. The simulator must provide characteristic buffet motions that result from operation of the airplane, or from atmospheric disturbances, which can be sensed in the cockpit; *e.g.,* high-speed buffet, extended landing gear or flaps, nosewheel scuffing, stall buffet, air turbulence, etc.				X	Simulator performance (with emphasis on amplitude and frequency) must be recorded and compared to airplane data. The results must be made a part of the QTG. For air turbulence, general purpose disturbance models that approximate demonstrable flight test data are acceptable.	The simulator should be programmed and instrumented in such a manner that the characteristic buffet modes can be measured and compared to airplane data.
7. Visual System						
a. The simulator must have a visual system providing an out-of-the-cockpit view.	X	X	X	X	A demonstration is required for initial and recurrent evaluations.	
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.	
d. The simulator must have operational landing lights for night scenes.	X	X	X	X	A demonstration is required for initial and recurrent evaluations. 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 demonstration is required for initial and recurrent evaluations.	
f. Each airport scene displayed must include the following:	X	X	X	X	A demonstration is required for initial and recurrent evaluations.	
(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.						

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

QPS requirements						Information notes
General simulator requirements	Simulator level				Additional details	
	A	B	C	D		
(iii) Taxiway lights.						
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:	X	X	X	X	A demonstration is required for initial and recurrent evaluations.	
(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; as required by three (3) arc-minutes resolution on day scenes.. h. The simulator must provide visual system compatibility with aerodynamic programming.	X	X	X	X		
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.	X	X	X	X	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. (iii) glideslope angle. (iv) Airplane pitch angle on approach. (3) Airplane data for manual testing: (i) Gross weight. (ii) Airplane configuration. (iii) Approach airspeed.	
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 demonstration is required for initial and recurrent evaluations.	

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements				Additional details	Information notes
	Simulator level					
	A	B	C	D		
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 demonstration is required for initial and recurrent evaluations. 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 ..... (1) Accurate portrayal of the environment relating to the simulator attitude	X	X	X	X	A demonstration is required for initial evaluation. However, if there is any question regarding this function, the NSPM may require the demonstration be repeated during any inspection or subsequent recurrent evaluation.	
(2) Quick confirmation of visual system color, RVR, focus, and intensity.			X	X	An SOC is required. A demonstration is required for initial evaluation. However, if there is any question regarding this function, the NSPM may require the demonstration be repeated during any inspection or subsequent recurrent evaluation.	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 indictor.
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.			X	X	A demonstration is required for initial and recurrent evaluations.	
n. The simulator must be capable of producing at least 10 levels of occulting.			X	X	A demonstration is required for initial evaluation. However, if there is any question regarding this function, the NSPM may require this demonstration to be accomplished during any inspection or subsequent recurrent evaluation.	
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 demonstration is required for initial and recurrent evaluations. 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.	

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

QPS requirements						Information notes
General simulator requirements	Simulator level				Additional details	
	A	B	C	D		
p. The surface resolution must be demonstrated by a test pattern of objects shown to occupy a visual angle of three (3) arc-minutes in the visual scene from the pilot's ''eye point''.			X	X	An SOC is required and must include the relevant calculations. A demonstration is required on initial evaluations. However, if there is any question regarding this function, the NSPM may require this demonstration to be accomplished during any inspection or subsequent recurrent evaluation.	
q. The lightpoint size must not be greater than six (6) arc-minutes.			X	X	An SOC is required and must include the relevant calculations. A demonstration is required on initial evaluations. However, if there is any question regarding this function, the NSPM may require this demonstration to be accomplished during any inspection or subsequent recurrent evaluation.	
r. The lightpoint contrast ratio must not be less than 25:1.			X	X	An SOC is required and must include the relevant calculations. A 1-degree spot photometer is used to measure a square of at least 1 degree, filled with lightpoints (where lightpoint modulation is just discernible) and compare the results to the measured adjacent background. A demonstration is required on initial evaluations. However, if there is any question regarding this function, the NSPM may require this demonstration to be accomplished during any inspection or subsequent recurrent evaluation.	
s. The simulator must have (1) daylight, (2) night, and (3) 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. The simulator cockpit ambient lighting must be dynamically consistent with the visual scene displayed.				X	A demonstration is required for initial and recurrent evaluations. The daylight visual scene must be part of a total daylight cockpit environment which at least represents the amount of light in the cockpit on an overcast day. For daylight scenes, such ambient lighting must not ''washout'' the displayed visual scene nor fall below 5 foot-lamberts (17 cd/m^2) of light as reflected from an instrument approach plate at knee height at both pilots' station. These requirement 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.

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements: Simulator level A	B	C	D	Additional details	Information notes
(1) The simulator visual system must provide a minimum contrast ratio of 5:1.					A raster-drawn pattern must be displayed that fills the entire visual scene (3 or more channels) consisting of a matrix of black and white squares no larger than 10° and no smaller than 5° per square, with a white square having a minimum threshold value of 2 foot-lamberts, or 7 cd/m^2 in the center of each channel. The contrast ratio is the numerical value of the brightness measured for the center (white) square divided by the brightness value for any adjacent (dark) square.	A 1° spot photometer is used to measure the brightness values.
(2) The simulator visual system must provide a highlight brightness of not less than six (6) foot-lamberts (20 cd/m^2).					The test must use the full pattern described above, measuring the brightness of a white square, superimposed completely with a highlighted area covering the square. Use of calligraphic capabilities to enhance raster brightness is acceptable; however, individual light points or light point arrays are not acceptable.	A 1° spot photometer is used to measure the brightness values.
t. The simulator must provide operational visual scenes that portray physical relationships known to cause landing illusions to pilots.				X	A demonstration is required for initial and recurrent evaluations.	For example: short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path, unique topographic features, *etc.*
u. 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 demonstration is required for initial and recurrent evaluations. 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.	
v. 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 demonstration is required for initial and recurrent evaluations.	
w. The simulator must present realistic color and directionality of all airport lighting.				X	A demonstration is required for initial and recurrent evaluations.	
8. 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		

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

QPS requirements						Information notes
General simulator requirements	Simulator level				Additional details	
	A	B	C	D		
b. The simulator must accurately simulate the sound of precipitation, windshield wipers, and other significant airplane noises perceptible to the pilot during normal 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 demonstration is required for initial and recurrent evaluations.	
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. These sounds must include, at least, the sound of precipitation, windshield wipers, engine, and airframe sounds. When appropriate, the sounds must be coordinated with the weather representations required in paragraph 4.*w*.	

Attachment 2 to Appendix A 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 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 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 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 simulator 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 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'' 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) Simulators are evaluated and qualified with an engine model simulating the airplane manufacturer's flight test engine. For qualification of alternate engine models (either variations of the flight test engines or other manufacturer's engines) additional simulator tests with the alternate engine models are required. Where thrust is different by more than 5% from the flight test engine, flight test data from an airplane equipped with the alternate engine is required. Where the airplane manufacturer certifies that the only impact on the simulator model is thrust, and that other variables related to the alternate 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 alternate engine model.

(11) 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.

(12) For testing Computer Controlled Airplane (CCA) simulators, or other highly augmented airplane simulators, flight test data are required for both the Normal (N) and Non-normal (NN) control states, as indicated in this attachment except that some tests require data only in the Normal control state and are so noted. Where test results are independent of control state, Non-normal control data may be used. 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. 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. 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.

(13) 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

b. Discussion

Begin Information

(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 3, Motion System, in the following table).

(3) In the following Table of Objective Tests, the last column is titled ''Paragraph 8.'' A ''yes'' indication in that column directs the reader to paragraph 8 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 8 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.

(4) The reader is encouraged to review 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 OBJECTIVE TESTS

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
2. Performance **a. Taxi**									
(1) Minimum Radius Turn	±3 ft (0.9m) or 20% of Airplane Turn Radius.	Ground/Takeoff		X	X	X	Record both Main and Nosegear turning radius. This test is to be accomplished without the use of brakes and only minimum thrust, except for airplanes requiring asymmetric thrust or braking to turn.	.....	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(2) Rate of Turn vs. Nosewheel Steering Angle.	±10% or ±2°/sec. Turn Rate ...	Ground/Takeoff		X	X	X	Record a minimum of two speeds, greater than minimum turning radius speed, with a spread of at least 5 knots.	.....	Yes.
b. Takeoff									
(1) Ground Acceleration Time and Distance.	±5% Time and Distance or ±5% Time and ±200 ft (61 m) of Distance.	Ground/Takeoff	X	X	X	X	Record acceleration time and distance for a minimum of 80% of the segment from brake release to V_R. Preliminary aircraft certification data may be used..	.....	Yes.
(2) Minimum Control Speed – Ground (V_{mcg}) using aerodynamic controls only (per applicable Airworthiness Standard) or Low Speed, Engine Inoperative 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).	Ground/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 simulator under test.	.....	Yes.
(3) Minimum Unstick Speed (V_{mu}) or equivalent as provided by the airplane manufacturer.	±3 Kts Airspeed ±1.5° Pitch	Ground/Takeoff	X	X	X	X	Record main landing gear strut compression or equivalent air/ground signal. Record from 10 Kts before start of rotation. Elevator input must precisely match airplane data. See 14CFR § 25.107(d).	.....	Yes.
(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).	Ground/Takeoff and First Segment Climb.	X	X	X	X	Record takeoff profile from brake release to at least 200 ft (61 m) above ground level (AGL).	.....	Yes.
(5) Critical Engine Failure on Takeoff.	±3 Kts Airspeed ±1.5° Pitch, ±1.5° Angle of Attack, ±20 ft (6 m) Altitude, ±2° Bank and Sideslip 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).	Ground/Takeoff and First Segment Climb.	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. **CCA:** Test in Normal AND Non-normal control state.	.....	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(6) Crosswind Takeoff	±3 Kts Airspeed, ±1.5° Pitch, ±1.5° Angle of Attack, ±20 ft (6 m) Altitude, ±2° Bank and Sideslip 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 ±3 lb (1.3daN); and Rudder Pedal Force; ±10% or ±5 lb (2.2 daN).	Ground/Takeoff and First Segment Climb.	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 (*i.e.*, wind speed and direction vs. altitude), for a crosswind component of at least 20 Kts., but not more than the maximum (or maximum demonstrated) crosswind for the airplane.	.....	Yes.
(7) Rejected Takeoff	±5% Time or ±1.5 sec; ±7.5% Distance or ±250 ft (±76 m.	Ground/Takeoff	X	X	X	X	Record time and distance from brake application to full stop. The airplane must be at or near the maximum takeoff gross weight. Use maximum braking effort, auto or manual.	Autobrakes will be used where applicable.	Yes.
(8) Dynamic Engine Failure After Takeoff.	±20% Body Rates	1st Segment Climb			X	X	Engine failure speed must be within ±3 Kts of airplane data. Record Hands Off from 5 secs. before to 5 secs. after engine failure or 30° Bank, whichever occurs first, and then Hands On until wings level recovery. 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	±3 kts Airspeed, ±5% or ±100 FPM (0.5 m/Sec.) Climb Rate.	All Engines Operating..	X	X	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.	.....	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(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) Rate of Climb.	Second Segment Climb with one engine inoperative.	X	X	X	X	Record results at airplane limiting conditions of weight, altitude, & temperature. Manufacturer's gross climb gradient may be used for flight test data. May be a Snapshot Test.	.....	Yes.
(3) One Engine Inoperative En route Climb.	±10% Time, ±10% Distance, ±10% Fuel Used.	En route Climb			X	X	Record results for at least a 5000 ft (1550 m) climb segment. Approved Performance Manual data may be used.		
(4) One Engine Inoperative Approach Climb (if 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 Rate of Climb.	Approach Climb With One Engine Inoperative.	X	X	X	X	Record results at not less than 80% of the FAA-certificated maximum landing weight. Manufacturer's gross climb gradient may be used for flight test data. May be a Snapshot Test.	.....	Yes.
d. Cruise									
(1) Level Acceleration and Deceleration.	±5% Time	Cruise	X	X	X	X	Record results for a minimum of 50 Kts speed change.		
(2) Cruise Performance ..	±.05 EPR ±5% of N_1 and N_2, ±5% of Torque, ±5% of Fuel Flow.	Cruise			X	X	May be a Snapshot Test; however, a minimum of 2 consecutive snapshots with a spread of at least 5 minutes will be required.		
e. Ground Deceleeration									
(1) Deceleration Time and Distance, using manual application of wheel brakes and no reverse thrust.	±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, Dry Runway.	X	X	X	X	Record time and distance for at least 80% of the segment from touch down to full stop. Data on 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 and light gross weight conditions.	Data is required for medium, light, and near maximum landing gross weights.	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(2) Deceleration Time and Distance, using reverse thrust and no wheel brakes.	±5% Time and the smaller of ±10% or ±200 ft (61 m) of Distance.	Landing, Dry Runway.	X	X	X	X	Record time and distance for at least 80% of the total demonstrated reverse thrust segment. Data on the position of ground spoilers, (including method of deployment, if used) must be provided. Engineering data may be used for the medium and light gross weight conditions.	Data is required for medium, light, and near maximum landing gross weights.	Yes.
(3) Deceleration Distance, using wheel brakes and no reverse thrust.	±10% of Distance or ±200 ft (61 m).	Landing, Wet Runway.	.....	.....	X	X	The FAA-approved AFM data or FAA accepted ground handling model calculations are permissible.		
(4) Deceleration Distance, using wheel brakes and no reverse thrust.	±10% of Distance or ±200 ft (61 m).	Landing, Icy Runway.	.....	.....	X	X	The FAA-approved AFM data or FAA accepted ground handling model calculations are permissible.		
f. Engines									
(1) Acceleration	±10% T_i, ±10% T_t	Approach or landing	X	X	X	X	Record engine power (N_1, N_2, EPR, Torque, etc.) from idle to go-around power for a rapid (slam) throttle movement.	.....	Yes
(2) Deceleration	±10% T_i, ±10% T_t	Ground/Takeoff					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.	.....	Yes.
3. HANDLING QUALITIES									

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
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. Contact the NSPM for clarification of any issue regarding airplanes with reversible controls.									
a. Static Control Checks									
(1) Column 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. **CCA:** Position vs. force not required if cockpit controller is installed in the simulator.		Yes.
(2) Wheel Position vs. Force and Surface Position Calibration.	Breakout: ±2 lb (0.9 daN). Force: ±10% or ±3 lb (1.3 daN) and ±1° Aileron, ±3° Spoiler Angle.	Ground	X	X	X	X	Record results for an uninterrupted control sweep to the stops. **CCA:** Position vs. force not required if cockpit controller is installed in the simulator.		Yes.
(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.		Yes.
(4) Nosewheel Steering 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, ±0.5° Deadband.	Ground	X	X	X	X	Record results of an uninterrupted control sweep to the stops.		Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(6) Pitch Trim Calibration (Indicator vs. Computed) and Rate.	±0.5° of Computed Trim Angle, ±10% Trim Rate.	Ground and Go Around.	X	X	X	X	Trim rate must be checked using the pilot primary trim control (ground) and using the autopilot or pilot primary trim control in flight at go-around flight conditions.	.....	Yes.
(7) Alignment of Power Lever Angle vs. Selected Engine Parameter (*e.g.*, EPR, N_1, Torque, etc.).	±5° of Power Lever Angle	Ground	X	X	X	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 shapshot test results.	.....	Yes.
(8) Brake Pedal Position vs. Force and Brake System Pressure.	±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.	.....	Yes.
b. Dynamic Control Checks									
(1) Pitch Control	±10% of time for first zero crossing and ±10 (n+1)% of period thereafter, ±10% amplitude of first overshoot, ±20% of amplitude of 2nd and subsequent overshoots greater than 5% of initial displacement (A_d), ±1 overshoot.	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. **CCA:** Test not required if cockpit controller is installed in the simulator.	''n'' is the sequential period of a full cycle of oscillation. Refer to paragraph 3 of this attachment for more information.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(2) Roll Control	±10% of time for first zero crossing, and ±10 (n±1)% of period thereafter, ±10% amplitude of first overshoot, ±20% of amplitude of 2nd and subsequent overshoots greater than 5% of initial displacement (A_d), ±1 overshoot.	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. **CCA:** Test not required if cockpit controller is installed in the simulator.	''n'' is the sequential period of a full cycle of oscillation. Refer to paragraph 3 of this attachment for more information.	
(3) Yaw Control	±10% of time for first zero crossing, and ±10 (n±1)% of period thereafter, ±10% amplitude of first overshoot, ±20% of amplitude of 2nd and subsequent overshoots greater than 5% of initial displacement (A_d), ±1 overshoot.	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 3 of this attachment for more information.	
(4) Small Control Inputs	±20% Body Rates	Cruise and Approach.			X	X	This test is applicable in all three axes. Small control inputs are 5% of total travel.		
c. Longitudinal			.....	.....					
(1) Power Change Dynamics.	±3 Kts Airspeed, ±100 ft (30 m) Altitude, ±20% or ±1.5° Pitch.	Approach	X	X	X	X	Wing flaps must remain in the approach position. Record the uncontrolled free response from 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.	Takeoff, and Approach.	X	X	X	X	Record the uncontrolled free response from 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.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(3) Spoiler/Speedbrake Change Dynamics.	±3 Kts Airspeed, ±100 ft (30 m) Altitude, ±20% or ±1.5° Pitch.	Cruise	X	X	X	X	Record the uncontrolled free response from 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.
(4) Gear Change Dynamics.	±3 Kts Airspeed, ±100 ft (30 m) Altitude, ±20% or ±1.5° Pitch.	Takeoff, Second Segment Climb, and Approach.	X	X	X	X	Record the time history of uncontrolled free response for a time increment from 5 seconds before the configuration change is initiated to 15 seconds after the configuration change is completed. (**CAA:** Test in Normal and Non-normal control state).	.....	Yes.
(5) Alternate Landing Gear and Alternate Flap/Slat Operating Times.	±1 second or ±10% of Time	Takeoff and Approach.	X	X	X	X	Record all data throughout full range. Record extension and retraction for alternate flap operation. Record extension only for alternate gear operation. Tabular data from production airplanes are acceptable.	Intermediate increment times are not required.	Yes.
(6) Longitudinal Trim	±1° Pitch Control (Stab and Elev.), ±1° Pitch Angle, ±5% Net Trust or Equivalent.	Cruise, Approach, and Landing.	X	X	X	X	May be Snapshot Tests. (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.
(7) Longitudinal Maneuvering Stability (Stick Force/g).	±5 lb (±2.2 daN) or ±10% Column Force or Equivalent Surface Position.	Cruise, Approach, and Landing.	X	X	X	X	Record results for approximately 20° and 30° of bank for approach and landing configurations. Record results for approximately 20°, 30°, and 45° of bank for the cruise configuration. May be a series of shapshot test results. (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(8) Longitudinal Static Stability.	±5 lb (±2.2 daN) or ±10% Column Force or Equivalent Surface Position.	Approach	X	X	X	X	Record results for at least 2 speeds above and 2 speeds below trim speed. May be a series of shapshot test results. (**CCA:** Test in Normal or Non-normal control state).	.....	Yes.
(9) Stick Shaker, Airframe Buffet, Stall Speeds.	±3 Kts Airspeed, ±2° Bank for speeds higher than stick shaker or initial buffet, Airplanes with reversible flight control systems, ±10% or ±5 lb (2.2 daN)) Stick/Column force.	Second Segment Climb, and Approach or Landing.	X	X	X	X	Record the stall warning signal and buffet on-set, if applicable. The 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 Non-normal control state).	.....	Yes.
(10) 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.
(11) Short Period Dynamics.	±1.5° Pitch 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									
(1) Minimum Control Speed, Air (V_{mca}), per Applicable Airworthiness Standard or Low Speed Engine Inoperative Handling Characteristics in Air.	±3 Kts Airspeed	Takeoff or Landing (Whichever is most critical in the airplane).	X	X	X	X	(**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% Roll Rate or ± 2°/sec. Additionally, for those simulators of airplanes with reversible flight control systems: wheel force ±10% or ±3lb (1.3 daN).	Cruise, and Approach or Landing.	X	X	X	X	Record results for normal wheel deflection (about 30%).		

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(3) Roll Response to Cockpit Roll Controller Step Input.	±10% or ±2°/sec. roll rate	Approach or Landing.	X	X	X	X	Record from initiation of roll through 15 seconds after control is returned to neutral and released. After the roll rate is established, the controller is returned to neutral and the remaining response is to be ''hands-off.'' (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.
(4) Spiral Stability	±2° Bank or ±10% in 20 seconds. Bank must be in the proper direction.	Cruise	X	X	X	X	Record results for both directions. Airplane data averaged from multiple tests may be used. (**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 Snapshot Tests.	.....	Yes.
(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	X	Record results for at least 6 cycles with stability augmentation OFF. (**CCA:** Test in Non-normal control state).	.....	Yes.
(8) 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. Additionally, for those 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).	Approach or Landing.	X	X	X	X	Propeller driven airplanes must test in each direction. May be a series of shapshot test results using at least two rudder positions.	.....	Yes.
e. Landings									

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(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. Results with medium, light, and near maximum landing weights must be shown. (**CCA:** Test in Normal and Non-normal control state).	Derotation may be shown as a separate segment from the time of MLG touch down.	Yes.
(2) Minimum/No 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 9/2.2 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.	Derotation may be shown as a separate segment from the time of MLG touch down.	
(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. Additionally, for those 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).	Landing		X	X	X	Record results from a minimum of 200 ft (61 m) AGL, through nosewheel touch down, to 50% of V_{REF} speed. Use maximum demonstrated crosswind if available. If not available use 20 kts.	.....	Yes.
(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.	Landing		X	X	X	Record results from a minimum of 200 ft (61 m) AGL, through nosewheel touch down, to 50% of V_{REF} speed.	.....	Yes.
(5) Autoland (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 from Maximum demonstrated crosswind (autoland) deviation.	Landing			X	X	Record Lateral Deviation and continue to Autopilot disconnect.	This test is not a substitute for the Ground Effects test requirement.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(6) Go Around	±3 Kts Airspeed, ±1.5° Pitch, ±1.5° Angle of Attack.	Go Around			X	X	Additionally, a Go Around with an engine inoperative is required. This test must be conducted at near maximum landing weight and with the critical engine inoperative. (Not required for single-engine airplanes.) A normal, all-engines-operating, Go Around with the autopilot engaged must also be demonstrated (if applicable) at medium landing weight. (**CCA:** Test in Normal and Non-normal control state).		
(7) Directional Control (Rudder Effectiveness) with symmetric reverse thrust.	±2 deg/sec yaw rate	On Ground		X	X	X	Record results from a speed approximating touchdown speed to the minimum thrust reverser operation speed. Airplane manufacturer's engineering simulator data may be considered as an alternative. Yaw control is applied in both directions until reaching minimum thrust reverser operation speed.		
(8) Directional Control (Rudder Effectiveness) with asymmetric reverse thrust.	±5 knots	On Ground		X	X	X	Maintain heading with yaw control. Record results from a speed approximating touchdown speed to a speed at which control of yaw cannot be maintained. The tolerance applies to this lower speed. Airplane manufacturer's engineering simulator data may be considered as an alternative.		
f. Ground Effect									
Demonstrate Longitudinal Ground Effect.	±1° Elevator or Stabilizer Angle, and ±5% Net Thrust or Equivalent, and ±1° Angle of Attack, and ±10% Height/Altitude or ±5 ft (1.5 m), and ±3 Knots Airspeed, and ±1° Pitch Attitude.	Landing		X	X	X	The Ground Effect model must be validated by the test selected and a rationale must be provided for selecting the particular test.	The test selected for validation is at the option of the sponsor. See paragraph 6, Ground Effect, in this attachment for additional information.	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
g. Brake Fade									
Demonstrate Decreased Braking Efficiency Due to Brake Temperature.	None	Takeoff or Landing			X	X	An SOC is required. The demonstration must show decreased braking efficiency due to brake temperature. Substantiating data must be provided.		
h. Windshear									
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.	
i. Envelope Protection Functions									
The requirements of tests i. (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. Flight test data must be provided for both normal and non-normal control states.									
(1) Overspeed	±5 Kts Airspeed	Cruise			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(2) Minimum Speed	±3 Kts Airspeed	Takeoff, Cruise, and Approach or Landing.			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(3) Load Factor	±0.1g Normal Acceleration	Takeoff and Cruise			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(4) Pitch Angle	±1.5° Pitch	Cruise, and Go Around.			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(5) Bank Angle	±2° or ±10% Bank	Approach			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(6) Angle of Attack	±1.5° AOA	Second Segment Climb, and Approach or Landing.			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
3. Motion System									
a. Minimum Excursion									
1) Pitch	At least ±40°	N/A	X	X			An SOC is required for 3.a.(1) through (6). (Applicable to Initial evaluations only.) The ''*'' in the Simulator Level column applies if this DOF is used..		
(2) Roll	At least ±40°	N/A	X	X					
(3) Yaw	At least ±45°	N/A	*	*					
(4) Heave	At least 40 inches total movement.	N/A	*	X					
		N/A	X	X					
(5) Sway	At least 45 inches total movement.	N/A	*	*					
(6) Surge	At least 50 inches total movement.								
(7) Pitch	At least ±50°	N/A			X	X	An SOC is required for 3.a.(7) through (12). (Applicable to Initial evaluations only.).		
(8) Roll	At least ±50°	N/A			X	X			
(9) Yaw	At least ±50°	N/A			X	X			
(10) Heave	At least 68 inches total movement.	N/A			X	X			

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(11) Sway	At least 90 inches total movement.	N/A			X	X			
(12) Surge	At least 68 inches total movement.	N/A			X	X			
b. Minimum Acceleration									
(1) Pitch	At least 80°/sec²	N/A	X	X			An SOC is required for 3.b.(1) through (6). (Applicable to Initial evaluations only.) The ''*'' in the Simulator Level column applies if this DOF is used.		
(2) Roll	At least 80°/sec²	N/A	X	X					
(3) Yaw	At least 80°/sec²	N/A	*	*					
(4) Heave	At least 0.6g in each direction	N/A	*	X					
(5) Sway	At least 0.6g in each direction	N/A	X	X			An SOC is required for 3.b.(7) through (12). (Applicable to Initial evaluations only.).		
(6) Surge	At least 0.6g in each direction	N/A	*	*					
(7) Pitch	At least 100°/sec²	N/A			X	X			
(8) Roll	At least 100°/sec²	N/A			X	X			
(9) Yaw	At least 100°/sec²	N/A			X	X			
(10) Heave	At least 0.8g in each direction	N/A			X	X			
(11) Sway	At least 0.6g in each direction	N/A			X	X			
(12) Surge	At least 0.6g in each direction	N/A			X	X			
c. Minimum Velocity									
(1) Pitch	At least 20°/sec	N/A	X	X			An SOC is required for 3.c.(1) through (6). (Applicable to Initial evaluations only.) The ''*'' in the Simulator Level column applies if this DOF is used.		
(2) Roll	At least 20°/sec	N/A	X	X					
(3) Yaw	At least 20°/sec	N/A	*	*					
(4) Heave	At least 20 in/sec	N/A	*	X					
(5) Sway	At least 20 in/sec	N/A	X	X					
(6) Surge	At least 20 in/sec	N/A	*	*					
(7) Pitch	At least 20°	N/A			X	X	An SOC is required for 3.c.(7) through (12). (Applicable to Initial evaluations only.).		
(8) Roll	At least 20°	N/A			X	X			
(9) Yaw	At least 20°	N/A			X	X			
(10) Heave	At least 24/in sec	N/A			X	X			
(11) Sway(12) Surge	At least 28/in sec	N/A			X	X			
	At least 28/in sec	N/A			X	X			
d. Frequency Response									
Phase lag	Not to exceed 45° at 4 Hz	N/A	X	X	X	X	A demonstration is required and must be made part of the MQTG. Iinject an acceleration command into the kinematic transformation equations and measuring the acceleration output of the motion platform. The response bandwidth must be determined in each applicable translational degree of freedom.		
e. Motion Cue									

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
Repeatability	.....	N/A	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 continues to perform as originally qualified. An example demonstration is described in paragraph 7, Motion Cue Repeatability.		
4. Sound System [Reserved]									

Begin Information

5. 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 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 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 nonuniform 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, ±20% of Subsequent Peaks
$T(A_d)$ ±5% 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 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.)

f. Tolerances.

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

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

g. The NPSM 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

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6. Ground Effect

Begin Information

a. During landing and takeoff, airplanes operate close to the ground for brief time intervals. The presence of the ground significantly modifies the air flow past the airplane and changes the aerodynamic characteristics. The close proximity of the ground imposes a barrier which inhibits the downward flow normally associated with the production of lift. The downwash is a function of height with the effects usually considered to be negligible above a height of approximately one wingspan. There are three main effects of the reduced downwash:

(1) A reduction in downwash angle at the tail for a conventional configuration.

(2) An increase in both wing and tail lift because of changes in the relationship of lift coefficient to angle of attack (increase in lift curve slope).

(3) A reduction in the induced drag.

b. Relative to out-of-ground effect flight (at a given angle of attack), these effects result in higher lift in ground effect and less power required for level flight. Because of the associated effects on stability, they also cause significant changes in elevator (or stabilizer) angle to trim and stick (column) forces required to maintain a given lift coefficient in level flight near the ground.

c. For a simulator to be used for takeoff and in particularly landing credit, it must faithfully reproduce the aerodynamic changes which occur in ground effect. The parameters chosen for simulator validation must obviously be indicative of these changes. The primary validation parameters for longitudinal characteristics in ground effect are:

(1) Elevator or stabilizer angle to trim.

(2) Power (thrust) required for level flight (PLF).

(3) Angle of attack for a given lift coefficient.

(4) Height/altitude.

(5)Airspeed.

d. The above list of parameters assumes that ground effect data is acquired by tests during ''fly-bys'' at several altitudes in and out of ground effect. These test altitudes would normally, as a minimum, be at 10 percent, 30 percent, and 70 percent of the airplane wingspan and one altitude out of ground effect; *e.g.*, 150 percent of wingspan. Level fly-bys are required for Level D; and, while they are acceptable for all levels, they are not required for Level C and Level B.

e. If, in lieu of the level fly-by method for Levels B and C, other methods such as shallow glidepath approaches to the ground maintaining a chosen parameter constant are proposed, then additional validation parameters are important. For example, if constant attitude shallow approaches are chosen as the test maneuver, pitch attitude, and flight path angle are additional necessary validation parameters. The selection of the test methods and procedures to validate ground effect is at the option of the organization performing the flight tests; however, rationale must be provided to conclude that the tests performed do indeed validate the ground effect model.

f. Tolerances (longitudinal parameters) for validation of ground effect characteristics are:

(1) Elevator or Stabilizer Angle ±1°

(2) Power for Level Flight (PLF)±5%

(3) Angle of Attack ±1°

(4) Altitude/Height ±10% or 5 feet (1.5 m.)

(5) Airspeed ±3 Knots

(6) Pitch Attitude ±1°

g.The lateral-directional characteristics are also altered by ground effect. Because of the above-mentioned changes in lift curve slope, roll damping, as an example, is affected. The change in roll damping will affect other dynamic modes usually evaluated for 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 must be accounted for in the simulator modeling. Several tests such as ''crosswind landing,'' ''one engine inoperative landing,'' and ''engine failure on takeoff'' serve to validate lateral-directional ground effect since portions of them are accomplished while transiting altitudes at which ground effect is an important factor.

End Information

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7. Motion Cue Repeatability

Begin Information

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 an airplane 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) are adjusted to ensure that the motion is exercised through approximately ⅔ of the maximum displacement capability in each axis. The time segment T_0–T_1, must be of sufficient duration to ensure steady initial conditions.

End Information

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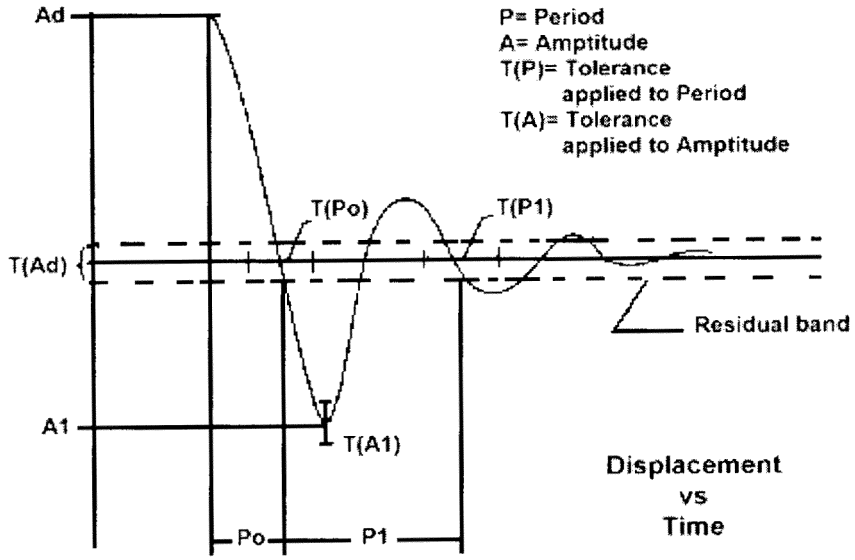
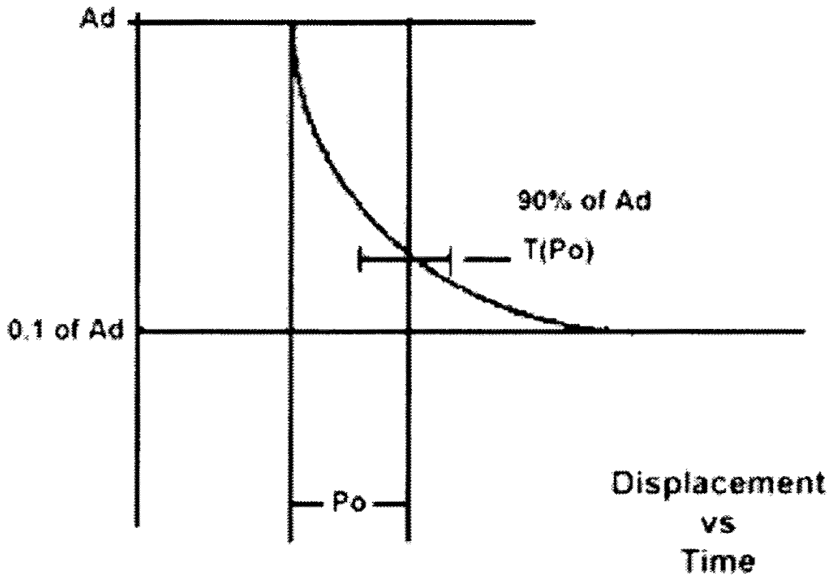


ATTACHMENT 2 TO APPENDIX A TO PART 60—

FIGURE 1. UNDER-DAMPED STEP RESPONSE

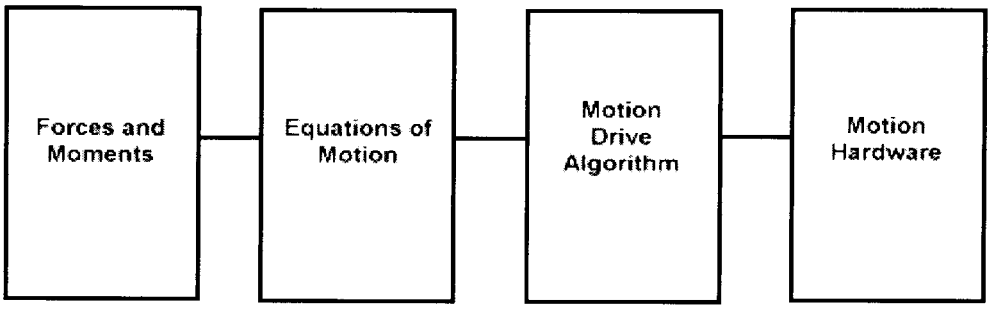


ATTACHMENT 2 TO APPENDIX A TO PART 60—

FIGURE 2. CRITICALLY-DAMPED STEP RESPONSE

ATTACHMENT 2 TO APPENDIX A TO PART 60—

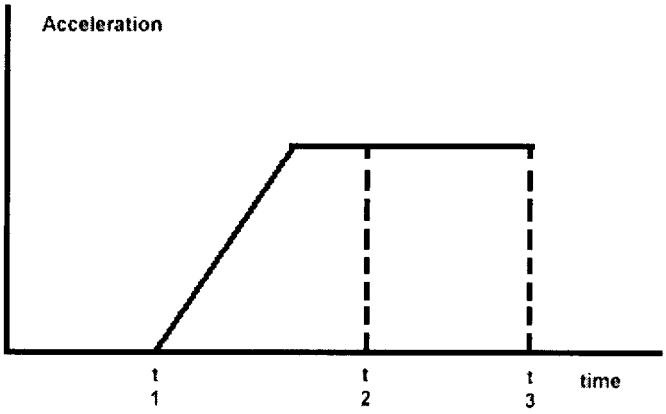
FIGURE 3. ACCELERATION TEST SIGNALS



Note to Figure 3: 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.

ATTACHMENT 2 TO APPENDIX A TO PART 60—

FIGURE 4, ACCELERATION TEST SIGNAL



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Note to Figure 4: 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.

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

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 test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
2.a.(1) Performance. Taxi. Minimum Radius turn.	X	X	TIR, AFM, or Design data may be used.	
2.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.
2.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.	
2.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.
2.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.	
2.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.

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION INFORMATION—Continued

Table of objective test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
2.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.
2.b.(7) Performance. Takeoff. Rejected Takeoff.	X	X	Data may be acquired with a synchronized video of: Calibrated airplane instruments, thrust lever position, engine parameters, and distance (e.g., runway markers). A stop watch is required.	
2.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.	
2.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.	
2.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.	
2.e.(1) Performance. Ground. Deceleration Time and Distance, using manual application of wheel brakes and no reverse thrust.	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.	
2.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.	
2.f.(1) Performance. Engines. Acceleration.	X	X	Data may be acquired with a synchronized video recording of: engine instruments and throttle position.	
2.f.(2) Performance. Engines. Deceleration.	X	X	Data may be acquired with a synchronized video recording of: engine instruments and throttle position.	
3.a.(1) Handling Qualities. Static Control Checks. Column 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.	

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION INFORMATION—Continued

Table of objective test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
3.a.(2) Handling Qualities. Static Control Checks. Wheel 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 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.	
3.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.	
3.a.(4) Handling Qualities. Static Control Checks. Nosewheel Steering 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.	
3.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.	
3.a.(6) Handling Qualities. Static Control Checks. Pitch Trim Calibration (Indicator vs. Computed) and Rate.	X	X	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.).	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.	
3.a.(8) Handling Qualities. Static Control Checks. Brake Pedal Position vs. Force and Brake System Pressure.	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.	
3.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.	
3.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.	

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION INFORMATION—Continued

Table of objective test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
3.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 instruments and spoiler/speedbrake position.	
3.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.	
3.c.(5) Handling Qualities. Longitudinal. Alternate Landing Gear and Alternate Flap/Slat Operating Times.	X	X	May use design data, production flight test schedule, or maintenance specification, together with an SOC.	
3.c.(6) 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.	
3.c.(7) 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 column force measurement indication.	
3.c.(8) 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.	
3.c.(9) Handling Qualities. Longitudinal. Stick Shaker, Airframe Buffet, Stall Speeds.	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.	
3.c.(10) Handling Qualities. Longitudinal. Phugoid Dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplaine instruments and the force/position measurements of cockpit controls.	
3.c.(11) 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.	
3.d.(1) Handling Qualities. Lateral Directional. Minimum Control Speed, Air (V_{mca}), per Applicable Airworthiness Standard or Low Speed Engine. Inoperative Handling Characteristics in 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.	
3.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 controls.	

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION INFORMATION—Continued

Table of objective test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
3.d.(4) Handling Qualities. Lateral Directional. Spiral Stability.	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; and a stop watch.	
3.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 fore/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.
3.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.	
3.d.(7) Handing 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: a calibrated airplane instruments; the force/position measurements of cockpit controls.	
3.d.(8) Handling Qualities. Laterial 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.	
3.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.	
3.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.	
3.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 laterial acceleration may be recorded in lieu of AOA and sideslip.	
3.f. Handling Qualities. Ground Effect. Demonstrate Longitudinal Ground Effect.		X	Data may be acquired by using an calibrated 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 Tests

1. 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 satisfactorily meets the appropriate training/testing/checking objectives and competently simulates each required maneuver, procedure, or task; and verifying correct operation of the simulator controls, instruments, and systems. The items in the list of operations tasks 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 found in the Pilot Qualification Performance 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 in paragraph 2 of 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 List of Simulator Systems in paragraph 3 of 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.

e. Simulators demonstrating a satisfactory circling approach will be recommended for approval for the circling approach maneuver as determined by the TPAA in the sponsor's FAA-approved flight training program. To be considered satisfactory here, the circling approach will be flown at maximum gross weight for landing, with minimum visibility, 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

2. List of Operations Tasks

Begin QPS Requirements

The NSPM will evaluate the simulator in the following Operations Tasks, as applicable to the airplane and simulator level, using the sponsor's approved manuals and checklists.

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 design and functions replicate the appropriate airplane.

b. Surface Operations (Pre-Takeoff)

(1) Engine start.
(a) Normal start.
(b) Alternate start operations.
(c) Abnormal starts and shutdowns (hot start, hung start, *etc.*).
(2) Pushback / Powerback.
(3) Taxi
(a) Thrust response.
(b) Power lever friction.
(c) Ground handling.
(d) Nosewheel scuffing.
(e) Brake operation (normal and alternate/emergency).
(f) Ground hazard.
(g) Surface Movement and Guidance System (SMGS).
(h) Other.

c. Takeoff

(1) Normal. (Day, Night, Dusk (or Twilight))
(a) Propulsion system checks (*e.g.*, engine parameter relationships; propeller and mixture controls).
(b) Airplane acceleration characteristics.
(c) Nosewheel and rudder steering.
(d) Crosswind (maximum demonstrated).
(e) Special performance.
(f) Lowest visibility takeoff.
(g) Landing gear, wing flap, leading edge device operation.
(h) Other.
(2) Abnormal/Emergency.
(a) Rejected, with brake fade (if applicable) due to rising brake temperature.
(b) Rejected, special performance.
(c) With propulsion system malfunction:
(i) Prior to V_1 (decision) speed.
(ii) Between V_1 and V_r (rotation speed).
(iii) Between V_r and 500 feet above ground level.
(d) Flight control system failure modes.
(e) Other.

d. Inflight Operation

(1) Climb.
(a) Normal.
(b) One engine inoperative operations.
(c) Other.
(2) Cruise.
(a) Performance characteristics (speed vs. power).
(b) Normal turns and turns with/without spoilers (speed brake) deployed.
(c) High altitude handling.
(d) High indicated airspeed handling, over-speed warning.
(e) Mach effects on control and trim.
(f) Normal and steep turns.
(g) Performance turns.
(h) Approach to stalls in the following configurations:
(i) Cruise;
(ii) Takeoff or approach; and
(iii) Landing.
(a) High angle of attack maneuvers in the following configurations:
(i) Cruise;
(ii) Takeoff or approach; and
(iii) Landing.
(j) Inflight engine shutdown.
(k) Inflight engine restart.
(l) Maneuvering with one or more engines inoperative, as applicable.
(m) Slow flight.
(n) Specific flight characteristics.
(o) Manual flight control reversion (*i.e.*, loss of all flight control power).
(p) Other flight control system failure modes.
(q) Holding.
(r) Airborne hazard.
(s) Operations during icing conditions.
(t) Upset / disturbance recovery.
(u) Unusual attitude recovery.
(v) Traffic alert and collision avoidance.
(w) Effects of airframe icing.
(x) Other.
(3) Descent.
(a) Normal.
(b) Maximum rate (clean, with speedbrake extended, etc.) and recovery.
(c) Flight Control System Failure Modes (*e.g.*, manual flight control reversion; split controls, *etc.*).
(d) High rate of sink and recovery.
(a) Other.

e. Approaches

(1) Instrument Approach Maneuvers.
(a) Non-precision:
(i) Non-Directional Beacon (NDB).
(ii) VHF Omni-Range (VOR), Area Navigation (RNAV), Tactical Air Navigation (TACAN).
(iii) Distance Measuring Equipment, Arc (DME ARC).
(iv) ILS Localizer Back Course (LOC/BC).
(v) Localizer Directional Aid (LDA), ILS Front Course Localizer (LOC), Simplified Direction Facility (SDF).
(vi) Airport Surveillance Radar (ASR).
(vii) Global Positioning System (GPS).
(viii) With one engine inoperative.

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

f. Missed Approach

(1) Manual.
(2) Automatic (if applicable).

g. Visual Segment and Landing

(1) Normal (Night visual scene for Level A and Level B simulators; Night and Dusk (or Twilight) visual scenes for Level C simulators; and Night, Dusk (or Twilight), and Daylight visual scenes for Level D simulators.)
(a) From visual traffic pattern.
(b) From non-precision approach.
(c) From precision approach.
(d) With maximum demonstrated crosswind.
(e) From circling approach.
(2) Abnormal/emergency.
(a) With engine(s) inoperative—
(i) For 2-engine airplanes, one engine inoperative.
(ii) For 3-engine airplanes, one wing-mounted and the center engine inoperative.
(iii) For other multi-engine airplanes, a 50% power loss on one side of the airplane.
(b) Rejected landing.
(c) With standby (or minimum) electric/hydraulic power.
(d) With longitudinal trim malfunction
(e) With jammed or mis-trimmed horizontal stabilizer.
(f) With lateral-directional trim malfunction.
(g) With worst case failure of flight control system (most significant degradation of the computer controlled airplane which is not extremely improbable).
(h) Other flight control system failure modes as dictated by training program.
(i) Land and hold short operations.
(j) Other.

h. Windshear

(1) Takeoff.
(2) Climb.
(3) Approach.

i. Surface Operations (Post Landing)

(1) Landing roll.
(2) Spoiler operation.
(3) Reverse thrust operation.
(4) Wheel brake operation.
(5) Ground hazard.
(6) Surface Movement and Guidance System (SMGS).
(7) Other.

J. Any Flight Phase

(1) Air conditioning.
(2) Anti-icing/deicing.
(3) Auxiliary powerplant.
(4) Communications.
(5) Electrical.
(6) Fire detection and suppression.
(7) Flaps/Slats.
(8) Flight controls (including spoiler/speedbrake).
(9) Fuel and oil.
(10) Hydraulic.
(11) Landing gear.
(12) Oxygen.
(13) Pneumatic.
(14) Propulsion System.
(15) Pressurization.
(16) Flight management and guidance systems.
(17) Automatic landing aids.
(18) Automatic pilot.
(19) Thrust management/auto-throttle.
(20) Flight data displays.
(21) Flight management computers.
(22) Flight director/system displays.
(23) Flight Instruments.
(24) Heads-up flight guidance system.
(25) Navigation systems.
(26) Weather radar system.
(27) Stall warning/avoidance.
(28) Stability and control augmentation.
(29) ACARS.
(30) Other

k. Engine Shutdown and Parking

(1) Systems operation.
(2) Parking brake operation.

3. List of Simulator Systems

a. Instructor Operating Station (IOS)

(1) Power switch(es).
(2) Airplane conditions.
(a) Gross weight, center of gravity, fuel loading and allocation, *etc.*
(b) Airplane systems status.
(c) Ground crew functions (*e.g.*, external power connections, push back, *etc.*)
(d) Other.
(3) Airports.
(a) Number and selection.
(b) Runway selection.
(c) Runway 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) Clouds (base and tops).
(b) Visibility (statute miles (kilometers)).
(c) Runway visual range (in feet (meters)).
(d) Temperature.
(e) Climate conditions (*e.g.*, ice, snow, rain, *etc.*).
(f) Wind speed and direction.
(g) Windshear.
(h) Other.
(5) Airplane 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. Motion/Control Loading System

(1) On/off/emergency stop.
(2) Crosstalk (motion response in a given degree of freedom not perceptible in other degrees of freedom).
(3) Smoothness (no perceptible ''turn-around bump'' as the direction of motion reverses with the simulator being ''flown'' normally).

d. Observer Stations

(1) Position.
(2) Adjustments.
(3) Positive seat restraint system.

End QPS Requirements

Attachment 4 to Appendix A to Part 60—Definitions and Abbreviations

1. Definitions

Begin Regulatory Language (14 CFR Part 1 and § 60.3)

(From Part 1—Definitions)

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

Flight simulator means a full size replica of a specific type or make, model, and series aircraft cockpit. It includes the assemblage of equipment and computer programs necessary to represent the aircraft in ground and flight operations, 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 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 standards (QPS) for a specific qualification level.

Flight training device (FTD) means a full size 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 the aircraft or set of aircraft 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 part and the qualification performance standard (QPS) for a specific qualification level.

(From Part 60—Definitions)

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.

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

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

Master Qualification Test Guide (MQTG). The FAA-approved Qualification Test Guide with the addition of the FAA-witnessed test, performance, or demonstration results, applicable to each individual FSD.

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 comparison of simulator performance data to actual or predicted aircraft performance data to ensure FSD performance is within the tolerances prescribed in the QPS.

Predicted data. Aircraft performance data derived from sources other than direct physical measurement of, or flight tests on, the subject aircraft. Predicted data may include engineering analysis and simulation, design data, wind tunnel data, estimations or extrapolations based on existing flight test data, or data from other models.

Qualification level. The categorization of the FSD, based on its demonstrated technical and operational capability as set out in the QPS.

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 FSD requirements, for establishing FSD qualification levels.

Qualification Test Guide (QTG). The primary reference document used for evaluating an aircraft FSD. It contains test results, performance or demonstration results, statements of compliance and capability, the configuration of the aircraft simulated, and other information for the evaluator to assess the FSD against the applicable regulatory criteria.

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.

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

Subjective test. A qualitative comparison to determine the extent to which the FSD performs and handles like the aircraft being simulated.

Training Program Approval Authority (TPAA). A person authorized by the Administrator to approve the aircraft flight training program in which the FSD will be used.

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

End Regulatory Language (14 CFR Part 1 and § 60.3)

Begin QPS Requirements

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.

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.

Automatic Testing—is simulator 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.

Closed Loop Testing—is a test method for which the input stimuli are generated by controllers which drive the simulator to follow a pre-defined target response.

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.

Computer Controlled Airplane—is an airplane where all pilot inputs to the control surfaces are transferred and augmented by computers.

Convertible Flight Simulator—is a simulator in which hardware and software can be changed so that the simulator becomes a replica of a different model, usually of the same type airplane. The same simulator 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.

Driven—is a test method where the input stimulus or variable is positioned by automatic means, generally a computer input.

Free Response—is the response of the simulator after completion of a control input or disturbance.

Frozen—is a test condition where one or more variables are held constant with time.

Fuel used—is the amount or mass of fuel used (kilograms or pounds).

Ground Effect—is the change in aerodynamic characteristics due to modification of the air flow 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 simulator 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 simulator such that all airplane 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 simulator testing wherein the pilot conducts the test without computer inputs except for initial setup and all modules of the simulation are active.

Medium—is the normal operational weight for a given flight segment.

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.

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.

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.

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.

Sideslip—is the angular difference between the airplane heading and the direction of movement in the horizontal plane.

Simulation Data—are the various types of data used by the simulator manufacturer and the applicant to design, manufacture, and test the simulator.

Simulator Approval—is the extent to which a simulator may be used by a certificate holder as authorized by the FAA. It takes account of airplane to simulator differences and the training ability of the organization.

Simulator Latency—is the additional time beyond that of the response time of the airplane due to the response of the simulator.

Snapshot—is a presentation of one or more variables at a given instant of time.

Source Data—are, for the purpose of this document, performance, stability and control, and other necessary test parameters electrically or electronically recorded in an airplane using a calibrated data acquisition system of sufficient resolution and verified as accurate by the company performing the test to establish a reference set of relevant parameters to which like simulator parameters can be compared.

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 simulator 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.

Surge—is simulator movement with respect to or along the longitudinal axis.

Sway—is simulator 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)—is the person who exercises authority on behalf of the Administrator in approving the aircraft flight training program for the appropriate airplane in which the simulator will be used. This person is the principal operations inspector (POI) for programs approved under 14 CFR parts 63, 121, 125, or 135; or the training center program manager (TCPM) for programs approved under 14 CFR part 141 or 142.

Transport Delay or ''Throughput''—is the total simulator 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.

Validation Data—are data used to determine if the simulator performance corresponds to that of the airplane.

Validation Test—is a test by which simulator parameters are compared to the relevant validation data.

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.

End QPS Requirements

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2. Abbreviations

Begin QPS Requirements

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/m^2 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
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.
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.
M,m—Meters, 1 Meter = 3.28083 feet.
Min(s)—Minute, minutes.
MLG—h;Main Landing Gear.
Mpa—MegaPascals (1 psi = 6894.76 pascals).
ms—millisecond(s).
N—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.
nm—Nautical Mile(s) 1 Nautical Mile = 6,080 feet.
NN—NON-NORMAL CONTROL Used in reference to Computer Controlled Airplanes.
NWA—Nosewheel Angle (degrees).
PAPI—Precision Approach Path Indicator System.
PLA—Power Lever Angle.
Pf—Impact or Feel Pressure, often expressed as ''q.''.
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.
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.
Vr—Rotate Speed.

Vs—Stall Speed or minimum speed in the stall.
WAT—Weight, Altitude, Temperature.

End QPS Requirements

Attachment 5 to Appendix A to Part 60—Sample Documents

Table of Contents

Title of Sample

BILLING CODE 4910–13–P

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 1 – Sample Letter of Request.

INFORMATION

Date

Name, POI. _____(Certificate Holder)

FAA FSDO _____

Address

City, State, Zip

Dear Mr./Ms. _____:

(Sponsor's name) _____ requests evaluation of our (type) _____ airplane simulator for Level _____ qualification. The (name) _____ simulator with (name) _____visual system is fully defined on page _____ of the accompanying qualification test guide (QTG). We have completed tests of the simulator 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 Airplane Flight Simulator 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) _____ airplane, has(have) assessed the simulator and found that it conforms to the (sponsor name) _____ (type) _____ airplane cockpit configuration and that the simulated systems and subsystems have been evaluated and found to function equivalently to those in the airplane. The above named pilot(s) has(have) found that the simulator represents the respective airplane in accordance with the attached Configuration List. He/She(They) has(have) also subjectively assessed the performance and flying qualities of the simulator and state that it represents the airplane. He/She(They) has(have) not subjectively tested the simulator 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 5 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 5 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 5 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 5 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:.....	BA-797-232.....	July 12, 1988
Re-configurable to:.....	BA-797-287 (see FAA ID#722)	
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 T2, Clear View, Inc.	
☐ CRT Installation:.....	5 Channel, 6 Window.....	July 12, 1988
☐ Projected System:.....	__° Horizontal Viewing Angle.....	
Flight Instruments:		
☐ Electro-Mechanical:.....	.....	July 12, 1988
☐ Display (CRT, LCD, etc.).....		
☐ Combination		
☐ Heads-Up Display.....	Jones Industries.....	December 1, 1993
Flight Director:		
☐ Single Cue.....		
☐ Dual Cue.....	Sperry.....	July 12, 1988
☐ None.....		
Engine Instruments:		
☐ Electro-Mechanical.....	.....	July 12, 1988
☐ Display (CRT, LCD, etc.).....		
☐ Combination.....		
Navigation Type(s):		
☐ ADF.....	.....	July 12, 1988
☐ VOR/ILS.....	.....	July 12, 1988
☐ GPS.....		
☐ INS.....	.....	October 10, 1991
☐ IRS.....		
Weather Radar:	Jones Industries, Inc.	August 3, 1996
Windshear Equipment		
TCAS		
ACARS		

(Continue as Necessary)

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 4B – Sample Statement of Qualification; Qualified/Non-Qualified Tasks

INFORMATION

STATEMENT of QUALIFICATION
Qualified/Non-Qualified Tasks
Go-Fast Training Center
Stratos BA-797 -- Level C -- FAA ID# 701

The following are those items listed in the Airplane Flight Simulator Qualification Performance Standards (QPS), FAA-S-120-40C, dated (May 1, 2000) Appendix 3, Subjective Tests, indicating what tasks and systems are qualified **(Q)** *and what tasks and systems are not qualified* **(NQ).**

NQ	Q	TASK		NQ	Q	TASK
		A. Preparation for Flight.				2. Abnormal/Emergency.
	X	Preflight.			X	(a) Rejected, with brake fade
		B. Surface Ops (Pre-Takeoff).		X		(b) Rejected, special perf.
		1. Engine start.				(c) Propulsion system malfunction.
	X	(a) Normal start.			X	(i) prior to V_1
	X	(b) Alternate start operations.			X	(ii) between V_1 and V_r
	X	(c) Abnormal starts			X	(iii) between V_r and 500' AGL
	X	2. Pushback		X		(d) Flight control system failure.
X		3. Powerback.			X	(e) Other.
		4. Taxi				**D. In-flight Operation.**
	X	(a) Thrust response.				1. Climb.
	X	(b) Power lever friction.			X	(a) Normal.
	X	(c) Ground handling.			X	(b) One engine inoperative.
	X	(d) Nosewheel scuffing.			X	(c) Other.
	X	(e) Brake operation				2. Cruise.
	X	(f) Ground hazard.			X	(a) Performance (speed vs. power).
X		(g) SMGS			X	(b) Turns w/wo spoilers
	X	(h) Other.			X	(c) High altitude handling.
		C. Takeoff.			X	(d) High airspeed handling
		1. Normal. (Day/Dusk/Night)		X		(e) Mach effects
X		(a) Day			X	(f) Normal and steep turns.
	X	(b) Dusk (or Twilight)		X		(g) Performance turns.
	X	(c) Night				(h) Approach to stalls
	X	(d) Propulsion system checks			X	1) cruise
	X	(e) Airplane acceleration			X	2) takeoff or approach
	X	(f) Nosewheel/rudder steering			X	3) landing
	X	(g) Crosswind (max. demo)				(i) High AOA maneuvers
X		(h) Special performance.		X		1) cruise
	X	(i) Lowest visibility.		X		2) takeoff or approach
	X	(j) Landing gear, flap/slat ops.		X		3) landing
	X	(k) Other.			X	(j) In-flight engine shutdown

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	TASK (Con't.)		NQ	Q	TASK (Con't.)
	X	(k) In-flight engine restart				(ii) ILS Category II
	X	(l) Maneuver w/ engine(s) inop.			X	A. W/Wo Auto-Couple
X		(m) Slow flight.			X	B. Engine inoperative..
X		(n) Spec flight characteristics.				(iii) ILS Category III
X		(o) Manual flight control		X		A. Min./stnby. electrical power.
X		(p) Other flight control failures		X		B. Generator/alternator failure
	X	(q) Holding.		X		C. Tail wind 10 knots
	X	(r) Airborne hazard.		X		D. Crosswind 10 knots
	X	(s) Ops. in icing conditions		X		E. Rollout.
	X	(t) Upset / disturbance recovery		X		F. Engine inoperative.
	X	(u) Unusual attitude recovery				(iv). Missed approach
X		(v) TCAS			X	A. All engines operating.
	X	(w) Effects of airframe icing.			X	B. One engine inoperative.
	X	(x) Other.				(v) PAR
		3. Descent.		X		A. Normal
	X	(a) Normal.		X		B. With crosswind.
	X	(b) Max. rate and recovery		X		C. With one engine inoperative.
X		(c) Flight control failure		X		D. Missed approach.
	X	(d) High sink rate and recovery.				(vi) DGPS
	X	(e) Other.		X		A. Normal
		E. Approaches.		X		B. With crosswind.
		1. Instrument Approach		X		C. With one engine inoperative.
		(a) Non-precision:		X		D. Missed approach.
	X	(i) NDB				(vi) MLS.
	X	(ii) VOR,		X		A. Normal
X		(iii)RNAV,		X		B. With crosswind.
X		(iv)TACAN		X		C. With one engine inoperative.
	X	(v) DME Arc		X		D. Missed approach.
	X	(vi) LOC/FC.				(vii) Steep Glide Path.
	X	(vii) LOC/BC,		X		A. Normal
X		(viii) LDA,		X		B. With crosswind.
X		(ix) SDF		X		C. With one engine inoperative.
X		(x) ASR.		X		D. Missed approach.
X		(xi) GPS.				2. Visual Approach Maneuvers.
	X	(xii) With engine inoperative			X	(a) Abnormal wing flaps/slats
	X	(xiii) Missed approach.			X	(b) No G/S or visual flightpath aid.
		(b) Precision:		X		(c) Circling Approach.
		(i) ILS Category I				3. Abnormal/emergency.
	X	A. Manual w/wo flight director			X	(a) One engine inoperative.
	X	B. Max. crosswind			X	(b) Min. electric/hydraulic power.
	X	C. Windshear.			X	(c) Pitch trim malfunction.
	X	D. Engine inoperative.			X	(d) Jammed horizontal stabilizer.

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	TASK (Con't.)		NQ	Q	TASK (Con't.)
	X	(e) Roll/Yaw trim malfunction.			X	5. Ground hazard.
X		(f) Worst Flt Cont fail. (+CCA).		X		6. SMGS.
X		(g) Other failures / trng. prog.			X	7. Other.
X		(h) LAHSO ops.				**J. Any Flight Phase.**
	X	(i) Other.			X	1. Air conditioning.
		F. Missed approach.			X	2. Anti-icing/deicing.
	X	1. Manual.			X	3. Auxiliary powerplant.
X		2. Automatic (if applicable).			X	4. Communications.
		G. Visual Segment / Landing.			X	5. Electrical.
		1. Normal			X	6. Fire detection and suppression.
X		(a) Day			X	7. Flaps/Slats.
	X	(b) Dusk (or Twilight)			X	8. Flight cont (+ spoiler/spdbrake).
	X	(c) Night			X	9. Fuel and oil.
	X	(b) From visual traffic pattern.			X	10. Hydraulic.
	X	(c) From NP approach.			X	11. Landing gear.
	X	(d) From precision approach			X	12. Oxygen.
	X	(e) Max. crosswind.			X	13. Pneumatic.
X		(f) From circling approach.			X	14. Propulsion System.
		2. Abnormal/emergency.			X	15. Pressurization.
		(a) With engine(s) inoperative –			X	16. Flt mgmt / guidance systems.
X		(i) 2-eng airpl, one inop.			X	17. Auto landing aids.
X		(ii) 3-eng airpl, wing+ctr. inop.			X	18. Auto-pilot.
	X	(iii) 4+eng airpl, 50%, one side.			X	19. Auto-throttle.
	X	(b) Rejected landing.			X	20. Flight data displays.
	X	(c) Min. elect./hyd. power.			X	21. Flight mgmt computers.
	X	(d) Pitch trim malfunction			X	22. Flight Director.
	X	(e) Jammed horizontal stab.			X	23. Flight Instruments.
	X	(f) Roll/Yaw trim malfunction.			X	24. HUD system.
X		(g) Worst Flt Cont fail.(+CCA).			X	25. Navigation systems.
X		(h) Other failures in trng. prog.			X	26. Weather radar.
X		(i) LAHSO ops.			X	27. Stall warning/avoidance.
	X	(j) Other.		X		28. Stability augmentation.
		H. Windshear.		X		29. ACARS.
	X	1. Takeoff.			X	30. Other.
	X	2. Climb.				**K. Eng. Shutdown and Parking.**
	X	3. Approach.			X	1. Systems operation.
		I. Surface Ops (Post Landing).			X	2. Parking brake operation.
	X	1. Landing roll.				
	X	2. Spoiler operation.				
	X	3. Reverse thrust operation.				
	X	4. Wheel brake operation.				

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	SIMULATOR SYSTEM		NQ	Q	SIMULATOR SYSTEM
		A. Inst. Ops. Station (IOS).				**B. Sound Controls.**
	X	1. Power switch(es).			X	-- On / off / rheostat
		2. Airplane conditions.				**C. Motion/Cont. Load. System.**
	X	(a) GW, CG, Fuel weight, etc.			X	1. On / off / emergency stop.
	X	(b) Airplane systems status.			X	2. Crosstalk
	X	(c) Ground crew functions			X	3. Smoothness
	X	(d) Other.				**D. Observer Stations.**
		3. Airports.			X	1. Position.
	X	(a) Number and selection.				
	X	(b) Runway selection.				
	X	(c) Runway surface condition				
	X	(d) Preset positions				
	X	(e) Lighting controls.				
	X	(f) Other.				
		4. Environmental controls.				
	X	(a) Clouds (base and tops).				
	X	(b) Visibility				
	X	(c) Runway visual range				
	X	(d) Temperature.				
	X	(e) Climate conditions				
	X	(f) Wind speed and direction.				
X		(g) Windshear.				
	X	(h) Other.				
		5. Airplane system malfunctions.				
	X	(a) Insertion / deletion.				
	X	(b) Problem clear.				
	X	(c) Other				
		6. Locks, freezes, repositioning.				
	X	(a) Problem freeze / release.				
	X	(b) Position freeze / release.				
	X	(c) Repositioning				
	X	(d) Ground speed control				
	X	(e) Other				
X		7. Remote IOS.				
	X	8. Other.				

Initials _____ Date_____

-- End --

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 5 – Sample Recurrent 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 6 TO APPENDIX A TO PART 60—

Figure 6 – Sample Request for Initial, Upgrade, or Reinstatement Evaluation Date

INFORMATION

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

Dear Mr. Cook:

RE: Request for Initial [Upgrade / Reinstatement] Evaluation Date

This is to advise you of our intent to request an evaluation of our (Aircraft Type/Level) Simulator located in (City/State) at the (Facility) on (proposed evaluation date). [The proposed evaluation date shall not be more than 180 days following the date of this letter.] This simulator [has / has not] been previously qualified by the FAA [and had been issued FAA identification number XXX]. [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.

[Added comments from Operator/Sponsor, if any]

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

A copy of this letter of intent has been provided to our Principal Operations Inspector (POI) and/or Training Center Program Manager (TCPM).

Sincerely,

(Signature)

Acknowledgement:

____ We concur with your proposed dates.

____ The date requested is not available, however, we propose the following date:

____ Please provide us with the following information:

_____ _____
Scheduler, National Simulator Program Date

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 7 – 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....

BILLING CODE 4910–13–C

Attachment 6 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 14 CFR 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 ±5°.

b. Be adjustable in intensity (or other parameter to achieve an intensity effect) to at least two (2) levels so that upon encountering the windshear the pilot may identify its presence 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

Attachment 7 to Appendix A to Part 60—Record of FSD Directives

Begin QPS Requirements

When the FAA determines that modification of a simulator is necessary for safety reasons, all affected simulators must be modified accordingly, regardless of the original qualification standards applicable to any specific simulator.

a. A copy of the notification to the sponsor from the TPAA or NSPM that a modification is necessary will be filed in and maintained as part of this attachment.

b. The effective FSD Directives, including the date of the directive, the direction to make these changes, and the date of completion of any resulting modification must be maintained in a separate section of the MQTG and indexed accordingly. The MQTG must also be updated to include the information described in § 60.15(b)(4) as may be appropriate as a result of the FSD Directive. See Attachment 5 for a sample Index of Effective FSD Directives.

End QPS Requirements

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 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 airplane FTD evaluations.

Table of Contents

1. Introduction

a. This appendix contains background information as well as information that is either directive or guiding in nature. Information considered directive is described in this document in terms such as ''will,'' ''shall,'' and ''must,'' and means that the actions are mandatory. Guidance information is described in terms such as ''should,'' or ''may,'' and indicate actions that are desirable, permissive, or not mandatory and provide for flexibility.

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 sections, separated by horizontal lines; headings associated with these horizontal lines will indicate that a particular section begins or ends. All of the text falls into one of three sections: a direct quote or a paraphrasing of the Part 60 rule language; additional requirements that are also regulatory but are found only in this appendix; and advisory or informative material.

(2) The text presented between horizontal lines beginning with the heading ''Begin Rule Language'' and ending with the heading ''End Rule Language,'' is a direct quote or is paraphrased from Part 60 of the regulations. For example: The rule uses the terms ''flight simulation device (FSD)'' and ''aircraft;'' however, in this appendix the rule is paraphrased and the term ''simulator'' is used instead of FSD, and ''airplane'' is used instead of aircraft. Additionally, the rule uses the terms ''this part'' and ''appropriate QPS;'' however, in this appendix the rule is paraphrased and the terms ''Part 60'' and ''this appendix,'' respectively, are used instead. (Definitions are not paraphrased or modified in any way.) For ease of referral, the Part 60 reference is noted at the beginning and the end of the bordered area.

(3) The text presented between horizontal lines beginning with the heading ''Begin QPS Requirements'' and ending with the heading ''End QPS Requirements,'' is also regulatory but is found only in this appendix.

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

(5) 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.

Important Note: While this appendix contains quotes and paraphrasing directly from the rule, the reader is cautioned *not* to rely solely on this appendix for regulatory requirements regarding flight simulators. For regulatory references for airplane flight simulators, the reader is referred to paragraphs 3.a through h of this appendix.

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: *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 Website.

End Information

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2. Definitions

Begin Information

See attachment 4 of this appendix for a list of definitions and abbreviations. Attachment 4 contains definitions directly quoted from 14 CFR part 1 or part 60, contained within a bordered area with Red-colored left hand columns, indicating they are quoted from 14 CFR part 1 or part 60 and are regulatory. Additional definitions and abbreviations used in reading and understanding this document are contained within bordered areas with Blue-colored left hand columns, indicating they are also regulatory but appear only within this document. For purposes of accuracy, the definitions listed are directly quoted, and are not paraphrased.

End Information

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3. Related Reading References

Begin Information

a. 14 CFR part 60
b. 14 CFR part 61.
c. 14 CFR part 63.
d. 14 CFR part 121.
e. 14 CFR part 125
f. 14 CFR part 135.
g. 14 CFR part 141
h. 14 CFR part 142
i. Advisory Circular (AC) 120–28C, Criteria for Approval of Category III Landing Weather Minima.
j. AC 120–29, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.
k. AC 120–35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.
l. AC 120–41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.
m. AC 120–57A, Surface Movement Guidance and Control System (SMGS).
n. AC 150/5300–13, Airport Design.
o. AC 150/5340–1G, Standards for Airport Markings.
p. AC 150/5340–4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.
q. AC 150/5340–19, Taxiway Centerline Lighting System.
r. AC 150/5340–24, Runway and Taxiway Edge Lighting System.
s. AC 150/5345–28D, Precision Approach Path Indicator (PAPI) Systems
t. International Air Transport Association document, ''Flight Simulator Design and Performance Data Requirements, Fifth Edition (1996).

u. AC 25–7, Flight Test Guide for Certification of Transport Category Airplanes.

v. AC 23–8A, Flight Test Guide for Certification of Part 23 Airplanes.

w. International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, First Edition, 1994 Doc 9625–AN/938.

x. Airplane Flight Simulator Evaluation Handbook, Volume I (February, 1995) and Volume II (July, 1996), The Royal Aeronautical Society, London, UK.

y. Airplane Flight Simulator Evaluation Handbook, Volume I (February, 1995) and Volume II (July, 1996), The Royal Aeronautical Society, London, UK.

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

End Information

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4. Background

Begin Information

a. 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.

b. 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 14 CFR 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.

c. For information purposes, the following is a chronological listing of the documents preceding this document 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

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5. Quality Assurance Program

Begin Rule Language (§ 60.5)

a. After [date 6 months after the effective date of the final rule], no sponsor may use or allow the use of or offer the use of an FTD 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 assurance (QA) program, acceptable to the NSPM, for the continuing surveillance and analysis of the sponsor's performance and effectiveness in providing a satisfactory FTD for use on a regular basis as described in this QPS.

b. The QA 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 QA 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.

d. Each sponsor of an FTD must identify to the NSPM and to the TPAA, by name, one individual, who is an employee of the sponsor, to be the management representative (MR) and the primary contact point for all matters between the sponsor and the FAA regarding the qualification of that FTD as provided for in this part.

End Rule Language (§ 60.5)

Begin QPS Requirements

e. The Director of Operations for a Part 119 certificate holder, the Chief Instructor for a Part 141 certificate holder, or the equivalent for a Part 142 or Flight Engineer School sponsor must designate a management representative (MR) who has the responsibility and authority to establish and modify the sponsor's policies, practices, and procedures regarding the QA program for the recurring qualification of, and the day-to-day use of, each FTD.

f. An acceptable Quality Assurance (QA) Program must contain a complete, accurate, and clearly defined 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 and the importance of establishing and meeting the requirements of a QA Program as defined in this paragraph.

(2) The method(s) used by management to determine that the regulatory standards and the QA 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 FTD.

(4) The criteria for and a definition or description of the workmanship expected for normal upkeep, repair, parts replacement, modification, etc., on the FTD and how, when, and by whom such workmanship is determined to be satisfactorily accomplished.

(5) The method used to maintain and control appropriate technical and reference documents, appropriate training records, and other documents for—

(a) Continuing FTD qualification; and

(b) The QA program.

(6) The criteria the sponsor uses (*e.g.*, training, experience, etc.) to determine who may be assigned to duties of inspection, testing, and maintenance (preventive and corrective) on FTDs.

(7) The method used to track inspection, testing, and maintenance (preventive and corrective) on each FTD.

(8) The method used by the sponsor to inform the TPAA in advance of each scheduled NSPM-conducted evaluation and, after completion, the results of each such evaluation.

(9) The method used to ensure that FTD instructors, check airmen, and those who conduct the daily preflight are capable of determining what circumstance(s) constitute(s) a discrepancy regarding the FTD and its operation.

(10) The method used to ensure that instructors, check airmen, and those who conduct the daily preflight, record in the FTD discrepancy log each FTD discrepancy and each missing, malfunctioning, or inoperative FTD component.

(11) The method used to ensure that instructors and check airmen are completely and accurately logging the number of disruptions and time not available for training or for obtaining flight experience during a scheduled FTD use-period, including the cause(s) of the disruption.

(12) The method used by the sponsor to notify users of the FTD of missing, malfunctioning, or inoperative components that restrict the use of the FTD.

(13) The method of recording NSPM-conducted evaluations and other inspections (*e.g.*, daily preflight inspections, NASIP inspections, sponsor conducted quarterly inspections, etc.), including the evaluation or inspection date, test results, discrepancies and recommendations, and all corrective actions taken.

(14) The method for ensuring that the FTD is configured the way the airplane it represents is configured and that if the configuration is authorized to be changed that the newly configured system(s) function(s) correctly.

(15) The method(s) for:
(a) Determining whether or not proposed modifications to the airplane will affect the performance, handling, or other functions or characteristics of the airplane;
(b) Determining whether or not proposed modifications to the FTD will affect the performance, handling, or other functions or characteristics of the FTD; and
(c) Coordinating and communicating items 5.f.(15)(a) and (b) of this appendix, as appropriate, with the sponsor's training organization, other users (*e.g.*, lease or service contract users), the TPAA, and the NSPM.
(16) How information found in the discrepancy log is used to correct discrepancies and how this information is used to review and, if necessary, modify existing procedures for FTD maintenance.
(17) The method for how and when software or hardware modifications are accomplished and tracked, documenting all changes made from the initial submission.
(18) The method used for determining that the FTD meets appropriate standards each day that it is used.
(19) The method for acquiring independent feedback regarding FTD operation (from persons recently completing training or obtaining flight experience; instructors and check airmen using the FTD for training or flight experience sessions; and FTD technicians and maintenance personnel) including a description of the process for addressing these comments.
(20) How devices used to test, measure, and monitor correct FTD 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.
(21) How, by whom, and how frequently internal audits of the QA 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

g. Additional Information.
(1) In addition to specifically designated QA evaluations, the NSPM will evaluate the sponsor's QA program as part of regularly scheduled recurrent FTD evaluations and no-notice FTD evaluations, focusing in large part on the effectiveness and viability of the QA program and its contribution to the overall capability of the FTD to meeting the requirements of this part.
(2) The sponsor, through the MR, may delegate duties associated with maintaining the qualification of the FTD (*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 initial and day-to-day qualification and quality of the FTD. One person may serve in this capacity for more than one FTD, but one FTD would not have more than one person serving in this capacity.
(3) Should a sponsor include a ''foreign FTD'' (*i.e.*, one maintained by a non-US certificate holder) under their sponsorship, the sponsor remains responsible for the QA program for that FTD. However, if that foreign FTD is maintained under a QA program accepted by that foreign regulatory authority and that authority and the NSPM have agreed to accept each other's QA programs (*e.g.*, the Joint Aviation Authorities, JAA, of Europe), the sponsor will be required only to perform an ''external audit'' of the non-US certificate holder's compliance with the accepted foreign QA program, with the results of that audit submitted to and accepted by the NSPM.

End Information

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6. Sponsor Qualification Requirements

Begin Rule Language (§ 60.7)

a. A person is eligible to apply to be a sponsor of an FTD 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 FTD will be used, or will be offered for use, in the sponsor's FAA-approved flight training program for the airplane being simulated as evidenced in a request for evaluation submitted to the NSPM through the TPAA.
b. A person is a sponsor of the FTD 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 operations specifications authorizing the use of the airplane type or set of airplanes being simulated by the FTD or has training specifications or a course of training authorizing the use of an FTD for that airplane type or set of airplanes.
(3) The person has an approved quality assurance program in accordance with § 60.5.
(4) The NSPM has approved the person as the sponsor of the FTD and that approval has not been withdrawn by the FAA.
c. A person continues to be a sponsor of an FTD, if the following conditions are met:
(1) Beginning 12 calendar months after the initial qualification and every 12 calendar months thereafter, the FTD must have been used within the sponsor's FAA-approved flight training program for the airplane type or set of airplanes for a minimum of 600 hours.
(2) The use of the FTD described in paragraph (c)(1) of this section must be dedicated to meeting the requirements of parts 61, 63, 91, 121, or 135 of this chapter.
(3) If the use requirements of paragraphs (c)(1) and (2) of this section are not met, the person will continue to sponsor the FTD on a provisional basis for a period not longer than 12 calendar months; and—
(i) If the FTD is used as described in paragraphs (c)(1) and (2) of this section within this additional 12 calendar month period, the provisional status will be removed and regular sponsorship resumed; or
(ii) If the FTD is not used as described in paragraphs (c)(1) and (2) of this section within the additional 12 calendar month period, the FTD is not qualified and the sponsor will not be eligible to apply to sponsor that FTD for at least 12 calendar months.

End Rule Language (§ 60.7)

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7. Additional Responsibilities of the Sponsor

Begin Rule Language (§ 60.9)

a. The sponsor must not allow the FTD to be used for flightcrew member training or evaluation or for attaining flight experience for the flightcrew member to meet any of the requirements under this chapter unless the sponsor, upon request, allows the NSPM to inspect immediately the FTD, including all records and documents relating to the FTD, to determine its compliance with this part.
b. The sponsor must, for each FTD—
(1) Establish a mechanism for the following persons to provide comments regarding the FTD and its operation and provide for receipt of those comments:
(i) Flightcrew members recently completing training or evaluation or recently obtaining flight experience in the FTD;
(ii) Instructors and check airmen using the FTD for training, evaluation, or flight experience sessions; and
(iii) Simulator technicians and maintenance personnel performing work on the FTD.
(2) Examine each comment received under paragraph (b)(1) of this section for content and importance and take appropriate action.
(3) Maintain a liaison with the manufacturer of the airplane being simulated by the FTD to facilitate compliance with § 60.13(f) when necessary.
(4) Post in or adjacent to the FTD the Statement of Qualification issued by the NSPM.

End Rule Language (§ 60.9)

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8. FTD Use

Begin Rule Language (§ 60.11)

No person may use or allow the use of or offer the use of an FTD for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification unless, in accordance with the QPS for the specific device—
a. It has a single sponsor who is qualified under § 60.9. The sponsor may arrange with another person for services of document preparation and presentation, as well as FTD 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. It is qualified as described in the Statement of Qualification that is required to be posted pursuant to § 60.9(b)(4)—

(1) For the make, model, and series of airplane or set of airplanes; and

(2) For all tasks and configurations.

c. It remains qualified, through satisfactory inspection, recurrent evaluations, appropriate maintenance, and use requirements in accordance with this part and the appropriate QPS.

d. Its software and active programming used during the training, evaluation, or flight experience is the same as the software and active programming that was evaluated by the NSPM.

End Rule Language (§ 60.11)

Begin QPS Requirements

e. Only those FTDs that are used by a certificate holder (as defined for use in Part 60 and this QPS) 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.

End QPS Requirements

Begin Information

f. Each FTD must be evaluated as completely as possible. To ensure a thorough and uniform evaluation, each FTD is subjected to the objective tests listed in attachment 2 of this appendix and the subjective tests listed in attachment 3 of this document. 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) Aerodynamic responses, including longitudinal and lateral-directional control responses (see attachment 2 of this appendix);

(2) Performance in authorized portions of the simulated airplane's, or set of airplanes'', operating envelope, to include tasks suitable to the NSPM in the areas of ground operations, takeoff, climb, cruise, descent, approach, and landing (see paragraph 22 of this appendix) as well as abnormal and emergency operations (see paragraph 23 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, or set of airplanes, systems and sub-systems (as appropriate) as compared to the airplane or set of airplanes 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.

g. 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 are used to compare FTD and airplane data objectively to ensure that the FTD performance and handling qualities are within specified tolerances.

(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 meets the appropriate training/testing/checking objectives and competently simulates each required maneuver, procedure, or task; and

(c) verifying correct operation of the FTD controls, instruments, and systems.

h. 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.

i. In addition to the scheduled recurrent evaluation (see paragraph 13 of this appendix), 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. While the intent is to observe the operation and interaction of the device and not the check airman, instructor, APD, FAA inspector, or student(s), the FTD evaluator is a qualified FAA operations inspector and must, without question, report any obvious lack of proficiency to the appropriate POI or TCPM.

End Information

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9. FTD Objective Data Requirements

Begin Rule Language (§ 60.13)

a. Except as provided in paragraphs (b) and (c) of this section, for the purposes of validating FTD performance and handling qualities during evaluation for qualification, the sponsor must submit the airplane manufacturer's flight test data to the NSPM.

b. The sponsor may submit flight test data from a source in addition to or independent of the airplane manufacturer's data to the NSPM in support of an FTD 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 sponsor may submit alternative data acceptable to the NSPM for consideration, approval and possible use in particular applications for FTD 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 flight testing to support certain FTD qualification requirements.

f. When an FTD sponsor learns, or is advised by an airplane manufacturer or supplemental type certificate (STC) holder, that an addition to, an amendment to, or a revision of the data used to program and operate an FTD used in the sponsor's training program is available, the sponsor must immediately notify the NSPM.

End Rule Language (§ 60.13)

Begin QPS Requirements

g. 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.

h. The data presented, 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.

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

End QPS Requirements

Begin Information

j. Any necessary data and the flight test plan should be reviewed with the NSP staff well in advance of commencing the flight test.

End Information

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10. Special Equipment and Personnel Requirements for Qualification of the FTD

Begin Rule Language (§ 60.14)

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

End Rule Language (§ 60.14)

Begin Information

b. Examples of a special evaluation would be an evaluation conducted at the request of the TPAA or 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.

c. The NSPM will notify the sponsor at least 24 hours in advance of the evaluation if special equipment or personnel will be required to conduct the evaluation. Examples of special equipment include spot photometers, flight control measurement devices, sound analyzer, etc. Examples of special personnel would be those specifically qualified to install or use any special equipment when its use is required.

End Information

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11. Initial (and Upgrade) Qualification Requirements

Begin Rule Language (§ 60.15)

a. For each FTD, the sponsor must submit a request through the TPAA to have the NSPM evaluate the FTD for initial qualification at a specific level. The request must be submitted in the form and manner described in the appropriate QPS.

b. The request must include all of the following:

(1) A statement that the FTD meets all of the applicable provisions of this part.

(2) A statement that the sponsor has established a procedure to verify that the configuration of hardware and software present during the evaluation for initial qualification will be maintained, except where modified as authorized in § 60.23. The statement must include a description of the procedure.

(3) A statement signed by at least one pilot who meets the requirements of paragraph (c) of this section asserting that each pilot so approved has determined that the following requirements have been met:

(i) The FTD systems and sub-systems function equivalently to those in the airplane or set of airplanes.

(ii) The performance and flying qualities of the FTD are equivalent to those of the airplane or set of airplanes.

(iii) For type specific FTD's, the cockpit configuration conforms to the configuration of the airplane make, model, and series being simulated.

(4) A list of all of the operations tasks or FTD systems in the subjective test appendix of the appropriate QPS for which the FTD has not been subjectively tested (*e.g.*, circling approaches, windshear training, etc.) and for which qualification is not sought.

(5) A qualification test guide (QTG) that includes all of the following:

(i) Objective data obtained from airplane 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 general FTD performance or demonstration results prescribed in the appropriate QPS.

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

c. The pilot or pilots who make the statement required by paragraph (b)(3) of this section must—

(1) Be designated by the sponsor;

(2) Be approved by the TPAA; and

(3) Be qualified in —

(i) The airplane or set of airplanes being simulated; or

(ii) For airplane types not yet issued a type certificate, an airplane type similar in size and configuration.

d. The subjective tests that form the basis for the statements described in paragraph (b)(3) of this section and the objective tests referenced in paragraph (b)(5) of this section must be accomplished at the sponsor's training facility except as provided for in the appropriate QPS.

e. The person seeking to qualify the FTD must provide the NSPM access to the FTD for the length of time necessary for the NSPM to complete the required evaluation of the FTD for initial qualification, which includes the conduct and evaluation of objective and subjective tests, including general FTD requirements, as described in the appropriate QPS, to determine that the FTD meets the standards in that QPS.

f. When the FTD 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 airplane or set of airplanes being simulated.

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

(4) A statement that the FTD is qualified as a flight training device.

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

(6) A list of all of the operations tasks or FTD systems in the subjective test appendix of the appropriate QPS for which the FTD has not been subjectively tested and for which the FTD is not qualified (*e.g.*, circling approaches, windshear training, etc.).

g. 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.

h. Upon issuance of the Statement of Qualification the updated QTG becomes the MQTG and must then be made available to the FAA upon request.

End Rule Language (§ 60.15)

Begin QPS Requirement

i. The QTG described in paragraph 11.b.(4) of this appendix, must provide the documented proof of compliance with the FTD objective tests in attachment 2 of this appendix.

j. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, through the TPAA 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) statements of how a particular test was accomplished or that certain requirements have been met (see appendices to this document for additional information);

(5) other information appropriate to the qualification level of the FTD.

k. The QTG described in paragraph 11.b.(4) of this appendix, must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see attachment 5, Figure 2, of this appendix for a sample QTG cover page).

(2) A recurrent evaluation schedule requirements page '' to be used by the NSPM to establish and record the frequency with which recurrent evaluations must be conducted and any subsequent changes that may be determined by the NSPM. See attachment 5, Figure 4, of this appendix for a sample Recurrent Evaluation Schedule Requirements page.

(3) An FTD information page that provides the information listed below (see attachement 5, Figure 3, of this appendix 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, or set of airplanes, 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) The source data.

(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 of this appendix, ''FTD Standards,'' or in the ''Test Details'' column in attachment 2 of this appendix, ''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 of this appendix, as applicable to the qualification level sought.

(a) Name of the test.

(b) Objective of the test.

(c) Initial conditions.

(d) Manual test procedures.

(e) Automatic test procedures (if applicable).

(f) Method for evaluating FTD objective test results.

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

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

(i) Tolerances for relevant parameters.

(j) Source of Airplane Test Data (document and page number).

(k) Copy of the Airplane Test 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.

l. 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 airplane test data (*e.g.*, use of a multi-channel recorder, line printer, cross plotting, overlays, transpariencies, etc.).

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

(3) Airplane 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, flight test 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.

m. 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.

n. 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 and submit a statement to the NSPM that the FTD has not changed from the original determination. The report must clearly indicate when and where these repeated tests were completed, but need not take more than one normal FTD period (*e.g.,* 4 to 8 hours) to complete.

o. The sponsor must maintain a copy of the MQTG at the FTD location. After [date 6 years from the effective date of the final rule] all MQTG's, regardless of initial qualification date of the FTD, must be available in an electronic format, acceptable to the NSPM. The electronic MQTG must include 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 document, the general FTD performance or demonstration results (reformatted or digitized) prescribed in this document, and a description of the equipment necessary to perform the evaluation for initial qualification and the recurrent evaluations for continuing qualification. This electronic MQTG must include the original airplane flight test 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 flight test time-history plots that were provided by the data supplier. An electronic copy of MQTG must be provided to the NSPM.

End QPS Requirements

Begin Information

p. 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.

q. 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.

r. 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 5, figure 5 of this appendix, Sample Request for Initial Evaluation Date.

s. 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.

t. 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.

End Information

12. Additional Qualifications for Currently Qualified FTD's

Begin Rule Language (§ 60.16)

a. A currently qualified FTD is required to undergo an additional qualification process if a user intends to use the FTD for meeting training, evaluation, or flight experience requirements of this chapter beyond the qualification issued to the sponsor. 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 FTD that are required to support the additional qualification.

(iii) Must submit a statement to the NSPM that a pilot, designated by the sponsor in accordance with § 60.15(c) and approved by the TPAA for the user, has subjectively evaluated the FTD in those areas not previously evaluated.

(2) The FTD must successfully pass an evaluation—

(i) For initial qualification, in accordance with § 60.15, 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 (e.g., objective tests, performance demonstrations, 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 FTD, any modifications to the FTD hardware or software that are involved, and any additions or modifications to the MQTG.

c. The FTD is qualified for the additional uses when the NSPM issues an amended Statement of Qualification in accordance with § 60.15(f).

d. The sponsor may not modify the FTD except as described in § 60.23.

End Rule Language (§ 60.16)

13. Previously Qualified FTDs

Begin Rule Language (§ 60.17)

a. Unless otherwise specified by an FSD Directive, further referenced in the appropriate QPS, or as specified in paragraph (e) of this section, an FTD qualified before [the effective date of the final rule] will retain its qualification as long as it continues to meet the standards, including the performance demonstrations and the objective test results recorded in the MQTG, under which it was originally evaluated, regardless of sponsor, and as long as the sponsor complies with the applicable provisions of this part.

b. If the FTD qualification is lost under § 60.27 and not restored under § 60.27 for two (2) years or more, the qualification basis for the re-qualification will be those standards in effect and current at the time of re-qualification application.

c. Except as provided in paragraph (d) of this section, any change in FTD qualification level initiated on or after [the effective date of the final rule] requires an evaluation for initial qualification in accordance with this part.

d. The NSPM may downgrade a qualified FTD without requiring and without conducting an initial evaluation for the new qualification level. Subsequent recurrent evaluations will use the existing MQTG, modified as necessary to reflect the new qualification level.

e. 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 FTD. The updated test(s) and tolerance(s) must be made a permanent part of the MQTG.

End Rule Language (§ 60.17)

Begin Information

f. 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.

Note: The reader is reminded of the requirement that each FTD user obtain approval for use of each FTD in an FAA-approved flight training program from the appropriate TPAA.

End Information

14. Inspection, Maintenance, and Recurrent Evaluation Requirements

Begin Rule Information (§ 60.19)

a. Inspection. No sponsor may use or allow the use of or offer the use of an FTD for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification unless the sponsor does the following:

(1) Accomplishes all appropriate QPS Appendix 1 performance demonstrations and all appropriate QPS Appendix 2 objective tests each year. To do this, the sponsor must conduct a minimum of four evenly spaced inspections throughout the year, as approved by the NSPM. The performance demonstrations and objective test sequence and content of each inspection in this sequence will be developed by the sponsor and submitted to the NSPM for approval. In deciding whether to approve the test sequence and the content of each inspection, the NSPM looks for a balance and a mix from the performance demonstrations and objective test requirement areas listed as follows:

(i) Performance.

(ii) Handling qualities.

(iii) Motion system (where appropriate).

(iv) Visual system (where appropriate).

(v) Sound system (where appropriate).

(vi) Other FTD systems.

(2) Completes a functional preflight check in accordance with the appropriate QPS each calendar day prior to the start of the first FTD period of use that begins in that calendar day.

(3) Completes at least one functional preflight check in accordance with the appropriate QPS in every 7 consecutive calendar days.

(4) Maintains a discrepancy log.

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

(i) Each discrepancy entry must be maintained in the log until the discrepancy is corrected as specified in § 60.25(b) and for at least 30 days thereafter.

(ii) The corrective action taken for each discrepancy and the date that action is taken must be entered in the log. This entry concerning the corrective action must be maintained for at least 30 days thereafter.

(iii) The discrepancy log is kept in a form and manner acceptable to the Administrator and is kept in or immediately adjacent to the FTD.

b. Recurrent evaluation.

(1) This evaluation consists of performance demonstrations, objective tests, and subjective tests, including general FTD requirements, as described in the appropriate QPS or as may be amended by an FSD Directive.

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

(3) The sponsor must provide the NSPM access to the objective test results and general FTD performance or demonstration results in the MQTG, and access to the FTD for the length of time necessary for the NSPM to complete the required recurrent evaluations, weekdays between 6 o'clock AM (local time) and 6 o'clock PM (local time).

(4) No sponsor may use, or allow the use of, or offer the use of, an FTD for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of this chapter unless the FTD has passed an NSPM-conducted recurrent evaluation within the previous 12 calendar months or as otherwise provided for in the MQTG.

(5) Recurrent evaluations conducted in the calendar month before or after the calendar month in which these recurrent evaluations are required will be considered to have been conducted in the calendar month in which they were required.

c. Maintenance. The sponsor is responsible for continuing corrective and preventive maintenance on the FTD to ensure that it continues to meet the requirements of § 60.15(b).

End Rule Language (§ 60.19)

Begin QPS Requirement

d. The preflight inspections described in paragraphs 14.a.(2) and (3) of this appendix, must consist of, as a minimum—

(1) An exterior inspection of the FTD for appropriate hydraulic (if applicable), pneumatic, and electrical connections (*e.g.*, in place, not leaking, appear serviceable);

(2) A check that the area around the FTD is free of potential obstacles throughout the motion system range (if applicable);

(3) A review of the FTD discrepancy log;

(4) A functional check of the major FTD systems and simulated airplane, or set of airplanes, systems (*e.g.*, cockpit instrumentation, control loading, and adequate air flow for equipment cooling) by doing the following:

(a) Turn on main power, including motion system (if applicable), and allow to stabilize.

(b) Connect airplane power. This may be connected through ''quick start'' of airplane engines, auxiliary power unit, or ground power. Airplane operations will require operating engines.

(c) A general look for light bulb function, lighted instruments and switches, etc., as well as inoperative ''flags'' or other such indications.

(d) Check Flight Management System(s) (and other date-critical information) for proper date range.

(e) Select takeoff position and from either pilot position, if applicable, observe the visual system, for proper operation (including light-point color balance and convergence, edge-matching and blending, etc.).

(f) If applicable, adjust visibility value to inside of the far end of the runway and release ''position freeze or flight freeze.'' From either pilot position, advance power to taxi down the runway (if applicable, observe visual system; check sound system and engine instrument response) and apply spoiler/speed brake, if applicable, and wheel brakes (to check spoiler/speed brake and wheel brake operation); select reverse thrust, if applicable, to check normal operation and continued deceleration.

(g) Select position on final approach, at least five (5) miles out (if applicable, observe visual scene). From either pilot position, adjust airplane configuration appropriately (if applicable, check for normal gear and flap operation). If applicable, adjust visibility to see entire airport. Release ''position freeze'' or ''flight freeze.'' Make a rapid left and right bank (check control feel and freedom; observe proper airplane response; and exercise motion system, if applicable). Observe simulated airplane systems operation.

(h) Extend gear and flaps,

(i) Fly to and land at airport, or select takeoff position.

(j) Shut down engines, turn off lights, turn off main power supply and motion system, as applicable.

(k) Record ''functional preflight'' in the FTD discrepancy log book, including any item found to be missing, malfunctioning, or inoperative.

End QPS Requirements

Begin Information

e. If the NSP evaluator plans to accomplish specific tests during a normal recurrent evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; usually not less than 24 hours. These tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests as may be applicable.

f. The recurrent evaluations described in paragraph 13.a.(7) of this appendix, require approximately eight (8) hours of FTD time and consist of the following:

(1) A review of the results of the objective tests and all the designated FTD performance demonstrations conducted by the sponsor since the last scheduled recurrent evaluation.

(2) At the discretion of the evaluator, a selection of approximately 20 percent of those objective tests conducted since the last scheduled recurrent evaluation and a selection of approximately 10 percent of the remaining objective tests in the MQTG. The tests chosen will be performed either automatically or manually, at the discretion of the evaluator.

(3) A subjective test of the FTD to perform a representative sampling of the tasks set out in appendix 3 of this document, selected at the discretion of the evaluator.

(4) An examination of the functions of the FTD, including, but not necessarily limited to the motion, visual, and sound system as applicable, and the instructor operating station, including the normal and simulated malfunctions of the simulated airplane systems.

End Information

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15. Logging FTD Discrepancies

Begin Rule Language (§ 60.20)

Each instructor, check airman, or representative of the Administrator conducting training or evaluation, or observing flight experience for flightcrew member certification or qualification, and each person conducting the preflight inspection (§ 60.19(a)(2), (3), and (4)), who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the FSD, must write or cause to be written a description of that discrepancy into the discrepancy log at the end of the FSD preflight or FSD use session.

End Rule Language (§ 60.20)

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16. [Reserved]

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17. Modifications to FTDs

Begin Rule Language (§ 60.23)

a. When the sponsor or the FAA determines that any of the following circumstances exist and the FAA determines that the FTD cannot be used adequately to train, evaluate, or provide flight experience for flightcrew members, the sponsor must modify the FTD accordingly:

(1) The airplane manufacturer or another approved source develops new data regarding the performance, functions, or other characteristics of the airplane or set of airplanes being simulated;

(2) A change in airplane performance, functions, or other characteristics occurs;

(3) A change in operational procedures or requirements occurs; or

(4) Other circumstances as determined by the NSPM.

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

c. Before modifying a qualified FTD, the sponsor must notify the NSPM and the TPAA as follows:

(1) The notification must include a complete description of the planned modification, including a description of the operational and engineering effect the proposed modification will have on the operation of the FTD.

(2) The notification must be submitted in a form and manner as specified in the appropriate QPS.

d. If the sponsor intends to add additional equipment or devices intended to simulate airplane appliances; modify hardware or software which would affect flight or ground dynamics, including revising FTD programming or replacing or modifying the host computer; or if the sponsor is changing or modifying the control loading system (or motion, visual, or sound system for FTD levels requiring these tests and measurements), the following applies:

(1) The sponsor must meet the notification requirements of paragraph (c) of this section and must include in the notification the results of all objective tests that have been re-run with the modification incorporated, including any necessary updates to the MQTG.

(2) However, the sponsor may not use, or allow the use of, or offer the use of, the FTD with the proposed modification for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of this chapter unless or until the sponsor receives written notification from the NSPM approving the proposed modification. Prior to approval, the NSPM may require that the modified FTD be evaluated in accordance with the standards for an evaluation for initial qualification or any part thereof before it is placed in service.

e. The sponsor may not modify a qualified FTD until one of the following has occurred:

(1) For circumstances described in paragraph (b) or (d) of this section, the sponsor receives written approval from the NSPM that the modification is authorized.

(2) For circumstances other than those described in paragraph (b) or (d) of this section, either:

(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 the NSPM or TPAA; or

(ii) The NSPM or TPAA approves the proposed modification in fewer than 21 days since the sponsor notified the NSPM and the TPAA of the proposed modification.

f. When a modification is made to an FTD, the sponsor must notify each certificate holder planning to use that FTD of that modification prior to that certificate holder using that FTD the first time after the modification is complete.

g. The MQTG must be updated with current objective test results in accordance with § 60.15(b)(5) and appropriate flight test data in accordance with § 60.13, each time an FTD is modified and an objective test is affected by the modification. If this update is initiated by an FSD Directive, the direction to make the modification and the record of the modification completion must be filed in the MQTG.

End Rule Language (§ 60.23)

Begin QPS Requirements

h. The notification described in paragraph 17.c.(1) of this appendix, will include a statement signed by a pilot, qualified in the airplane type, or set of airplanes, being simulated and designated by the sponsor, that, with the modification proposed—

(1) the FTD systems and sub-systems function equivalently to those in the airplane, or set of airplanes, being simulated;

(2) the performance and flying qualities of the FTD are equivalent to those of the airplane, or set of airplanes, being simulated; and

(3) the cockpit configuration conforms to the configuration of the airplane, or set of airplanes, being simulated.

End QPS Requirements

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18. Operation With Missing, Malfunctioning, or Inoperative Components

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Begin Rule Language (§ 60.25)

a. No person may use or allow the use of or offer the use of an FTD with a missing, malfunctioning, or inoperative component for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification during maneuvers, procedures, or tasks that require the use of the correctly operating component.

b. Each missing, malfunctioning, or inoperative component must be repaired or replaced within 30 calendar days unless otherwise authorized by the NSPM. Failure to repair or replace this component within the prescribed time may result in loss of FTD qualification.

c. Each missing, malfunctioning, or inoperative component must be placarded as such on or adjacent to that component in the FTD and a list of the currently missing, malfunctioning, or inoperative components must be readily available in or immediately adjacent to the FTD for review by users of the device.

End Rule Language (§ 60.25)

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19. Automatic Loss of Qualification and Procedures for Restoration of Qualification

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Begin Rule Language (§ 60.27)

a. An FTD is not qualified if any of the following occurs:

(1) The FTD is not used in the sponsor's FAA-approved flight training program in accordance with § 60.9(b)(4).

(2) The FTD is not maintained and inspected in accordance with § 60.19.

(3) The FTD is physically moved from one location to another, regardless of distance.

(4) The FTD is disassembled (*e.g.,* for repair or modification) to such an extent that it cannot be used for training, evaluation, or experience activities.

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

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

(1) The FTD successfully passes an evaluation:

(i) For initial qualification, in accordance with § 60.15 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 approved as necessary by the NSPM.

(2) The NSPM or the TPAA 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 inspections and recurrent evaluations missed, the amount of disassembly and re-assembly of the FTD that was accomplished, and the care that had been taken of the device since the last evaluation.

End Rule Language (§ 60.27)

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20. Other Losses of Qualification and Procedures for Restoration of Qualification

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Begin Rule Language (§ 60.29)

a. Except as provided in paragraph (c) of this section, when the NSPM or the TPAA notifies the sponsor that the FTD no longer meets qualification standards, the following procedure applies:

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

(2) The NSPM or the TPAA sets a reasonable period (but not less than 7 days) within which the sponsor may submit written information, views, and arguments on the FTD qualification.

(3) After considering all material presented, the NSPM or the TPAA notifies the sponsor of the FTD qualification.

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

(i) The NSPM or the TPAA find under paragraph© of this section that there is an emergency requiring immediate action with respect to safety in air transportation or air commerce; or

(ii) The sponsor petitions for reconsideration of the NSPM or the TPAA finding under paragraph (b) of this section.

b. When a sponsor seeks reconsideration of a decision from the NSPM or the TPAA concerning the FTD 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 FTD is no longer qualified.

(2) The sponsor must address its petition to the Director, Flight Standards Service.

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

c. If the NSPM or the TPAA find that an emergency exists requiring immediate action with respect to safety in air transportation or air commerce that makes the procedures set out in this section impracticable or contrary to the public interest:

(1) The NSPM or the TPAA withdraws qualification of some or all of the FTD 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 or the TPAA 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.

End Rule Language (§ 60.29)

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21. Recordkeeping and Reporting

Begin Rule Language (§ 60.31)

a. The FTD sponsor must maintain the following records for each FTD it sponsors:

(1) The MQTG and each amendment thereto.

(2) A copy of the programming used during the evaluation of the FTD for initial qualification and for any subsequent upgrade qualification, and a copy of all programming changes made since the evaluation for initial qualification.

(3) A copy of all of the following:

(i) Results of the evaluations for the initial and each upgrade qualification.

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

(iii) Results of the previous three recurrent evaluations, or the recurrent evaluations from

the previous 2 years, whichever covers a longer period.

(iv) Comments obtained in accordance with § 60.9(b)(1) for a period of at least 18 months.

(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.

(5) A record of all modifications to FTD hardware configurations made since initial qualification.

b. The FTD sponsor must keep a current record of each certificate holder using the FTD. The sponsor must provide a copy of this list to the NSPM at least semiannually.

c. 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.

d. The sponsor must submit an annual report, in the form of a comprehensive statement signed by the quality assurance primary contact point, certifying that the FTD continues to perform and handle as qualified by the NSPM.

End Rule Language (§ 60.31)

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22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements

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Begin Rule Language (§ 60.33)

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 or the QPS.

(2) A fraudulent or intentionally false statement in or omission from any record or report that is kept, made, or used to show compliance with this part or the QPS, 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 or the QPS.

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 FTD qualification and approval for use in a training program.

c. The following may serve as a basis for removal of qualification of an FTD including the withdrawal of authorization for use of an FTD; 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 FTD qualification or an approval for use.

End Rule Language (§ 60.33)

23. [Reserved]

24. Levels of FTD.

Begin Information

a. The following is a general description of each level of FTD. Detailed standards and tests for the various levels of FTDs are fully defined in attachments 1 through 3 of this appendix.

(1) *Level 1.* Currently Reserved for possible future use.

(2) *Level 2.* A device that may have an open flight deck area, or an enclosed cockpit; a generic aero program that is representative of the simulated airplane, or set of airplanes; at least one fully functional system; and control loading that, as a minimum, is representative of the simulated airplane, or set of airplanes, only at an approach speed.

(3) *Level 3.* A device that has an enclosed generic cockpit with a generic aerodynamic program; all applicable operating systems; control loading that is representative of the simulated airplane, or set of airplanes, throughout it's ground and flight envelope; and significant sound representation.

(4) *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).

(5) *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.

(6) *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

1. General

Begin QPS Requirements

a. Requirements

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

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b. Discussion

Begin Information

(1) This attachment describes the minimum 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 be consulted.

(2) The material contained in this attachnment 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

TABLE OF MINIMUM FLIGHT TRAINING DEVICE REQUIREMENTS INFORMATION

QPS Requirement	FTD level						Additional details	Notes
General FTD Standards	1	2	3	4	5	6		
2. 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			X	Level 3 must be representative of a single set of airplanes, and must have navigation controls, displays, and instrumentation as set out in 14 CFR 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.
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	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		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 airplane attitude, thrust, drag, altitude, temperature, and configuration.		X	X		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.	
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	X	X		

TABLE OF MINIMUM FLIGHT TRAINING DEVICE REQUIREMENTS INFORMATION—Continued

QPS Requirement	FTD level						Additional details	Notes
General FTD Standards	1	2	3	4	5	6		
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	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).		X	X		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 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.	
4. 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		X	X		
b. Navigation equipment must be installed and operate within the tolerances applicable for the airplane or set of airplanes.		X	X		X	X	Levels 2 and 5 need have only that navigation equipment necessary to fly an instrument approach. Levels 3 and 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.	

TABLE OF MINIMUM FLIGHT TRAINING DEVICE REQUIREMENTS INFORMATION—Continued

QPS Requirement	FTD level						Additional details	Notes
General FTD Standards	1	2	3	4	5	6		
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	X	X	Level 6 must simulate all applicable airplane flight, navigation, and systems operation. Level 3 must have flight and navigational controls, displays, and instrumentation for powered aircraft as set out in part 91,§ 91.205 for IFR operation. Levels 2 and 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	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			X		
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			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	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	X	X		
6. Motion System:								

TABLE OF MINIMUM FLIGHT TRAINING DEVICE REQUIREMENTS INFORMATION—Continued

QPS Requirement	FTD level						Additional details	Notes
General FTD Standards	1	2	3	4	5	6		
a. The FTD may have a motion system; if desired, although it is not required.		X	X	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 (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		X	X	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 acceptable. However, if additional authorizations (training, testing, or checking credits) are sought that require the use of a visual system, these standards apply.	
8. Sound System:								
a. The FTD must simulate significant cockpit sounds resulting from pilot actions that correspond to those heard in the airplane.			X			X		

Attachment 2 to Appendix B to Part 60—Flight Training Device (FTD) 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 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 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 Flight Test Data described in § 60.13, and Paragraph 9 of this attachment. (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 appendix 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 aerodynamic 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'' 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) FTDs are evaluated and qualified with an engine model simulating the airplane manufacturer's flight test engine. For qualification of alternate engine models (either variations of the flight test engines or other manufacturer's engines) additional FTD tests with the alternate engine models are required. Where thrust is different by more than 5% from the flight test engine, flight test data from an airplane equipped with the alternate engine is required. Where the airplane manufacturer certifies that the only impact on the FTD model is thrust, and that other variables related to the alternate 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 alternate 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

(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.

End Information

TABLE OF OBJECTIVE TESTS

QPS requirement										Info notes
Test	Tolerance	Flight conditions	Flight training device level						Test details	
			1	2	3	4	5	6		
2. Performance a. Takeoff										

TABLE OF OBJECTIVE TESTS—Continued

QPS requirement											Info notes
Test	Tolerance	Flight conditions	Flight training device level						Test details	
			1	2	3	4	5	6		
(1) Ground Acceleration Time	±5% Time or ±1 Second	Ground/Takeoff			X			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		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	Landing Dry Runway			X			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	Landing Dry Runway			X			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		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.	
(2) Deceleration	±10% Time	Ground/Takeoff		X	X		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 result of an 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	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—Continued

QPS requirement										Info notes
Test	Tolerance	Flight conditions	Flight training device level						Test details	
			1	2	3	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, ±27° 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	X		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	X		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			X		
(5) Rudder Pedal Steering Calibration.	±2° Noswheel Angle	Ground			X			X		
(6) Pitch Trim Calibration Indicator vs. Computed.	±0.5° of Computed Trim Angle.	Ground						X		
(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 serious of snapshot test results.	
(8) Brake Pedal Position vs. Force.	±2° Pedal Position, ±5 lbs. (2.2 daN) or 10% Force.	Ground			X			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		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		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—Continued

QPS requirement										Info notes
Test	Tolerance	Flight conditions	Flight training device level						Test details	
			1	2	3	4	5	6		
(3) Gear Change Force	±5 lbs. (2.2 daN) or ±20% Force.	Takeoff and Approach		X	X		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		X	X		
(5) Longitudinal Trim	±1° Pitch Control (Stab and Elevator); ±1° Pitch Angle, ±2% Net Thrust or equivalent in Cruise; ±5% Net Thrust, or equivalent in Approach and Landing.	Cruise, Approach, Landing		X	X		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		X	X	May be a series of snapshot test results. Levels 2,3, and 5 must exhibit positive static stability, but need not comply with the numerical tolerance. (CCA: Test 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		X	X		
(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	X		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	Cruise and Approach or Landing.		X	X		X	X		
(2) Response to Roll Controller Step Input.	±10% or ±2°/sec Roll Rate	Approach or Landing			X			X	CCA: Test in Normal and Non-normal control state.	
(3)(a) Spiral Stability	Correct Trend	Cruise		X			X		CCA: Test in Normal and Non-normal control state.	
(3)(b) Spiral Stability	Correct Trend, and ±3° of Bank Angle or ±10% at 20 sec.	Cruise			X			X	Data averaged from direction may be used. (CCA: Test in Normal and Non-normal control state.).	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirement										Info notes
Test	Tolerance	Flight conditions	Flight training device level						Test details	
			1	2	3	4	5	6		
(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.	
(4)(b) Rudder Response	Yaw Rate ±2°/sec, Bank Angle ±3°.	Approach or Landing		X	X		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 (2a)±10% of Time to ½ Amplitude or Double Amplitude, or (2b) ±.02 of Damping Ratio.	Cruise, and 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.	Cruise, and Approach or Landing.			X				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		X	X	May be a series of snapshot test results. Propeller driven airplanes must test in each direction.	

4. Control Dynamics

Begin Information

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 2.b. of this attachment. 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 takeoff, cruise, and landing flight conditions and configurations.

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. For simulators 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 that were produced concurrently and show satisfactory agreement. Repeat of the alternative method during the initial evaluation would then satisfy this test requirement.

(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 that 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) Tests to verify that control feel dynamics represent the airplane must show that the dynamic damping cycles (free response of the control) match that of the airplane 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.

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 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 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 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 must 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 must be the same as the airplane within ±10 percent. The simulator response must be critically damped also. Figure 2 of this attachment illustrates the procedure.

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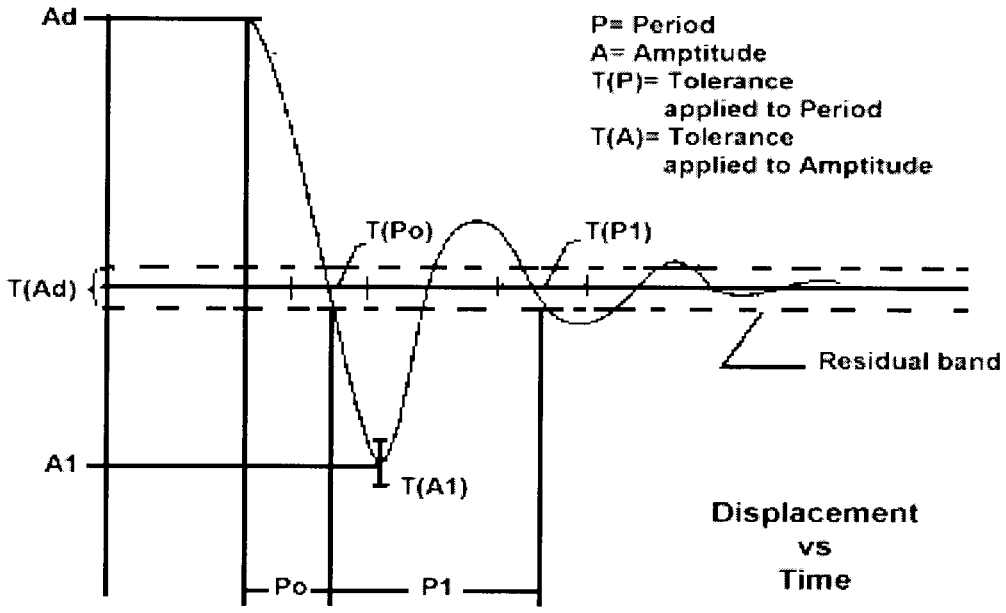
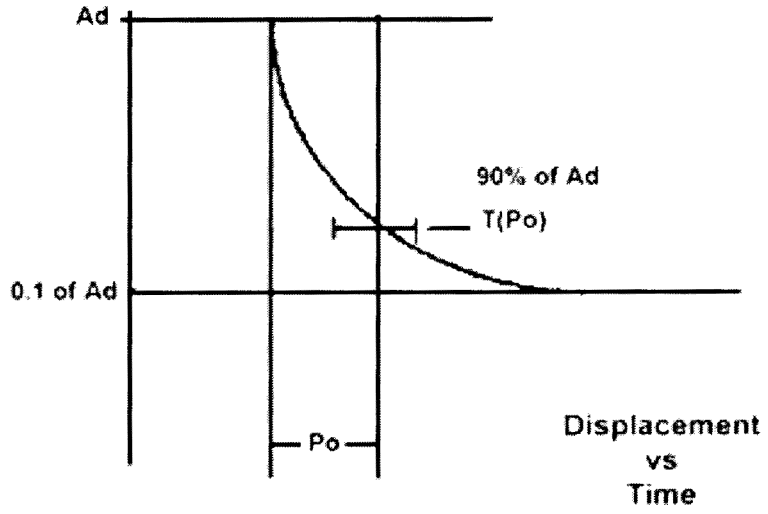


ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 1. UNDER-DAMPED STEP RESPONSE



ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 2. CRITICALLY-DAMPED STEP RESPONSE

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Begin Information

(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, ±20% of Subsequent Peaks
$T(A_d)$ ±10% 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 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 shall 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 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.

f. Tolerances.

(1) Static Test—Items 2.a.(1) (2) and (3) of this appendix.

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

g. The FAA 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 FAA finds that alternative methods do not result in satisfactory simulator performance, then more conventionally accepted methods must be used.

End Information

5. Alternative Objective Data for FTD Levels 2, 3, and 5

Begin QPS Requirements

a. This paragraph 5 (including the following tables) is relevant only to FTD Levels 2, 3, and 5 and is provided due to the fact that these levels are 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. The reader is reminded that Level 3 devices require testing in more areas than Level 2 and Level 5 devices. Therefore, as the following tables contain information for all three FTD levels, some of the data in these tables may not be pertinent to a Level 2 or Level 5 FTD.

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 LEVELS 2, 3, AND 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.	(a) 5–15 lbs (2.2–6.6 daN) of force (Pull).
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.	(b) 5–15 lbs (2.2–6.6 daN) of force (Push).
(2) Flap/slat change force	
(a) Trim for straight and level flight with flaps fully retracted at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Extend the flaps to 50% of full flap travel. After stabilized, record stick force necessary to maintain original airspeed.	(a) 5–15 lbs (2.2–6.6 daN) of force (Pull).
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.	(b) 5–15 lbs (2.2–6.6 daN) of force (Push).
(3) Gear change force	

TABLE OF ALTERNATIVE SOURCE DATA FTD LEVELS 2, 3, AND 5—Continued

[Small, Single Engine (Reciprocating) Airplane]

QPS REQUIREMENT	
Applicable Test and Test Number	Authorized Performance Range
(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.	(a) 2–12 lbs (0.88–5.3 daN) of force (Pull).
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.	(b) 2–12 lbs (0.88–5.3 daN) of force (Push).
(4) Gear and flap operating times	
(a) Extend gear	(a) 2–12 seconds.
(b) Retract gear	(b) 2–12 seconds.
(c) Extend flaps, zero to 50% travel	(c) 3–13 seconds.
(d) Retract flaps, 50% travel to zero	(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	(a) 40–60 knots; ± 5° of bank.
(b) Clean configuration	(b) Landing configuration speed + 10–20 percent.
(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	6–12 degrees/second yaw rate.
Applicable to approach or landing configuration	
(5)(b) Dutch roll, yaw damper off	A period of 2–5 seconds; and ½–2 cycles.
Applicable to cruise and approach configurations	
(6) Steady state sideslip	2–10 degrees of bank; 4–10 degrees of sideslip; and
Use 50 percent rudder deflection	2–10 degrees of aileron.
Applicable to approach and landing configurations	
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.

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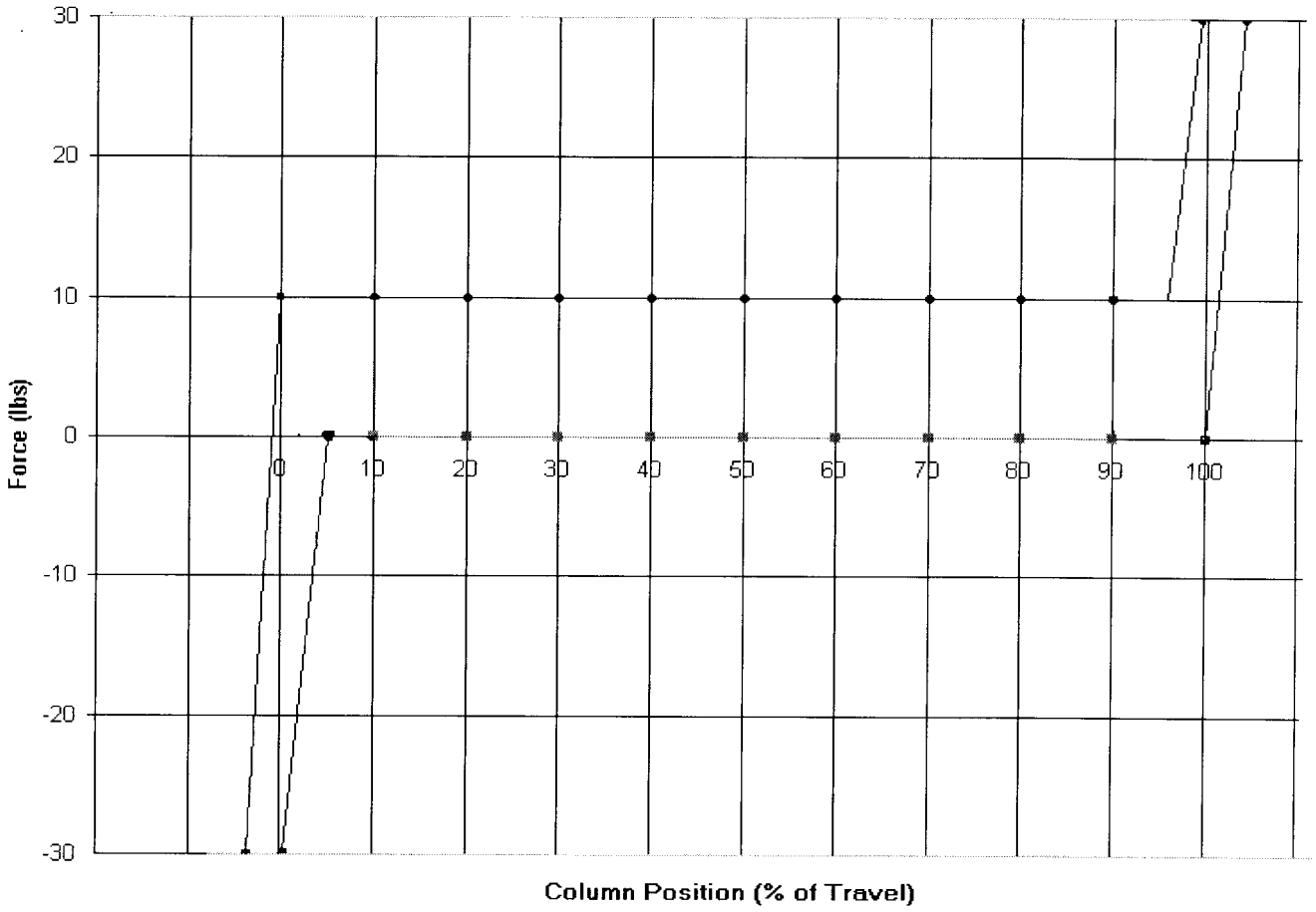
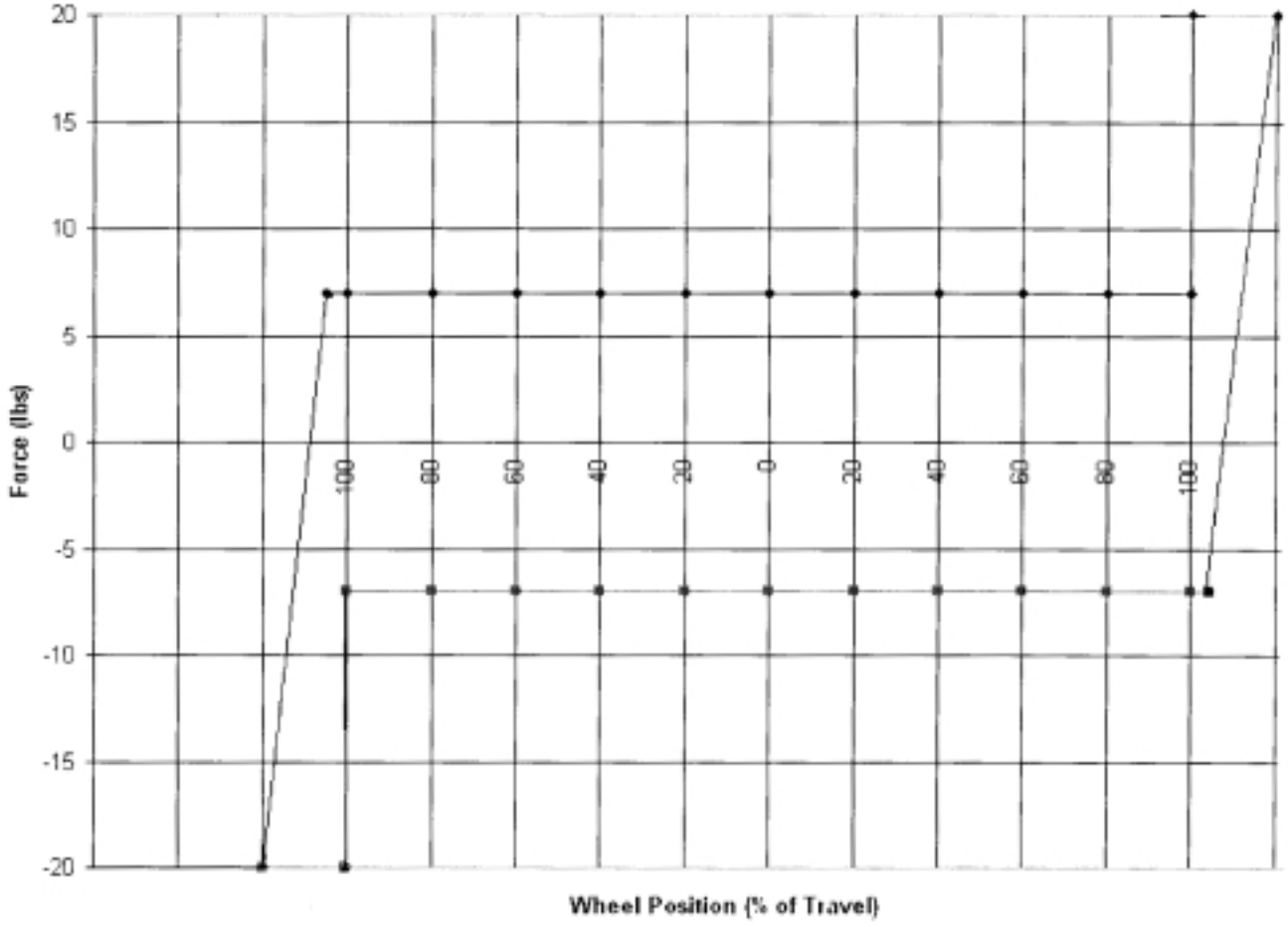


ATTACHMENT 2 TO APPENDIX B TO PART 60—

FIGURE 3. SMALL SINGLE ENGINE (RECIPROCATING) AIRPLANE

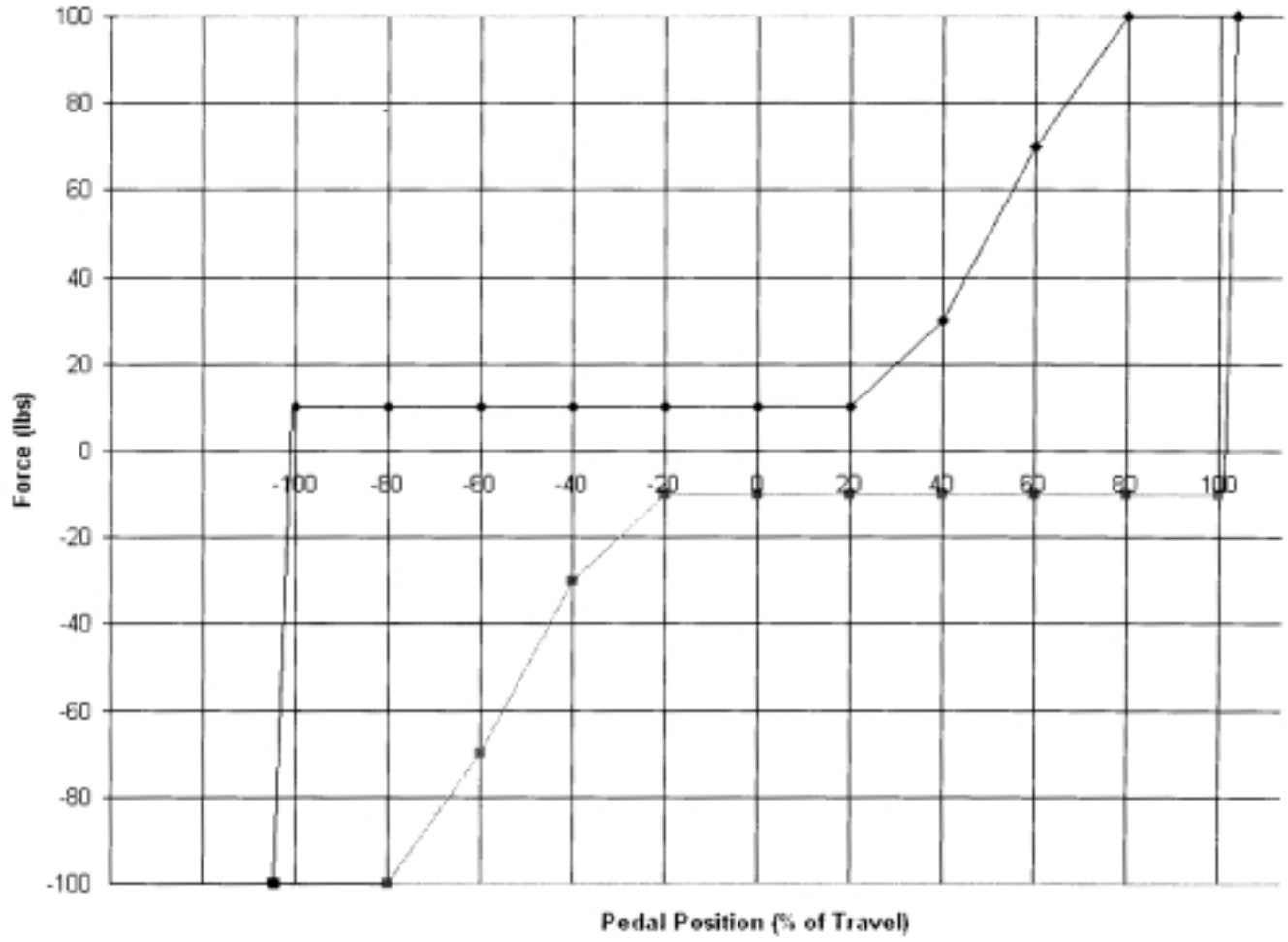
COLUMN POSITION VS. FORCE



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

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TABLE OF ALTERNATIVE SOURCE DATA FTD LEVELS 2, 3, AND 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	20–230 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.

TABLE OF ALTERNATIVE SOURCE DATA FTD LEVELS 2, 3, AND 5—Continued

[Small, Multi-Engine (Reciprocating) Airplane]

QPS REQUIREMENT	
Applicable Test and Test Number	Authorized Performance Range
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 side 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.	(a) 10–25 lbs (2.2–6.6 daN) of force (Pull).
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.	(b) 5–15 lbs (2.2–6.6 daN) or force (Push).
(2) Flap/slat change force	
(a) Trim for straight and level flight with flaps fully retracted at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Extend the flaps to 50% of full flap travel. After stabilized, record stick force necessary to maintain original airspeed.	(1) 5–15lbs (2.2–6.6 daN) of force (Pull).
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.	(a) 2–12 lbs (0.88–5.3 daN) of force (Pull).
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.	(b) 2–12 lbs (0.88–5.3 daN) of force (Push).
(4) Gear and flap operating times.	
(a) Extend gear	(a) 2–12 seconds.
(b) Retract gear	(b) 2–12 seconds.
(c) Extend flaps, zero to 50% travel	(c) 3–13 seconds.
(d) Retract flaps, 50% travel to zero	(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) 60–90 knots; ±5 degrees of bank.
(a) Landing configuration	(b) Landing confirguration speed, + 10–20 percent.
(b) Clean configuration.	
(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	

TABLE OF ALTERNATIVE SOURCE DATA FTD LEVELS 2, 3, AND 5—Continued

[Small, Multi-Engine (Reciprocating) Airplane]

QPS REQUIREMENT	
Applicable Test and Test Number	Authorized Performance Range
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.
4. Cockpit Instrument Response	
Instrument systems response to an abrupt pilot controller input. One test is required to each axis (pitch, roll, and yaw).	300 milliseconds or less.

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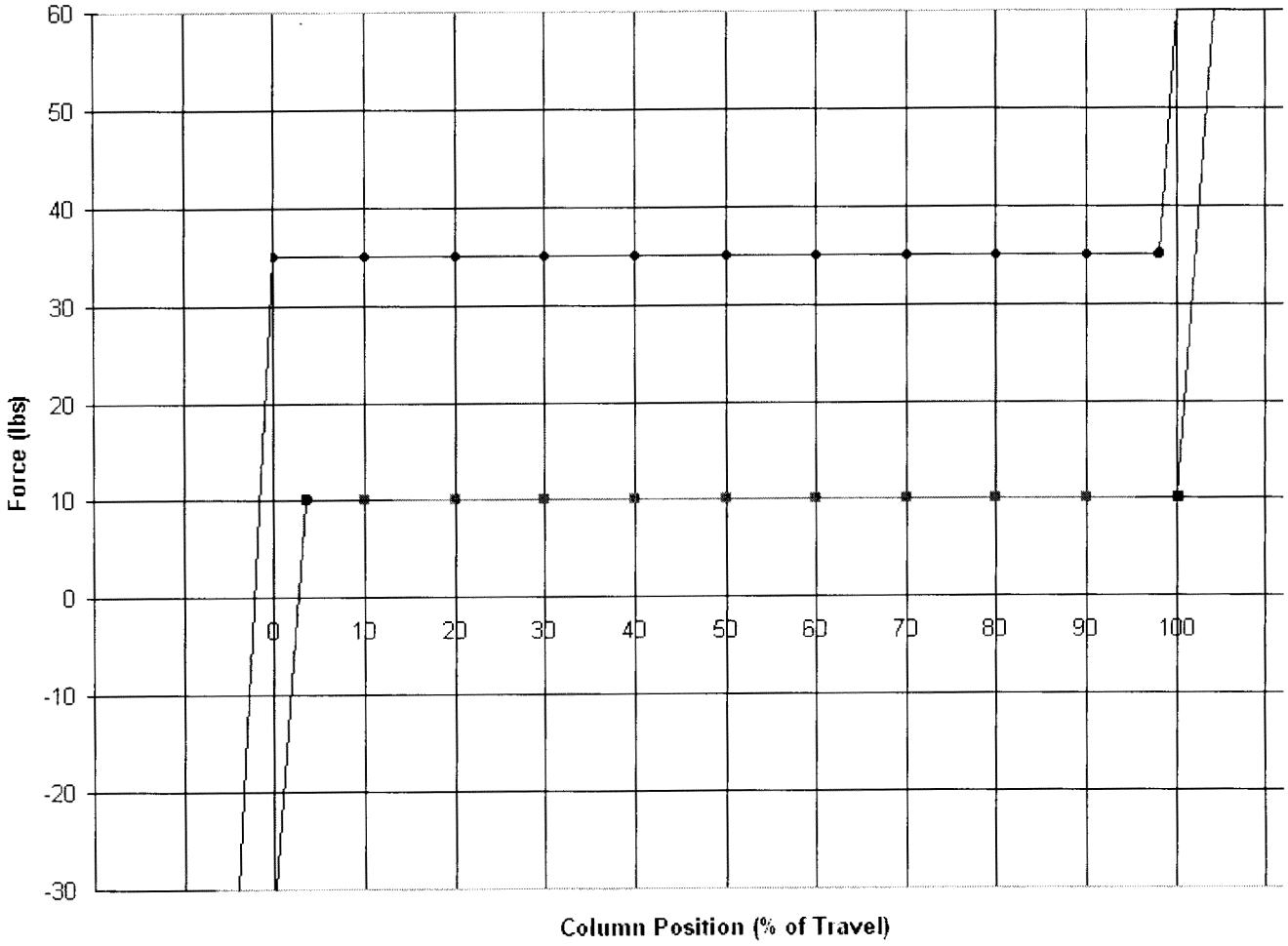
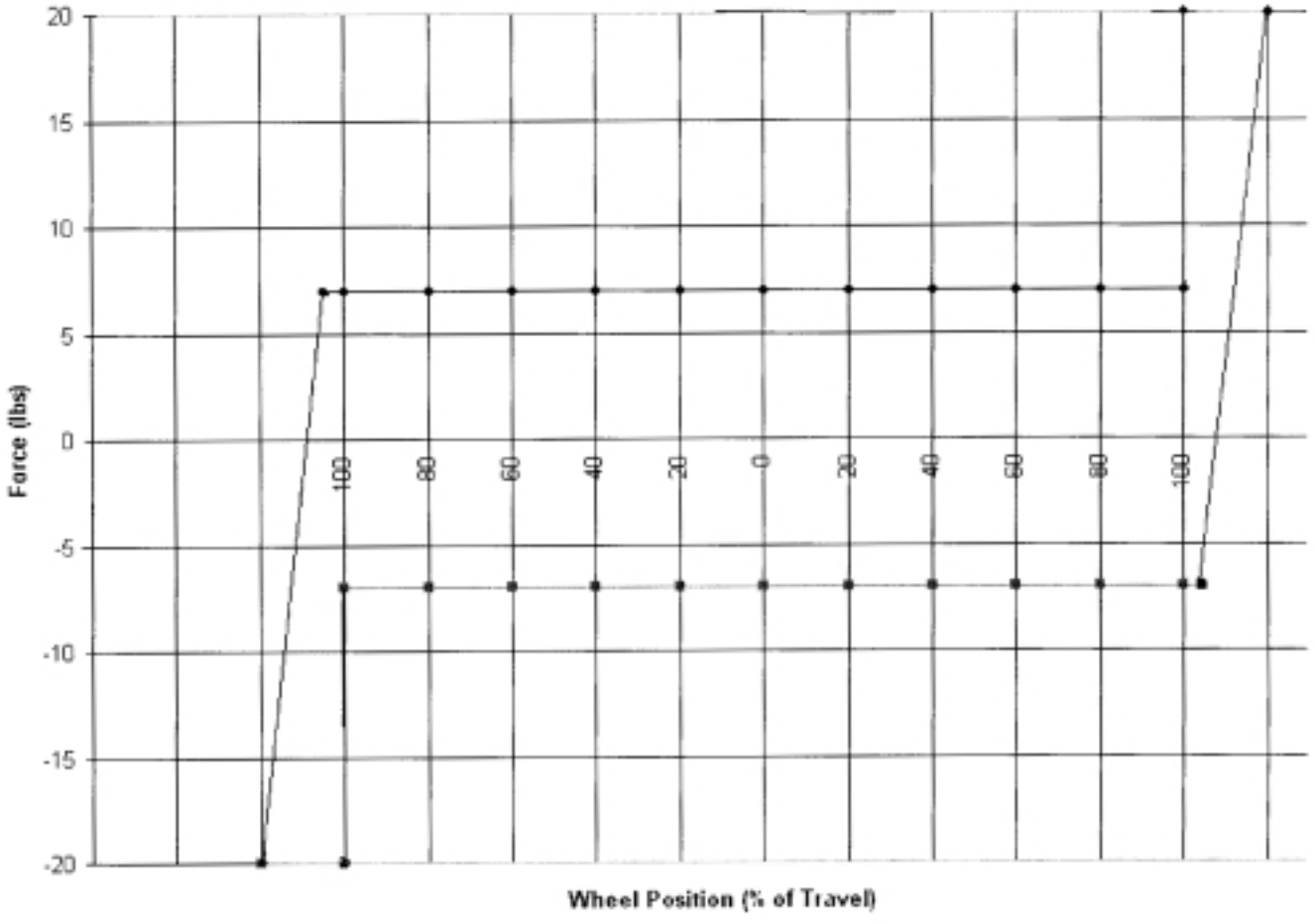
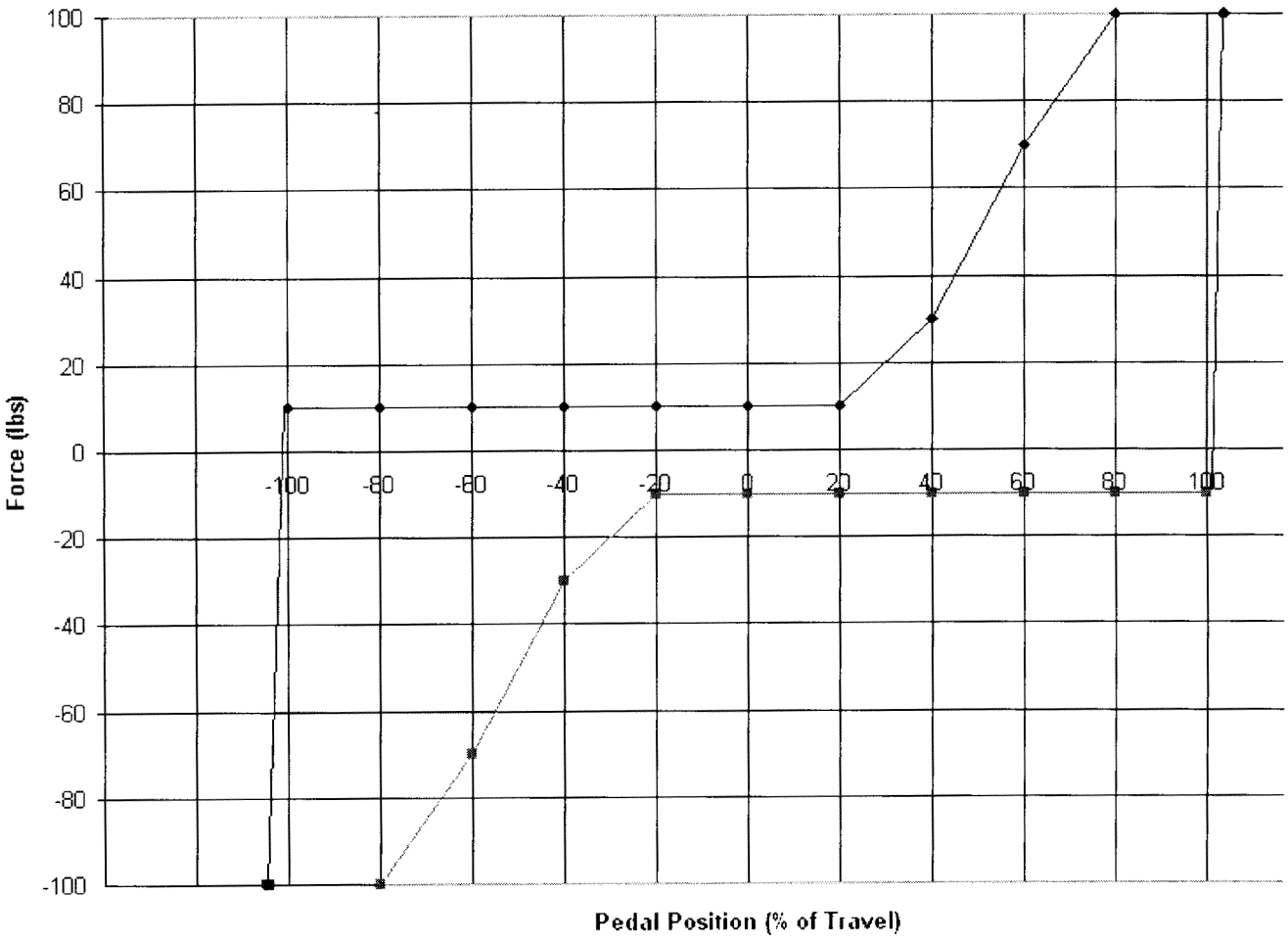


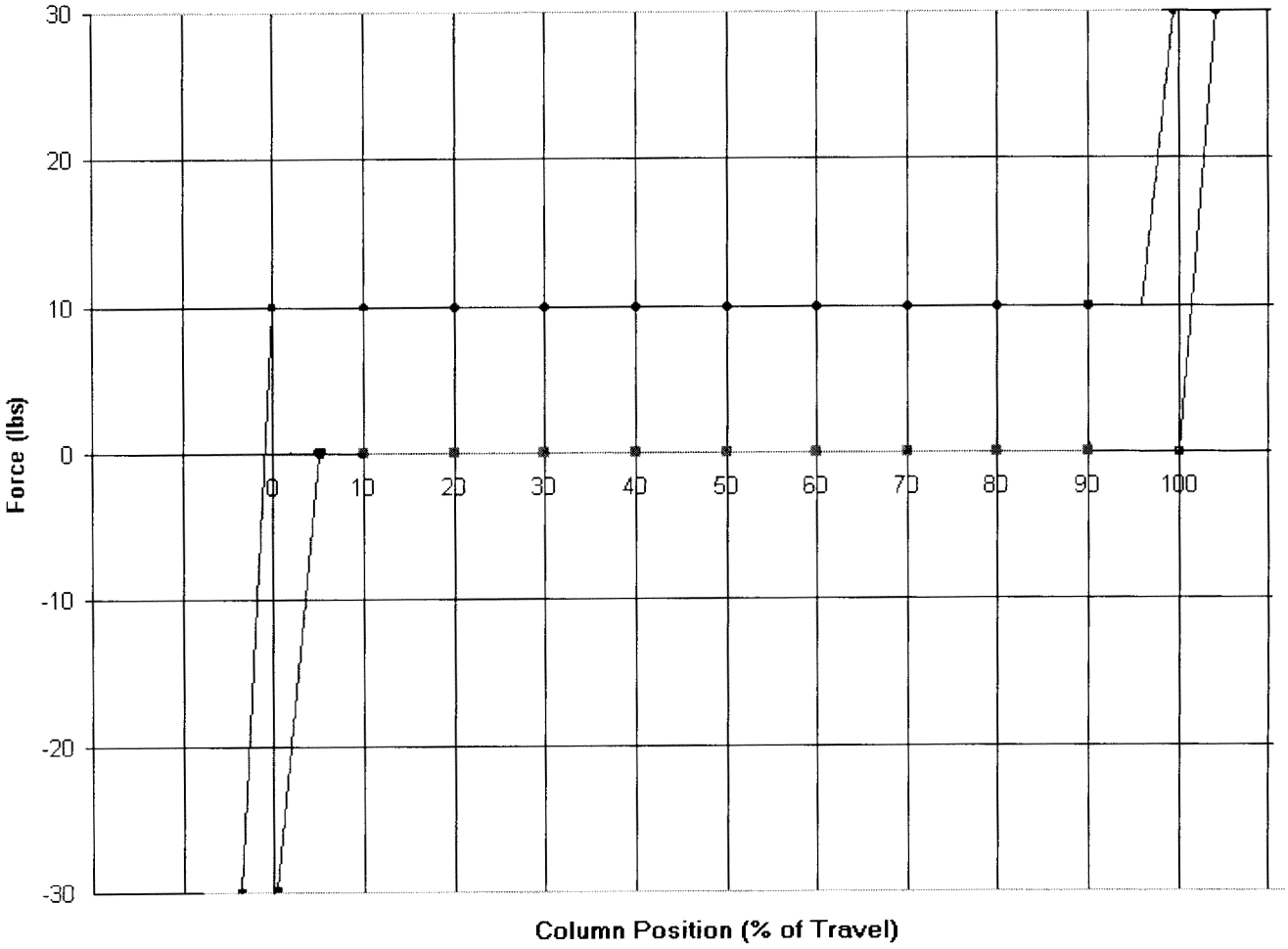
ATTACHMENT 2 TO APPENDIX B TO PART 60—
FIGURE 4. SMALL, MULTI-ENGINE (RECIPROCATION) AIRPLANE COLUMN POSITION VS. FORCE



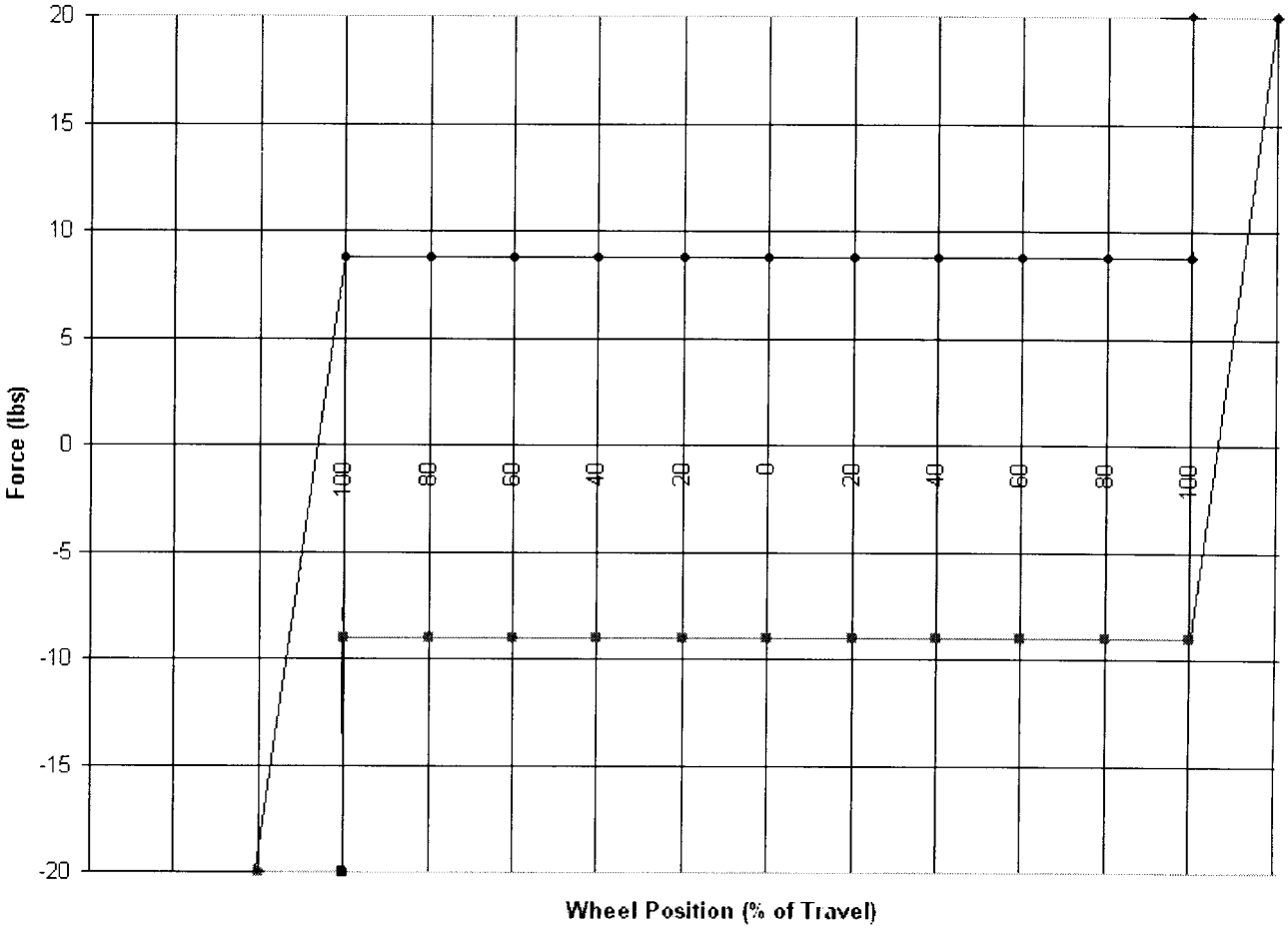
ATTACHMENT 2 TO APPENDIX B TO PART 60—
FIGURE 5. SMALL, MULTI-ENGINE (RECIPROCATING) AIRPLANE WHEEL POSITION VS. FORCE



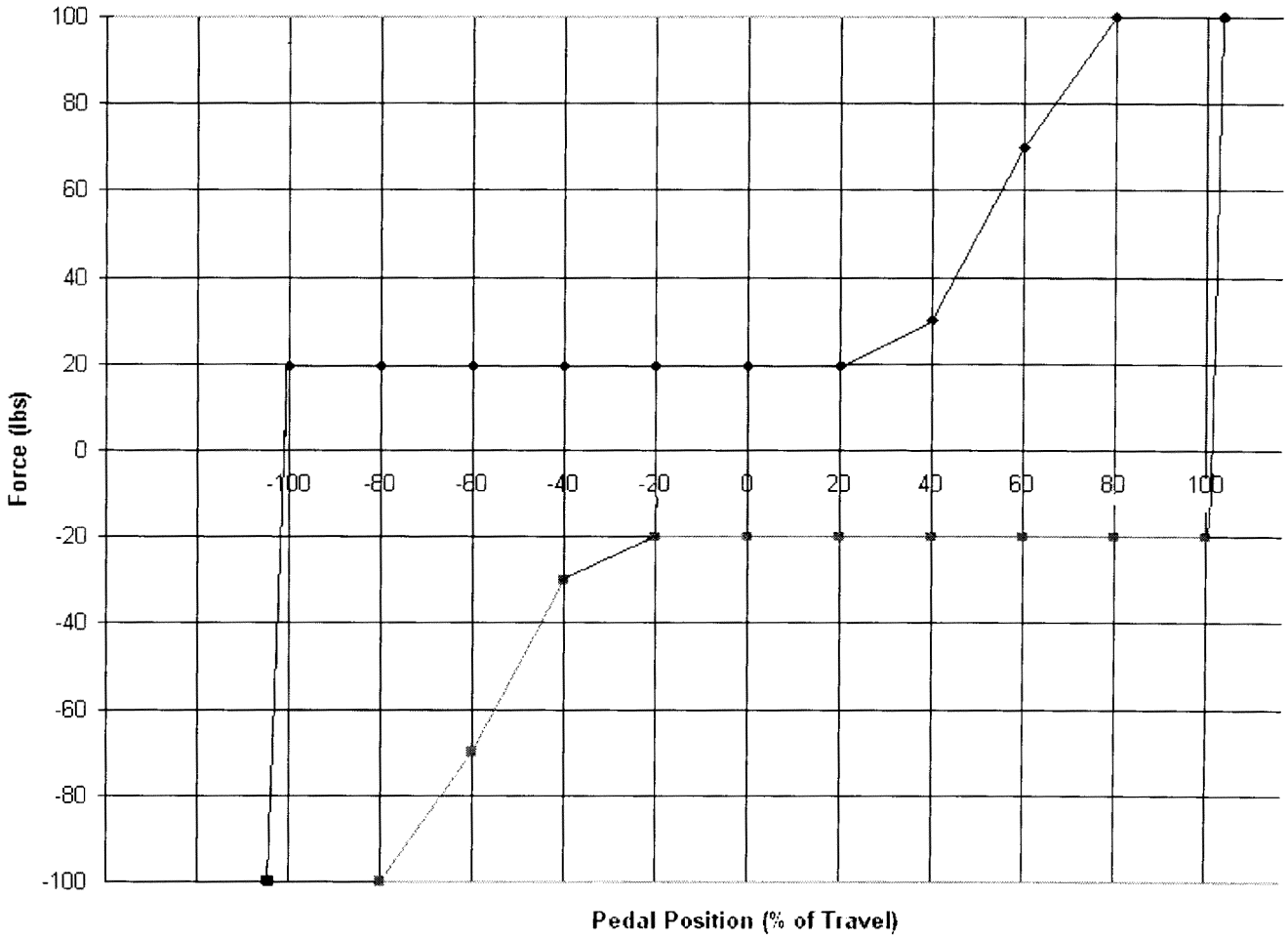
ATTACHMENT 2 TO APPENDIX B TO PART 60—
FIGURE 6. SMALL, MULTI-ENGINE (RECIPROCATING) AIRPLANE RUDDER PEDAL POSITION VS. FORCE



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

BILLING CODE 4910–13–C

TABLE OF ALTERNATIVE SOURCE DATA FTD LEVELS 2, 3, AND 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	

TABLE OF ALTERNATIVE SOURCE DATA FTD LEVELS 2, 3, AND 5—Continued

[Multi Engine (Turbo-Propeller) Airplanes ≤ 19,000 Pounds]

QPS REQUIREMENT	
Applicable Test and Test Number	Authorized Performance Range
(1)(b) Column position vs. force	Plot of Column Position vs. Force must fall within the shaded areas shown in Figure 10, page 43 (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, page 44 (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, page 45 (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, page 45 (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.	(a) 8 lbs (3.5 daN) of Push force to 8 lbs (3.5 daN) of Pull force.
OR	
(b) Trim for straight and level flight at 80% 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.	(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 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.	(a) 5–15 lbs (2.2–6.6 daN) of force (Pull).
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.	(a) 2–12 lbs (0.88–5.3 daN) of force (Pull).
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.	(b) 2–12 lbs (0.88–5.3 daN) of force (Push).
(4) Gear and flap operating times	
(a) Extend gear	(a) 2–12 seconds.
(b) Retract gear	(b) 2–12 seconds.
(c) Extend flaps, zero to 50% travel	(c) 3–13 seconds.
(d) Retract flaps, 50% travel to zero	(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.
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	(a) 80–100 knots; ± 5 degrees of bank.
(b) Clean configuration	(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	

TABLE OF ALTERNATIVE SOURCE DATA FTD LEVELS 2, 3, AND 5—Continued

[Multi Engine (Turbo-Propeller) Airplanes ≤ 19,000 Pounds]

QPS REQUIREMENT	
Applicable Test and Test Number	Authorized Performance Range
(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, and yaw).	300 milliseconds or less.

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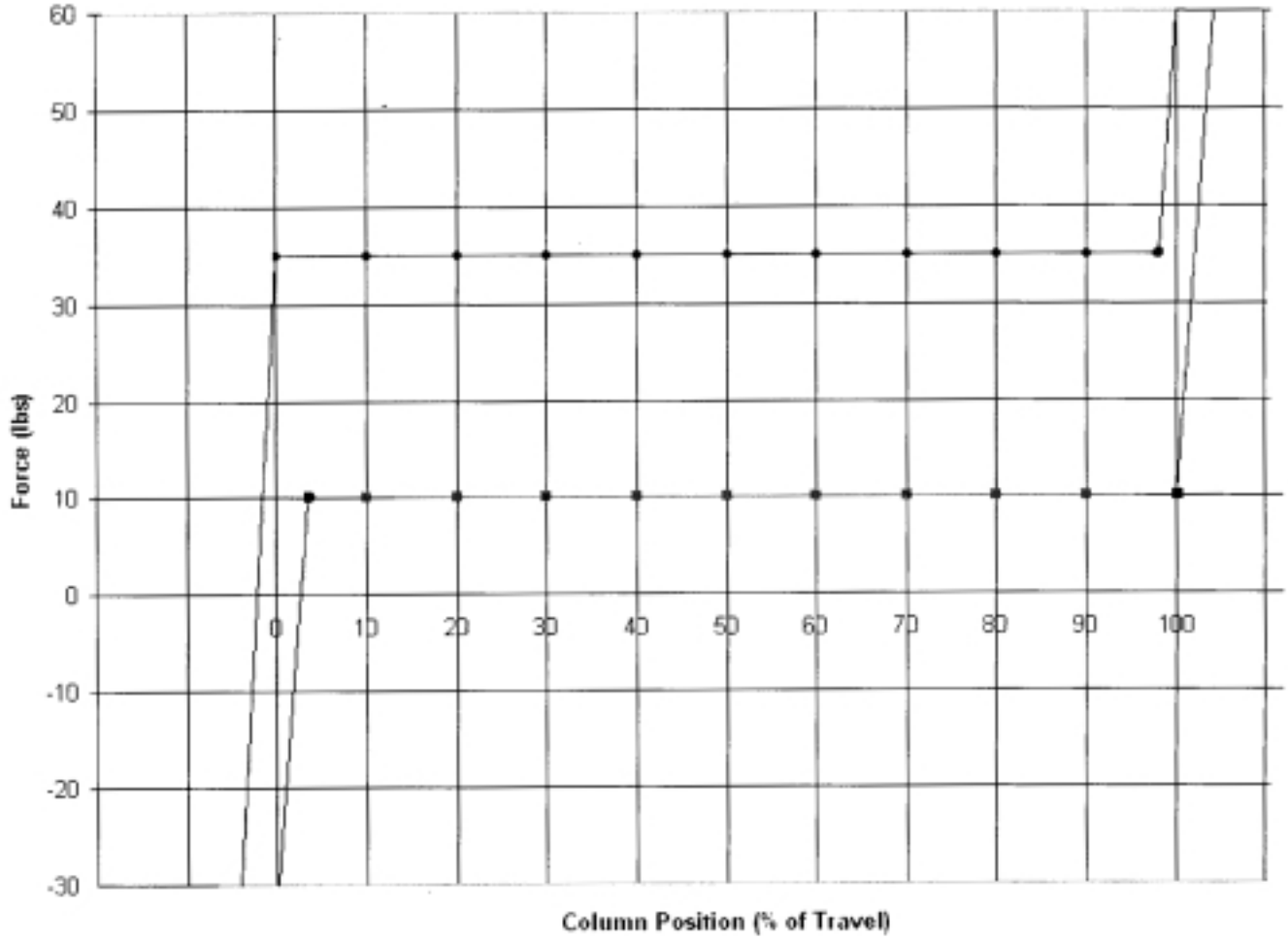
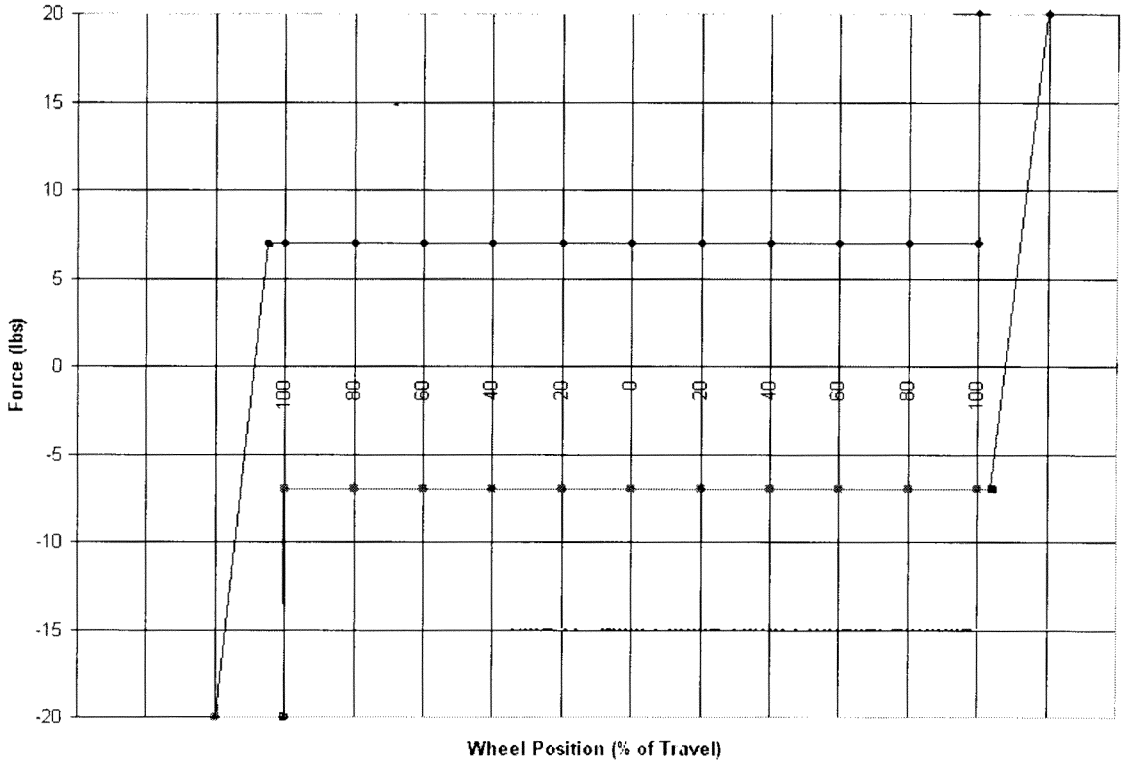
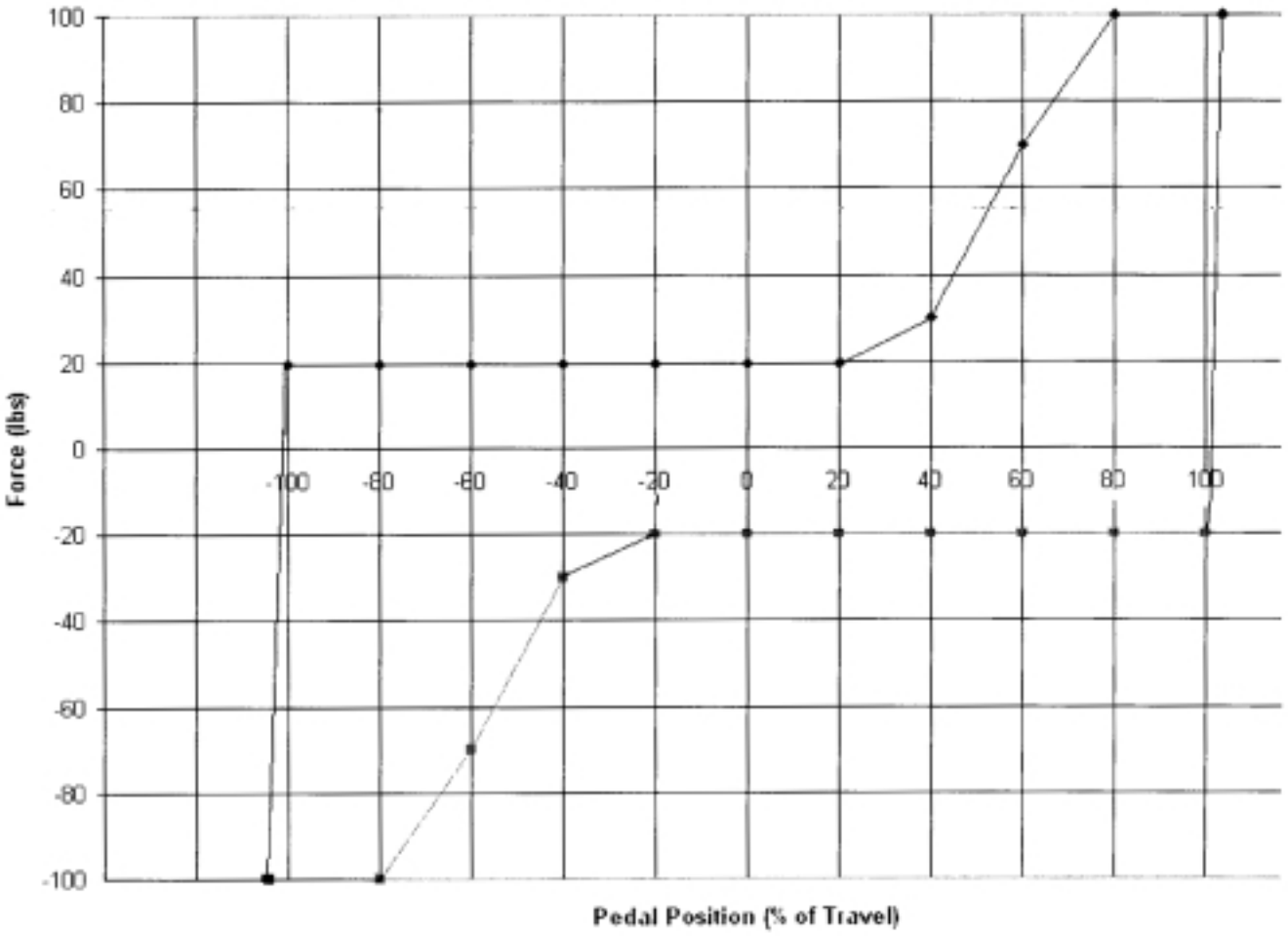


ATTACHMENT 2 TO APPENDIX B TO PART 60—
FIGURE 10. MULTI-ENGINE TURBO-PROPELLER AIRPLANE COLUMN POSITION VS. FORCE



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

BILLING CODE 4910–13–C

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

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 No.	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. Handrecord 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) Handing 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.	

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION: LEVEL 6 FTD ONLY—Continued

QPS requirement (if this source used)		
Applicable test and test No.	Alternative data sources, procedures, and instrumentation	Notes, reminders, and information
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. Rudder Pedal Steering Calibration.	Data may be acquired through the use of force pads on the rudder pedals and a pedal position measurement device, together with design data for nose wheel position measurement device, together with 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: the calibrated airplane instruments; flap/slat position; and the force/position measurements of cockpit controls.	
3.b.(3) 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.	

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION: LEVEL 6 FTD ONLY—Continued

QPS requirement (if this source used)		
Applicable test and test No.	Alternative data sources, procedures, and instrumentation	Notes, reminders, and information
3.b.(7) Handling Qualities. Longitudinal. Longitudinal Static Stability.	Data may be acquired through the use of a synchronized video of: the airplane flight instruments and a hand held force gauge.	
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; 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; the force/position measurements of cockpit controls. Ground track and wind corrected heading may be used for sideslip angle.	

Attachment 3 to Appendix B to Part 60—Flight Training Device (FTD) Subjective Tests

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 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 Pilot Qualification Performance 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 in paragraph 2 of 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 List of FTD Systems in paragraph 3 of 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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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 airplane and FTD level, using the sponsor's approved manuals and checklists.

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.

b. Surface Operations (Pre-Takeoff)

(1) Engine start.
(a) Normal start.
(b) Alternate start operations.
(c) Abnormal starts and shutdowns (hot start, hung start, *etc.*).
(2) Pushback/Powerback (as applicable, powerback requires visual system).
(3) Taxi
(a) Thrust response.
(b) Power lever friction.
(c) Ground handling.
(d) Nosewheel scuffing.
(e) Brake operation (normal and alternate/emergency).
(f) Ground Hazard (if applicable) requires visual system.
(g) Surface Movement and Guidance System (SMGS) (if applicable) requires visual system.
(h) Other.

c. Takeoff

(1) Normal.
(a) Propulsion system checks (*e.g.*,engine parameter relationships; propeller and mixture controls).
(b) Airplane acceleration characteristics.
(c) Nosewheel and rudder steering.
(d) Crosswind (maximum demonstrated).
(e) Special performance.
(f) Instrument.
(g) Landing gear, wing flap, leading edge device operation.
(h) Other.
(2) Abnormal/Emergency.
(a) Rejected, with brake fade (if applicable) due to rising brake temperature.
(b) Rejected, special performance.
(c) Flight control system failure modes.
(d) Other.

d. Inflight Operation

(1) Climb.
(a) Normal.
(b) Other.
(2) Cruise.
(a) Performance characteristics (speed vs. power).
(b) Normal turns and turns with/without spoilers (speed brake) deployed.
(c) High altitude handling.
(d) High indicated airspeed handling, over-speed warning.
(e) Mach effects on control and trim.
(f) Normal and steep turns.
(g) Performance turns.
(h) Approach to stalls in the following configurations: (i) cruise; (ii) takeoff or approach; and (iii) landing.
(i) High angle of attack maneuvers in the following configurations: (i) cruise; (ii) takeoff or approach; and (iii) landing.
(j) Inflight engine shutdown (as applicable, procedures only).
(k) Inflight engine restart (as applicable, procedures only).
(l) Maneuvering with one or more engines inoperative (as applicable, procedures only).
(m) Slow flight.
(n) Specific flight characteristics.
(o) Manual flight control reversion (*i.e.*, loss of all flight control power).
(p) Other flight control system failure modes.
(q) Holding.
(r) Airborne hazard (if applicable, requires visual system).
(s) Operations during icing conditions.
(t) Traffic alert and collision avoidance.
(u) Effects of airframe icing.
(v) Other.
(3) Descent.
(a) Normal.
(b) Maximum rate (clean, with speedbrake extended, *etc.*) and recovery.
(c) Flight Control System Failure Modes (*e.g.*, manual flight control reversion; split controls, *etc.*).
(d) High rate of sink and recovery.
(e) Other.

e. Approaches

(1) Instrument Approach Maneuvers.
(a) Non-precision:
(i) Non-Directional Beacon (NDB).
(ii) VHF Omni-Range (VOR), Area Navigation (RNAV), Tactical Air Navigation (TACAN).
(iii) Distance Measuring Equipment, Arc (DME ARC).
(iv) ILS Localizer Back Course (LOC/BC).
(v) Localizer Directional Aid (LDA), ILS Front Course Localizer (LOC), Simplified Direction Facility (SDF).
(vi) Airport Surveillance Radar (ASR).
(vii) Global Positioning System (GPS).
(vii) Missed approach.
(b) Precision:
(i) Instrument Landing System (ILS)
A. Category I published:
i. Manually controlled with and without flight director to 100 feet below published decision height.
ii. With maximum demonstrated crosswind.
B. Category II published—with and without use of autopilot, autothrottle, and autoland, as applicable.
C. Category III published:
i. With minimum/standby electrical power.
ii. With generator/alternator failure (transient).
iii. With 10 knot tail wind.
iv. With 10 knot crosswind.
D. Missed approach.
(ii) Precision Approach Radar (PAR)
A. Normal.
B. With crosswind.
C. Missed approach.
(iii) Digital Global Positioning System (DGPS)
A. Normal.
B. With crosswind.
C. Missed approach.
(iv) Microwave landing system (MLS).
A. Normal.
B. With crosswind.
C. Missed approach.
(v) Steep Glide Path.
A. Normal.
B. With crosswind.
C. Missed approach.
(2) Visual Approach Maneuvers (if applicable, requires visual system).
(a) Abnormal wing flaps/slats.
(b) Without glide slope guidance or visual vertical flightpath aid (if applicable, requires visual system).
(3) Abnormal/emergency.
(a) With standby (or minimum) electric/hydraulic power.
(b) With longitudinal trim malfunction.
(c) With jammed or mis-trimmed horizontal stabilizer.
(d) With lateral-directional trim malfunction.
(e) With worst case failure of flight control system (most significant degradation of the computer controlled airplane which is not extremely improbable).
(f) Other flight control system failure modes as dictated by training program.
(g) Land and hold short operations.
(h) Other.

f. Missed Approach

(1) Manual.
(2) Automatic (if applicable).

g. Any Flight Phase

(1) Air conditioning.
(2) Anti-icing/deicing.
(3) Auxiliary powerplant.
(4) Communications.
(5) Electrical.
(6) Fire detection and suppression.
(7) Flaps.
(8) Flight controls (including spoiler/speedbrake).
(9) Fuel and oil.
(10) Hydraulic.
(11) Landing gear.
(12) Oxygen.
(13) Pneumatic.
(14) Propulsion System.
(15) Pressurization.
(16) Flight management and guidance systems.
(17) Automatic landing aids.
(18) Automatic pilot.
(19) Thrust management/auto-throttle.

(20) Flight data displays.
(21) Flight management computers.
(22) Flight director/system displays.
(23) Flight Instruments.
(24) Heads-up flight guidance system.
(25) Navigation systems.
(26) Weather radar system.
(27) Stall warning/avoidance.
(28) Stability and control augmentation.
(29) ACARS
(30) Other.

h. Engine Shutdown and Parking

(1) Systems operation.
(2) Parking brake operation.

3. FTD Systems

a. Instructor Operating Station (IOS)

(1) Power switch(es).
(2) Airplane conditions.
  (a) Gross weight, center of gravity, fuel loading and allocation, *etc.*
  (b) Airplane systems status.
  (c) Ground crew functions (*e.g.*, external power connections, push back, *etc.*)
  (d) Other.
(3) Airports.
  (a) Selection.
  (b) Runway selection.
  (c) Preset positions (*e.g.* ramp, over FAF, etc.)
  (d) Other.
(4) Environmental controls.
  (a) Temperature.
  (b) Climate conditions (*e.g.*, ice, rain, *etc.*).
  (c) Wind speed and direction.
  (d) Other.
(5) Airplane 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 (or other).
  (e) Other
(7) Remote IOS.
(8) Other.

b. Sound Controls. On / off / rheostat

c. Control Loading System. (as applicable) On / off / emergency stop.

d. Observer Stations.

(1) Position.
(2) Adjustments.

End QPS Requirements

Attachment 4 to Appendix B to Part 60—Definitions and Abbreviations

1. Definitions

Begin Regulatory Language (14 CFR Part 1 and § 60.3)

(From Part 1—Definitions)

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

Flight simulator means a full size replica of a specific type or make, model, and series aircraft cockpit. It includes the assemblage of equipment and computer programs necessary to represent the aircraft in ground and flight operations, 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 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 standards (QPS) for a specific qualification level.

Flight training device (FTD) means a full size 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 the aircraft or set of aircraft 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 qualification level.

(From Part 60—Definitions)

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.

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

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

Master Qualification Test Guide (MQTG). The FAA-approved Qualification Test Guide with the addition of the FAA-witnessed test, performance, or demonstration results, applicable to each individual FSD.

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 comparison of simulator performance data to actual or predicted aircraft performance data to ensure FSD performance is within the tolerances prescribed in the QPS.

Predicted data. Aircraft performance data derived from sources other than direct physical measurement of, or flight tests on, the subject aircraft. Predicted data may include engineering analysis and simulation, design data, wind tunnel data, estimations or extrapolations based on existing flight test data, or data from other models.

Qualification level. The categorization of the FSD, based on its demonstrated technical and operational capability as set out in the QPS.

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 FSD requirements, for establishing FSD qualification levels.

Qualification Test Guide (QTG). The primary reference document used for evaluating an aircraft FSD. It contains test results, performance or demonstration results, statements of compliance and capability, the configuration of the aircraft simulated, and other information for the evaluator to assess the FSD against the applicable regulatory criteria.

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.

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

Subjective test. A qualitative comparison to determine the extent to which the FSD performs and handles like the aircraft being simulated.

Training Program Approval Authority (TPAA). A person authorized by the Administrator to approve the aircraft flight training program in which the FSD will be used.

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

End Regulatory Language (14 CFR Part 1 and § 60.3)

Begin QPS Requirements

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.

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.

Automatic Testing—is FTD 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.

Closed Loop Testing—is a test method for which the input stimuli are generated by controllers which drive the FTD to follow a pre-defined target response.

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.

Computer Controlled Airplane—is an airplane where all pilot inputs to the control surfaces are transferred and augmented by computers.

Convertible FTD—is an FTD in which hardware and software can be changed so that the FTD becomes a replica of a different model, usually of the same type airplane. The same FTD 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 engine 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.

Driven—is a test method where the input stimulus or variable is positioned by automatic means, generally a computer input.

Free Response—is the response of the FTD after completion of a control input or disturbance.

Frozen—is a test condition where one or more variables are held constant with time.

FTD Approval—is the extent to which an FTD may be used by a certificate holder as authorized by the FAA. It takes account of airplane to FTD differences and the training ability of the organization.

FTD Latency—is the additional time beyond that of the response time of the airplane due to the response of the FTD.

Fuel used—is the amount or mass of fuel used (kilograms or pounds).

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.

Height—is the height above ground level (or AGL) expressed in meters or feet.

Integrated Testing—is testing of the FTD such that all airplane 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 FTD testing wherein the pilot conducts the test without computer inputs except for initial setup and all modules of the simulation are active.

Medium—is the normal operational weight for a given flight segment.

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.

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.

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.

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.

Sideslip—is the angular difference between the airplane heading and the direction of movement in the horizontal plane.

Simulation Data—are the various types of data used by the FTD manufacturer and the applicant to design, manufacture, and test the FTD.

Snapshot—is a presentation of one or more variables at a given instant of time.

Source Data—are, for the purpose of this document, performance, stability and control, and other necessary test parameters electrically or electronically recorded in an airplane using a calibrated data acquisition system of sufficient resolution and verified as accurate by the company performing the test to establish a reference set of relevant parameters to which like FTD parameters can be compared.

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 FTD 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.

Time History—is a presentation of the change of a variable with respect to time.

Training Program Approval Authority (TPAA)—is the person who exercises authority on behalf of the Administrator in approving the aircraft flight training program for the appropriate airplane in which the FTD will be used. This person is the principal operations inspector (POI) for programs approved under 14CFR parts 63, 121, 125, or 135; or the training center program manager (TCPM) for programs approved under part 141 or 142.

Transport Delay or ''Throughput''—is the total FTD 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.

Validation Data—are data used to determine if the FTD performance corresponds to that of the airplane.

Validation Test—is a test by which FTD parameters are compared to the relevant validation data.

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.

End QPS Requirements

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2. Abbreviations

Begin QPS Requirements

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/m ^{2}—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
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.
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.
Kt—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.
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.
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.
nm—Nautical Mile(s) 1 Nautical Mile = 6,080 feet.
NN—NON-NORMAL CONTROL Used in reference to Computer Controlled Airplanes.
NWA—Nosewheel Angle (degrees).
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_R—Rotation 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.
Vs—Stall Speed or minimum speed in the stall.
WAT—Weight, Altitude, Temperature.

End QPS Requirements

Attachment 5 to Appendix B to Part 60—Sample Documents

Begin Information

Table of Contents

Title of Sample

BILLING CODE 4910–13–P

Attachment 5 to Appendix B to Part 60—
Figure 1 – Sample Letter of Request

INFORMATION

Date

Name, TCPM, _____(Certificate Holder)

FAA FSDO _____

Address

City, State, Zip

Dear Mr./Ms. _____:

(Sponsor's name) _____ requests evaluation of our _____ (type airplane or set of airplanes) FTD for Level _____ qualification. The (name) _____ FTD [with (name) _____visual system - if applicable] 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 Airplane Flight Training Device 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_____ (airplane type or set of airplanes) has(have) assessed the FTD and found that it conforms to the (sponsor name) _____ airplane (type or set of airplanes) cockpit configuration and that the simulated systems and subsystems have been evaluated and found to function equivalently to those in the airplane (or set of airplanes). The above named pilot(s) has(have) found that the FTD represents the respective airplane (or set of airplanes) 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 airplane (or set of airplanes). 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 5 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 OR SET OF AIARPLANES)
for example
Stratos BA797-320A – or – Multi-Engine, Turbo-Propeller Driven

(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 5 to Appendix B to Part 60—
Figure 3 – Sample FTD Information Page

SPONSOR NAME	
SPONSOR FTD 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:	BR707-320; 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. "The World" 1 Channel, 2-window CRT display
VISUAL SYSTEM COMPUTER:	LMB-1
MOTION SYSTEM:	N/A

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 5 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 5 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 -- Level 6 -- FAA ID# 721

Configuration		Date Qualified
Airplane Model:.....	BA-797.....	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:	The World, Clear View, Inc.	
☐ CRT Installation:.....	1 Channel, 2 Window.....	July 12, 1988
☐ Projected System:.....	__° Horizontal Viewing Angle.....	
Flight Instruments:		
☐ Electro-Mechanical:.....	.....	July 12, 1988
☐ Display (CRT, LCD, etc.).....		
☐ Combination		
☐ Heads-Up Display.....	Jones Industries.....	December 1, 1993
Flight Director:		
☐ Single Cue.....		
☐ Dual Cue.....	Sperry.....	July 12, 1988
☐ None.....		
Engine Instruments:		
☐ Electro-Mechanical.....	.....	July 12, 1988
☐ Display (CRT, LCD, etc.).....		
☐ Combination.....		
Navigation Type(s):		
☐ ADF.....	.....	July 12, 1988
☐ VOR/ILS.....	.....	July 12, 1988
☐ GPS.....		
☐ INS.....	.....	October 10, 1991
☐ IRS.....		
Weather Radar:	Jones Industries, Inc.	August 3, 1996
TCAS		
ACARS		

(Continue, As Needed)

Attachment 5 to Appendix B to Part 60—
Figure 4B – Sample Statement of Qualification; Qualified/Non-Qualified Tasks

INFORMATION

STATEMENT of QUALIFICATION
Qualified/Non-Qualified Tasks
Go-Fast Training Center
Stratos BA-797 -- Level 6 -- FAA ID# 721

The following are those items listed in the Airplane Flight Training Device Qualification Performance Standards (QPS), FAA-S-120-45B, dated (May 1, 2000) Appendix 3, Subjective Tests, indicating what tasks and systems are qualified **(Q)** *and what tasks and systems are not qualified* **(NQ).**

NQ	Q	TASK		NQ	Q	TASK
		A. Preparation for Flight.				**D. In-flight Operation.**
	X	Preflight.				1. Climb.
		B. Surface Ops (Pre-Takeoff).			X	(a) Normal.
		1. Engine start.			X	(b) Other.
	X	(a) Normal start.				2. Cruise.
	X	(b) Alternate start operations.			X	(a) Performance (speed vs. power).
	X	(c) Abnormal starts			X	(b) Turns w/wo spoilers
	X	2. Pushback			X	(c) High altitude handling.
X		3. Powerback.			X	(d) High airspeed handling
		4. Taxi		X		(e) Mach effects
	X	(a) Thrust response.			X	(f) Normal and steep turns.
	X	(b) Power lever friction.		X		(g) Performance turns.
	X	(c) Ground handling.				(h) Approach to stalls
	X	(d) Nosewheel scuffing.			X	1) cruise
	X	(e) Brake operation			X	2) takeoff or approach
	X	(f) Other.			X	3) landing
		C. Takeoff.				(i) High AOA maneuvers
		1. Normal.		X		1) cruise
	X	(a) Propulsion system checks		X		2) takeoff or approach
	X	(b) Airplane acceleration		X		3) landing
	X	(c) Nosewheel/rudder steering			X	(j) In-flight engine shutdown
	X	(d) Crosswind (max. demo)			X	(k) In-flight engine restart
X		(e) Special performance.			X	(l) Maneuver w/ engine(s) inop.
	X	(f) Landing gear, flap/slat ops.		X		(m) Slow flight.
	X	(g) Other.		X		(n) Spec flight characteristics.
		2. Abnormal/Emergency.		X		(o) Manual flight control
	X	(a) Rejected, with brake fade		X		(p) Other flight control failures
X		(b) Rejected, special perf.			X	(q) Holding.
X		(c) Flight control system failure.			X	(r) Ops. in icing conditions
	X	(d) Other.		X		(s) TCAS

Initials _____ Date _____ (Continued)

NQ	Q	TASK		NQ	Q	TASK
	X	(t) Effects of airframe icing.		X		B. With crosswind.
	X	(u) Other.		X		C. Missed approach.
		3. Descent.				(vi) MLS.
	X	(a) Normal.		X		A. Normal
	X	(b) Max. rate and recovery		X		B. With crosswind.
X		(c) Flight control failure		X		C. Missed approach.
	X	(d) High sink rate and recovery.				(vii) Steep Glide Path.
	X	(e) Other.		X		A. Normal
		E. Approaches.		X		B. With crosswind.
		1. Instrument Approach		X		C. Missed approach.
		(a) Non-precision:				2. Visual Approach Maneuvers.
	X	(i) NDB			X	(a) Abnormal wing flaps/slats
	X	(ii) VOR,			X	(b) No G/S or visual flightpath aid.
X		(iii)RNAV,				3. Abnormal/emergency.
X		(iv)TACAN			X	(a) One engine inoperative.
	X	(v) DME Arc			X	(b) Min. electric/hydraulic power.
	X	(vi) LOC/FC.			X	(c) Pitch trim malfunction.
	X	(vii) LOC/BC,			X	(d) Jammed horizontal stabilizer.
X		(viii) LDA,			X	(e) Roll/Yaw trim malfunction.
X		(ix) SDF		X		(f) Worst Flt Cont fail. (+**CCA**).
X		(x) ASR.		X		(g) Other failures / trng. prog.
X		(xi) GPS.			X	(h) Other.
	X	(xii) Missed approach.				**F. Missed approach.**
		(b) Precision:			X	1. Manual.
		(i) ILS Category I		X		2. Automatic (if applicable).
	X	A. Manual w/wo flight director				**J. Any Flight Phase.**
	X	B. Max. crosswind			X	1. Air conditioning.
		(ii) ILS Category II			X	2. Anti-icing/deicing.
	X	A. W/Wo Auto-Couple			X	3. Auxiliary powerplant.
	X	B. Max. crosswind			X	4. Communications.
		(iii) ILS Category III			X	5. Electrical.
X		A. Min./stnby. electrical power.			X	6. Fire detection and suppression.
X		B. Generator/alternator failure			X	7. Flaps/Slats.
X		C. Tail wind 10 knots			X	8. Flight cont (+ spoiler/spdbrake).
X		D. Crosswind 10 knots			X	9. Fuel and oil.
		(iv) PAR			X	10. Hydraulic.
X		A. Normal			X	11. Landing gear.
X		B. With crosswind.			X	12. Oxygen.
X		C. Missed approach.			X	13. Pneumatic.
		(v) DGPS			X	14. Propulsion System.
X		A. Normal			X	15. Pressurization.

Initials _____ Date _____ (Continued)

NQ	Q	TASK	NQ	Q	TASK
	X	16. Flt mgmt / guidance systems.		X	25. Navigation systems.
	X	17. Auto landing aids.		X	26. Weather radar.
	X	18. Auto-pilot.		X	27. Stall warning/avoidance.
	X	19. Auto-throttle.	X		28. Stability augmentation.
	X	20. Flight data displays.	X		29. ACARS.
	X	21. Flight mgmt computers.		X	30. Other.
	X	22. Flight Director.			**K. Eng. Shutdown and Parking.**
	X	23. Flight Instruments.		X	1. Systems operation.
	X	24. HUD system.		X	2. Parking brake operation.

Initials _____ Date_____ (Continued)

NQ	Q	FTD SYSTEM		NQ	Q	FTD SYSTEM
		A. Inst. Ops. Station (IOS).				**B. Sound Controls.**
	X	1. Power switch(es).			X	-- On / off / rheostat
		2. Airplane conditions.				**C. Control Loading System.**
	X	(a) GW, CG, Fuel weight, etc.			X	On / off /.
	X	(b) Airplane systems status.				**D. Observer Stations.**
	X	(c) Ground crew functions			X	1. Position.
	X	(d) Other.			X	2. Adjustment.
		3. Airports.				
	X	(a) Number and selection.				
	X	(b) Runway selection.				
	X	(c) Preset positions				
	X	(d) Lighting controls.				
	X	(e) Other.				
		4. Environmental controls.				
	X	(a) Temperature.				
	X	(b) Climate conditions				
	X	(c) Wind speed and direction.				
	X	(d) Other.				
		5. Airplane system malfunctions.				
	X	(a) Insertion / deletion.				
	X	(b) Problem clear.				
	X	(c) Other				
		6. Locks, freezes, repositioning.				
	X	(a) Problem freeze / release.				
	X	(b) Position freeze / release.				
	X	(c) Repositioning				
	X	(d) Ground speed control				
	X	(e) Other				
X		7. Remote IOS.				
	X	8. Other.				

Initials _____ Date_____ -- End --

Attachment 5 to Appendix B to Part 60—
Figure 5 – Sample Recurrent 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 5 to Appendix B to Part 60—
Figure 6 – Sample Request for Initial, Upgrade, or Reinstatement Evaluation Date

INFORMATION

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

Dear Mr. Cook:

RE: Request for Initial [Upgrade / Reinstatement] Evaluation Date

This is to advise you of our intent to request an evaluation of our (Aircraft type or set / Level) FTD 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]. [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.

[Added comments from Operator/Sponsor, if any]

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

A copy of this letter of intent has been provided to our Principal Operations Inspector (POI) and/or Training Center Program Manager (TCPM).

Sincerely,

(Signature)

Acknowledgement:

____ We concur with your proposed dates.

____ The date requested is not available, however, we propose the following date:

____ Please provide us with the following information:

_____ _____
Scheduler, National Simulator Program Date

Attachment 5 to Appendix B to Part 60— Figure 7 – 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....

BILLING CODE 4910–13–C

Attachment 6 to Appendix B to Part 60— Record of FSD Directives

Begin QPS Requirements

When the FAA determines that modification of an FTD is necessary for safety reasons, all affected FTDs must be modified accordingly, regardless of the original qualification standards applicable to any specific FTD.

a. A copy of the notification to the sponsor from the TPAA or NSPM that a modification is necessary will be filed in and maintained as part of this attachment.

b. The effective FSD Directives, including the date of the directive, the direction to make these changes, and the date of completion of any resulting modification must be maintained in a separate section of the MQTG and index accordingly. The MQTG must also be updated to include the information described in § 60.15(b)(4) as may be appropriate as a result of the FSD Directive. See Attachment 5, Figure 7, of this appendix for a sample Index of Effective FSD Directives.

End QPS Requirements

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

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.

Table of Contents

1. Introduction

a. This appendix contains background information as well as information that is either directive or guiding in nature. Information considered directive is described in this document in terms such as ''will,'' ''shall,'' and ''must,'' and means that the actions are mandatory. Guidance information is described in terms such as ''should,'' or ''may,'' and indicate actions that are desirable, permissive, or not mandatory and provide for flexibility.

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 sections, separated by horizontal lines; headings associated with these horizontal lines will indicated that a particular section begins or ends. All of the text falls into one of three sections: a direct quote or a paraphrasing of the Part 60 rule language; additional requirements that are also regulatory but are found only in this appendix; and advisory or informative material.

(2) The text presented between horizontal lines beginning with the heading ''Begin Rule Language'' and ending with the heading ''End Rule Language,'' is a direct quote or is paraphrased from Part 60 of the regulations. For example: the rule uses the terms ''flight simulation device (FSD)'' and ''aircraft;'' however, in this appendix the rule is paraphrased and the term ''simulator'' is used instead of FSD, and ''airplane'' is used instead of aircraft. Additionally, the rule uses the terms ''this part'' and ''appropriate QPS;'' however, in this appendix the rule is paraphrased and the terms ''Part 60'' and ''this appendix,'' respectively, are used instead. (Definitions are not paraphrased or modified in any way.) For ease of referral, the Part 60 reference is noted at the beginning and the end of the bordered area.

(3) The text presented between horizontal lines beginning with the heading ''Begin QPS Requirements'' and ending with the heading ''End QPS Requirements,'' is also regulatory but is found only in this appendix.

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

(5) 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.

Important Note: While this appendix contains quotes and paraphrasing directly from the rule, the reader is cautioned not to rely solely on this appendix for regulatory requirements regarding flight simulators. For regulatory references for airplane flight simulators, the reader is referred to paragraphs 3.a through h of this appendix.

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: *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.

End Information

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2. Definitions

Begin Information

See Attachment 4 of this appendix for a list of definitions and abbreviations. Attachment 4 of this appendix contains definitions directly quoted from 14 CFR Part 1 or Part 60, contained within a bordered area with Red-colored left hand columns, indicating they are quoted from 14 CFR Part 1 or Part 60 and are regulatory. Additional definitions and abbreviations used in reading and understanding this document are contained within bordered areas with Blue-colored left hand columns, indicating they are also regulatory but appear only within this document. For purposes of accuracy, the definitions listed are directly quoted, and are not paraphrased.

End Information

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3. Related Reading References

Begin Information

a. 14 CFR part 60.
b. 14 CFR part 61.
c. 14 CFR part 63.
d. 14 CFR part 121.
e. 14 CFR part 125.
f. 14 CFR part 135.
g. 14 CFR part 141.
h. 14 CFR part 142.
i. Advisory Circular (AC) 120–28C, Criteria for Approval of Category III Landing Weather Minima.
j. AC 120–29, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.
k. AC 120–35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.
l. AC 120–41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.
m. AC 120–57A, Surface Movement Guidance and Control System (SMGS).
n. AC 150/5300–13, Airport Design.
o. AC 150/5340–1G, Standards for Airport Markings.
p. AC 150/5340–4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.
q. AC 150/5340–19, Taxiway Centerline Lighting System.
r. AC 150/5340–24, Runway and Taxiway Edge Lighting System.
s. AC 150/5345–28D, Precision Approach Path Indicator (PAPI) Systems.
t. International Air Transport Association document, ''Flight Simulator Design and Performance Data Requirements,'' Fifth Edition (1996).
u. AC 29–2B, Flight Test Guide for Certification of Transport Category Rotorcraft.
v. AC 27–1A, Flight Test Guide for Certification of Normal Category Rotorcraft.
x. International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, First Edition, 1994 Doc 9625–AN/938.
y. Airplane Flight Simulator Evaluation Handbook, Volume I (February, 1995) and Volume II (July, 1996), The Royal Aeronautical Society, London, UK.
z. FAA Publication FAA–S–8081 series (Practical Test Standards for Airline Transport Pilot Certificate, Type Ratings, Commercial Pilot, and Instrument Ratings).

End Information

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4. Background

Begin Information

a. 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.

b. 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.

c. 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.

d. 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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5. Quality Assurance Program

Begin Rule Language (§ 60.5)

a. After [date 6 months after the effective date of the final rule], no sponsor may use or allow the use of or offer the use of a simulator 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 assurance (QA) program, acceptable to the NSPM, for the continuing surveillance and analysis of the sponsor's performance and effectiveness in providing a satisfactory simulator for use on a regular basis as described in the appropriate QPS.

b. The QA 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 QA 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.

d. Each sponsor of a simulator must identify to the NSPM and to the TPAA, by name, one individual, who is an employee of the sponsor, to be the management representative (MR) and the primary contact point for all matters between the sponsor and the FAA regarding the qualification of that simulator as provided for in this part.

End Rule Language (§ 60.5)

Begin QPS Requirements

e. 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 QA program for the recurring qualification of, and the day-to-day use of, each simulator.

f. An acceptable Quality Assurance (QA) Program must contain a complete, accurate, and clearly defined 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 and the importance of establishing and meeting the requirements of a QA Program as defined in this paragraph f.

(2) The method(s) used by management to determine that the regulatory standards and the QA 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 simulator.

(4) The criteria for and a definition or description of the workmanship expected for normal upkeep, repair, parts replacement, modification, *etc.,* on the simulator and how, when, and by whom such workmanship is determined to be satisfactorily accomplished.

(5) The method used to maintain and control appropriate technical and reference documents, appropriate training records, and other documents for—

(a) continuing simulator qualification; and

(b) the QA program.

(6) The criteria the sponsor uses (*e.g.,* training, experience, *etc.*) to determine who may be assigned to duties of inspection, testing, and maintenance (preventive and corrective) on simulators.

(7) The method used to track inspection, testing, and maintenance (preventive and corrective) on each simulator.

(8) The method used by the sponsor to inform the TPAA in advance of each scheduled NSPM-conducted evaluation and after the completion, the results of each such evaluation.

(9) The method used to ensure that instructors, check airmen, and those who conduct the daily preflight, are capable of determining what circumstance(s) constitute(s) a discrepancy regarding the simulator and its operation.

(10) The method used to ensure that instructors, check airmen, and those who conduct the daily preflight, record in the simulator discrepancy log each simulator discrepancy and each missing, malfunctioning, or inoperative simulator component.

(11) The method used to ensure that instructors and check airmen are completely and accurately logging the number of disruptions and time not available for training, testing, checking, or for obtaining flight experience during a scheduled simulator use-period, including the cause(s) of the disruption.

(12) The method used by the sponsor to notify users of the simulator of missing, malfunctioning, or inoperative components that restrict the use of the simulator.

(13) The method of recording NSPM-conducted evaluations and other inspections (*e.g.,* daily preflight inspections, NASIP inspections, sponsor conducted quarterly inspections, *etc.*), including the evaluation or inspection date, test results, discrepancies and recommendations, and all corrective actions taken.

(14) The method for ensuring that the simulator is configured the way the helicopter it represents is configured and that if the configuration is authorized to be changed that the newly configured system(s) function(s) correctly.

(15) The method(s) for:

(a) determining whether or not proposed modifications of the helicopter will affect the performance, handling, or other functions or characteristics of the helicopter; and

(b) determining whether or not proposed modifications of the simulator will affect the performance, handling, or other functions or characteristics of the simulator;

(c) coordinating and communicating items 5.f.(15)(a) and (b) of this appendix, as appropriate, with the sponsor's training organization, other users (*e.g.,* lease or service contract users), the TPAA, and the NSPM.

(16) How information found in the discrepancy log is used to correct discrepancies and how this information is used to review and, if necessary, modify existing procedures for simulator maintenance.

(17) The method for how and when software or hardware modifications are accomplished and tracked, documenting all changes made from the initial submission.

(18) The method used for determining that the simulator meets appropriate standards each day that it is used.

(19) The method for acquiring independent feedback regarding simulator operation (from persons recently completing training, evaluation, or obtaining flight experience; instructors and check airmen using the simulator for training, evaluation or flight experience sessions; and simulator technicians and maintenance personnel) including a description of the process for addressing these comments.

(20) How devices used to test, measure, and monitor correct simulator 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.

(21) How, by whom, and how frequently internal audits of the QA 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

g. Additional Information.

Begin Information

(1) In addition to specifically designated QA evaluations, the NSPM will evaluate the sponsor's QA program as part of regularly scheduled recurrent simulator evaluations and no-notice simulator evaluations, focusing in large part on the effectiveness and viability of the QA program and its contribution to the overall capability of the simulator to meeting the requirements of this part.

(2) The sponsor, through the MR, may delegate duties associated with maintaining the qualification of the simulator (*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 initial and day-to-day qualification and quality of the simulator. One person may serve in this capacity for more than one simulator, but one simulator would not have more than one person serving in this capacity.

(3) Should a sponsor include a ''foreign simulator'' (*i.e.*, one maintained by a non-US certificate holder) under their sponsorship, the sponsor remains responsible for the QA program for that simulator. However, if that foreign simulator is maintained under a QA program accepted by that foreign regulatory authority and that authority and the NSPM have agreed to accept each other's QA programs (*e.g.*, the Joint Aviation Authorities, JAA, of Europe), the sponsor will be required only to perform an ''external audit'' of the non-US certificate holder's compliance with the accepted foreign QA program, with the results of that audit submitted to and accepted by the NSPM.

End Information

6. Sponsor Qualification Requirements

Begin Rule Language (§ 60.7)

a. A person is eligible to apply to be a sponsor of a simulator 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 simulator will be used, or will be offered for use, in the sponsor's FAA-approved flight training program for the helicopter being simulated as evidenced in a request for evaluation submitted to the NSPM through the TPAA.

b. A person is a sponsor of the simulator 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 operations specifications authorizing the use of the helicopter type being simulated by the simulator or has training specifications or a course of training authorizing the use of a simulator for that helicopter type.

(3) The person has an approved quality assurance program in accordance with § 60.5.

(4) The NSPM has approved the person as the sponsor of the simulator and that approval has not been withdrawn by the FAA.

c. A person continues to be a sponsor of a simulator, if the following conditions are met:

(1) Beginning 12 calendar months after the initial qualification and every 12 calendar months thereafter, the simulator must have been used within the sponsor's FAA-approved flight training program for the helicopter type for a minimum of 600 hours.

(2) The use of the simulator described in paragraph (c)(1) of this section must be dedicated to meeting the requirements of parts 61, 63, 91, 121, or 135 of this chapter.

(3) If the use requirements of paragraphs (c)(1) and (2) of this section are not met, the person will continue to sponsor the simulator on a provisional basis for a period not longer than 12 calendar months; and—

(i) If the simulator is used as described in paragraphs (c)(1) and (2) of this section within this additional 12 calendar month period, the provisional status will be removed and regular sponsorship resumed; or

(ii) If the simulator is not used as described in paragraphs (c)(1) and (2) of this section within the additional 12 calendar month period, the simulator is not qualified and the sponsor will not be eligible to apply to sponsor that simulator for at least 12 calendar months.

End Rule Language (§ 60.7)

7. Additional Responsibilities of the Sponsor

Begin Rule Language (§ 60.9)

a. The sponsor must not allow the simulator to be used for flightcrew member training or evaluation or for attaining flight experience for the flightcrew member to meet any of the requirements under this chapter unless the sponsor, upon request, allows the NSPM to inspect immediately the simulator, including all records and documents relating to the simulator, to determine its compliance with this part.

b. The sponsor must, for each simulator—

(1) Establish a mechanism for the following persons to provide comments regarding the simulator and its operation and provide for receipt of those comments:

(i) Flightcrew members recently completing training or evaluation or recently obtaining flight experience in the simulator;

(ii) Instructors and check airmen using the simulator for training, evaluation, or flight experience sessions; and

(iii) Simulator technicians and maintenance personnel performing work on the simulator.

(2) Examine each comment received under paragraph (b)(1) of this section for content and importance and take appropriate action.

(3) Maintain a liaison with the manufacturer of the helicopter being simulated by the simulator to facilitate compliance with § 60.13(f) when necessary.

(4) Post in or adjacent to the simulator the Statement of Qualification issued by the NSPM.

End Rule Language (§ 60.9)

8. Simulator Use

Begin Rule Language (§ 60.11)

No person may use or allow the use of or offer the use of a simulator for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification unless, in accordance with the QPS for the specific device—

a. It has a single sponsor who is qualified under § 60.9. The sponsor may arrange with another person for services of document preparation and presentation, as well as simulator 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. It is qualified as described in the Statement of Qualification that is required to be posted pursuant to § 60.9(b)(4)—

(1) For the make, model, and series of helicopter; and

(2) For all tasks and configurations.

c. It remains qualified, through satisfactory inspection, recurrent evaluations, appropriate maintenance, and use requirements in accordance with this part and the appropriate QPS.

d. Its software and active programming used during the training, evaluation, or flight experience is the same as the software and active programming that was evaluated by the NSPM.

End Rule Language (§ 60.11)

Begin QPS Requirements

e. Only those simulators that are used by a certificate holder (as defined for use in Part 60 and this QPS) 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.

End QPS Requirements

Begin Information

f. Each simulator must be evaluated as completely as possible. To ensure a thorough and uniform evaluation, each simulator is subjected to the 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 in this paragraph f

will include, but not necessarily be limited to the following, as appropriate, for the qualification level of the simulator.

(1) Aerodynamic responses, including control responses in the longitudinal, lateral-directional, and vertical directions; as well as low airspeed responses (see attachment 2 of this appendix);

(2) Performance in authorized portions of the simulated helicopter's operating envelope, to include tasks suitable to the NSPM in the areas of ground operations, takeoff, climb, cruise, descent, approach, landing, hover (if appropriate), and vertical climb, as well as abnormal and emergency operations (see paragraph 23 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 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.

g. 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 are used to compare simulator and helicopter data objectively to ensure that the simulator performance and handling qualities are within specified tolerances.

(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 meets the appropriate training/testing/checking objectives and competently simulates each required maneuver, procedure, or task; and

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

h. 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.

i. In addition to the scheduled recurrent evaluation (see paragraph 14 of this appendix), 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. While the intent is to observe the operation and interaction of the device and not the check airman, instructor, APD, FAA inspector, or student(s), the simulator evaluator is a qualified FAA operations inspector and must, without question, report any obvious lack of proficiency to the appropriate POI or TCPM.

End Information

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9. Simulator Objective Data Requirements

Begin Rule Language (§ 60.13)

a. Except as provided in paragraph (b) and (c) of this section, for the purposes of validating simulator performance and handling qualities during evaluation for qualification, the sponsor must submit the helicopter manufacturer's flight test data to the NSPM.

b. The sponsor may submit flight test data from a source in addition to or independent of the helicopter manufacturer's data to the NSPM in support of a simulator 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 sponsor may submit alternative data acceptable to the NSPM for consideration, approval and possible use in particular applications for simulator 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 flight testing to support certain simulator qualification requirements.

f. When a simulator sponsor learns, or is advised by a helicopter manufacturer or supplemental type certificate (STC) holder, that an addition to, an amendment to, or a revision of the data used to program and operate a simulator used in the sponsor's training program is available, the sponsor must immediately notify the NSPM.

End Rule Language (§ 60.13)

Begin QPS Requirements

g. 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.

h. The data presented, 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.

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

End QPS Requirements

Begin Information

j. Any necessary data and the flight test plan should be reviewed with the NSP staff well in advance of commencing the flight test.

End Information

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10. Special Equipment and Personnel Requirements for Qualification of the Simulator

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Begin Rule Language (§ 60.14)

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

End Rule Language (§ 60.14)

Begin Information

b. Examples of a special evaluation would be an evaluation conducted at the request of the TPAA or 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.

c. The NSPM will notify the sponsor at least 24 hours in advance of the evaluation if special equipment or personnel will be required to conduct the evaluation. Examples of special equipment include spot photometers, flight control measurement devices, sound analyzer, etc. Examples of special personnel would be those specifically qualified to install or use any special equipment when its use is required.

End Information

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11. Initial (and Upgrade) Qualification Requirements

Begin Rule Language (§ 60.15)

a. For each simulator, the sponsor must submit a request through the TPAA to have the NSPM evaluate the simulator for initial qualification at a specific level. The request must be submitted in the form and manner described in the appropriate QPS.

b. The request must include all of the following:

(1) A statement that the simulator meets all of the applicable provisions of this part.

(2) A statement that the sponsor has established a procedure to verify that the configuration of hardware and software present during the evaluation for initial qualification will be maintained, except where modified as authorized in § 60.23. The statement must include a description of the procedure.

(3) A statement signed by at least one pilot who meets the requirements of paragraph (c) of this section asserting that each pilot so approved has determined that the following requirements have been met:

(i) The simulator systems and sub-systems function equivalently to those in the helicopter.

(ii) The performance and flying qualities of the simulator are equivalent to those of the helicopter.

(iii) The cockpit configuration conforms to the configuration of the helicopter make, model, and series being simulated.

(4) A list of all of the operations tasks or simulator systems in the subjective test appendix of the appropriate QPS for which the simulator has not been subjectively tested (*e.g.*, circling approaches, windshear training, *etc.*) and for which qualification is not sought.

(5) A qualification test guide (QTG) that includes all of the following:

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

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

(iii) The general simulator performance or demonstration results prescribed in the appropriate QPS.

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

c. The pilot or pilots who make the statement required by paragraph (b)(3) of this section must—

(1) Be designated by the sponsor;

(2) Be approved by the TPAA; and

(3) Be qualified in—

(i) The helicopter being simulated; or

(ii) For helicopter types not yet issued a type certificate, a helicoptertype similar in size and configuration.

d. The subjective tests that form the basis for the statements described in paragraph (b)(3) of this section and the objective tests referenced in paragraph (b)(5) of this section must be accomplished at the sponsor's training facility except as provided for in the appropriate QPS.

e. The person seeking to qualify the simulator must provide the NSPM access to the simulator for the length of time necessary for the NSPM to complete the required evaluation of the simulator for initial qualification, which includes the conduct and evaluation of objective and subjective tests, including general simulator requirements, as described in the appropriate QPS, to determine that the simulator meets the standards in that QPS.

f. When the simulator 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 helicopter being simulated.

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

(4) A statement that the simulator is qualified.

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

(6) A list of all of the operations tasks or simulator systems in the subjective test appendix of the appropriate QPS for which the simulator has not been subjectively tested and for which the simulator is not qualified (e.g., circling approaches, windshear training, etc.).

g. 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.

h. Upon issuance of the Statement of Qualification the updated QTG becomes the MQTG and must then be made available to the FAA upon request.

End Rule Language (§ 60.15)

Begin QPS Requirements

i. The QTG described in paragraph 11.b.(4) of this appendix, must provide the documented proof of compliance with the simulator objective tests in attachment 2 of this appendix.

j. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, through the TPAA 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) statements of how a particular test was accomplished or that certain requirements have been met (see appendices to this document for additional information);

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

k. The QTG described in paragraph 11.b(4) of this appendix, must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see attachment 5, Figure 2, of this appendix for a sample QTG cover page).

(2) A recurrent evaluation schedule requirements page—to be used by the NSPM to establish and record the frequency with which recurrent evaluations must be conducted and any subsequent changes that may be determined by the NSPM. See attachment 5, Figure 4, of this appendix for a sample Recurrent Evaluation Schedule Requirements page.

(3) A simulator information page that provides the information listed below (see attachment 5, Figure 3, of this appendix 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) The source data.

(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 of this appendix, ''Simulator Standards,'' or in the ''Test Details'' column in attachment 2 of this appendix, ''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 of this appendix, as applicable to the qualification level sought.

(a) Name of the test.

(b) Objective of the test.

(c) Initial conditions.

(d) Manual test procedures.

(e) Automatic test procedures (if applicable).

(f) Method for evaluating simulator objective test results.

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

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

(i) Tolerances for relevant parameters.

(j) Source of Helicopter Test Data (document and page number).

(k) Copy of the Helicopter Test 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.

l. 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 helicopter test data (*e.g.*, use of a multi-channel recorder, line printer, cross plotting, overlays, transpariencies, *etc.*).

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

(3) Helicopter 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, flight test 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.

m. 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.

n. 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 and submit a statement to the NSPM that the simulator has not changed from the original determination. The report must clearly indicate when and where these repeated tests were completed, but need not take more than one normal simulator period (e.g., 4 to 8 hours) to complete.

o. The sponsor must maintain a copy of the MQTG at the simulator location. After [date 6 years from the effective date of this rule] all MQTG's, regardless of initial qualification date of the simulator, must be available in an electronic format, acceptable to the NSPM. The electronic MQTG must include 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 document, the general simulator performance or demonstration results (reformatted or digitized) prescribed in this document, and a description of the equipment necessary to perform the evaluation for initial qualification and the recurrent evaluations for continuing qualification. This electronic MQTG must include the original helicopter flight test 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 flight test time-history plots that were provided by the data supplier. An electronic copy of MQTG must be provided to the NSPM.

End QPS Requirements

Begin Information

p. 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.

q. 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.

r. 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 5, figure 5 of this appendix, Sample Request for Initial Evaluation Date.

s. 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.

t. 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, Simulator Objective Tests.

End Information

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12. Additional Qualifications for a Currently Qualified Simulator

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Begin Rule Language (§60.16)

a. A currently qualified simulator is required to undergo an additional qualification process if a user intends to use the simulator for meeting training, evaluation, or flight experience requirements of this chapter beyond the qualification issued to the sponsor. 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 simulator that are

required to support the additional qualification.

(iii) Must submit a statement to the NSPM that a pilot, designated by the sponsor in accordance with § 60.15(c) and approved by the TPAA for the user, has subjectively evaluated the simulator in those areas not previously evaluated.

(2) The simulator must successfully pass an evaluation—

(i) For initial qualification, in accordance with § 60.15, 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 (e.g., objective tests, performance demonstrations, 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 simulator, any modifications to the simulator hardware or software that are involved, and any additions or modifications to the MQTG.

c. The simulator is qualified for the additional uses when the NSPM issues an amended Statement of Qualification in accordance with § 60.15(f).

d. The sponsor may not modify the simulator except as described in § 60.23.

End Rule Language (§ 60.16)

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13. Previously Qualified Simulators

Begin Rule Language (§60.17)

a. Unless otherwise specified by an FSD Directive, further referenced in the appropriate QPS, or as specified in paragraph (e) of this section, a simulator qualified before [the effective date of the final rule] will retain its qualification as long as it continues to meet the standards, including the performance demonstrations and the objective test results recorded in the MQTG, under which it was originally evaluated, regardless of sponsor, and as long as the sponsor complies with the applicable provisions of this part.

b. If the simulator qualification is lost under § 60.27 and not restored under § 60.27 for two (2) years or more, the qualification basis for the re-qualification will be those standards in effect and current at the time of re-qualification application.

c. Except as provided in paragraph (d) of this section, any change in simulator qualification level initiated on or after [the effective date of this rule] requires an evaluation for initial qualification in accordance with this part.

d. The NSPM may downgrade a qualified simulator without requiring and without conducting an initial evaluation for the new qualification level. Subsequent recurrent evaluations will use the existing MQTG, modified as necessary to reflect the new qualification level.

e. 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 simulator. The updated test(s) and tolerance(s) must be made a permanent part of the MQTG.

End Rule Language (§ 60.17)

Begin Information

f. 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 12, above.

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Note: The reader is reminded of the requirement that each simulator user obtain approval for use of each simulator in an FAA-approved flight training program from the appropriate TPAA.

End Information

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14. Inspection, Maintenance, and Recurrent Evaluation Requirements.

Begin Rule Language (§60.19)

a. Inspection. No sponsor may use or allow the use of or offer the use of a simulator for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification unless the sponsor does the following:

(1) Accomplishes all appropriate QPS Attachment 1 performance demonstrations and all appropriate QPS Attachment 2 objective tests each year. To do this, the sponsor must conduct a minimum of four evenly spaced inspections throughout the year, as approved by the NSPM. The performance demonstrations and objective test sequence and content of each inspection in this sequence will be developed by the sponsor and submitted to the NSPM for approval. In deciding whether to approve the test sequence and the content of each inspection, the NSPM looks for a balance and a mix from the performance demonstrations and objective test requirement areas listed below as follows.

(i) Performance.

(ii) Handling qualities.

(iii) Motion system.

(iv) Visual system.

(v) Sound system (where appropriate).

(vi) Other simulator systems.

(2) Completes a functional preflight check in accordance with the appropriate QPS each calendar day prior to the start of the first simulator period of use that begins in that calendar day.

(3) Completes at least one functional preflight check in accordance with the appropriate QPS in every 7 consecutive calendar days.

(4) Maintains a discrepancy log.

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

(i) Each discrepancy entry must be maintained in the log until the discrepancy is corrected as specified in § 60.25(b) and for at least 30 days thereafter.

(ii) The corrective action taken for each discrepancy and the date that action is taken must be entered in the log. This entry concerning the corrective action must be maintained for at least 30 days thereafter.

(iii) The discrepancy log is kept in a form and manner acceptable to the Administrator and is kept in or immediately adjacent to the simulator.

b. Recurrent evaluation.

(1) This evaluation consists of performance demonstrations, objective tests, and subjective tests, including general simulator requirements, as described in the appropriate QPS or as may be amended by an FSD Directive.

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

(3) The sponsor must provide the NSPM access to the objective test results and general simulator performance or demonstration results in the MQTG, and access to the simulator for the length of time necessary for the NSPM to complete the required recurrent evaluations, weekdays between 6 o'clock AM (local time) and 6 o'clock PM (local time).

(4) No sponsor may use, or allow the use of, or offer the use of, a simulator for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of this chapter unless the simulator has passed an NSPM-conducted recurrent evaluation within the previous 12 calendar months or as otherwise provided for in the MQTG.

(5) Recurrent evaluations conducted in the calendar month before or after the calendar month in which these recurrent evaluations are required will be considered to have been conducted in the calendar month in which they were required.

c. Maintenance. The sponsor is responsible for continuing corrective and preventive maintenance on the simulator to ensure that it continues to meet the requirements of § 60.15(b).

End Rule Language (§ 60.19)

Begin QPS Requirements

d. The preflight inspections described in paragraphs 14.a(2) and (3) of this appendix must consist of, as a minimum—

(1) an exterior inspection of the simulator for appropriate hydraulic, pneumatic, and electrical connections (e.g., in place, not leaking, appear serviceable);

(2) a check that the area around the simulator is free of potential obstacles throughout the motion system range;

(3) a review of the simulator discrepancy log;

(4) a functional check of the major simulator systems and simulated helicopter systems (e.g., visual, motion, sound, cockpit instrumentation, and control loading, including adequate air flow for equipment cooling) by doing the following:

(i) Turn on main power, including motion system, and allow to stabilize.

(ii) Connect helicopter power. This may be connected through ''quick start'' of helicopter engines, auxiliary power unit, or ground power. Helicopter operations will require operating engines.

(iii) A general look for light bulb function, lighted instruments and switches, etc., as well as inoperative ''flags'' or other such indications.

(iv) Check Flight Management System(s) (and other date-critical information) for proper date range.

(v) Select takeoff position and from either pilot position, observe the visual system, for proper operation; e.g., light-point color balance and convergence, edge-matching and blending, etc.

(vi) Adjust visibility value to inside of the far end of the runway and release ''position freeze or flight freeze.'' From either pilot position, add power to taxi (or hover taxi as applicable) down the runway (observe visual system, check sound system and engine instrument response) and apply wheel brakes if appropriate (to check wheel brake operation as applicable and to exercise simulator motion system); check normal operation.

(vii) Select position on final approach, at least five (5) miles out (observe visual scene). From either pilot position, adjust helicopter configuration appropriately (check for normal gear operation as applicable). Adjust visibility to see entire airport. Release ''position freeze'' or ''flight freeze.'' Make a rapid left and right bank (check control feel and freedom; observe proper helicopter response; and exercise motion system). Observe visual system and simulated helicopter systems operation.

(viii) Extend gear, as applicable

(ix) Fly to and land at airport, or select takeoff position.

(x) Shut down engines, turn off lights, turn off main power supply and motion system.

(xi) Record ''functional preflight'' in the simulator discrepancy log book, including any item found to be missing, malfunctioning, or inoperative.

End QPS Requirements

Begin Information

e. If the NSP evaluator plans to accomplish specific tests during a normal recurrent evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; usually not less than 24 hours. These tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests.

f. The recurrent evaluations described in paragraph 13.a(7), of this appendix require approximately eight (8) hours of simulator time and consist of the following:

(1) a review of the results of the objective tests and all the designated simulator performance demonstrations conducted by the sponsor since the last scheduled recurrent evaluation.

(2) at the discretion of the evaluator, a selection of approximately 20 percent of those objective tests conducted since the last scheduled recurrent evaluation and a selection of approximately 10 percent of the remaining objective tests in the MQTG. The tests chosen will be performed either automatically or manually, at the discretion of the evaluator.

(3) a subjective test 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.

(4) an examination of the functions of the simulator, including, but not necessarily limited to the motion system, visual system, sound system, instructor operating station, and the normal and simulated malfunctions of the simulated helicopter systems.

End Information

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15. Logging Simulator Discrepancies.

Begin Rule Language (§ 60.20)

Each instructor, check airman, or representative of the Administrator conducting training or evaluation, or observing flight experience for flightcrew member certification or qualification, and each person conducting the preflight inspection (§ 60.19(a)(2), (3), and (4)), who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the simulator, must write or cause to be written a description of that discrepancy into the discrepancy log at the end of the simulator preflight or simulator use session.

End Rule Language (§ 60.20)

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16. [Reserved]

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17. Modifications to Simulators

Begin Rule Language (§ 60.23)

a. When the sponsor or the FAA determines that any of the following circumstances exist and the FAA determines that the simulator cannot be used adequately to train, evaluate, or provide flight experience for flightcrew members, the sponsor must modify the simulator accordingly:

(1) The helicopter manufacturer or another approved source develops new data regarding the performance, functions, or other characteristics of the helicopter being simulated;

(2) A change in helicopter performance, functions, or other characteristics occurs;

(3) A change in operational procedures or requirements occurs; or

(4) Other circumstances as determined by the NSPM.

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

c. Before modifying a qualified simulator, the sponsor must notify the NSPM and the TPAA as follows:

(1) The notification must include a complete description of the planned modification, including a description of the operational and engineering effect the proposed modification will have on the operation of the simulator.

(2) The notification must be submitted in a form and manner as specified in the appropriate QPS.

d. If the sponsor intends to add additional equipment or devices intended to simulate helicopter appliances; modify hardware or software which would affect flight or ground dynamics, including revising simulator programming or replacing or modifying the host computer; or if the sponsor is changing or modifying the motion, visual, or control loading systems (or sound system for simulator levels requiring sound tests and measurements), the following applies:

(1) The sponsor must meet the notification requirements of paragraph (c) of this section and must include in the notification the results of all objective tests that have been re-run with the modification incorporated, including any necessary updates to the MQTG.

(2) However, the sponsor may not use, or allow the use of, or offer the use of, the simulator with the proposed modification for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of this chapter unless or until the sponsor receives written notification from the NSPM approving the proposed modification. Prior to approval, the NSPM may require that the modified simulator be evaluated in accordance with the standards for an evaluation for initial qualification or any part thereof before it is placed in service.

e. The sponsor may not modify a qualified simulator until one of the following has occurred:

(1) For circumstances described in paragraphs (b) or (d) of this section, the sponsor receives written approval from the NSPM that the modification is authorized.

(2) For circumstances other than those described in paragraphs (b) or (d) of this section, either:

(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 the NSPM or TPAA; or

(ii) The NSPM or TPAA approves the proposed modification in fewer than 21 days since the sponsor notified the NSPM and the TPAA of the proposed modification.

f. When a modification is made to a simulator, the sponsor must notify each certificate holder planning to use that simulator of that modification prior to that certificate holder using that simulator the first time after the modification is complete.

g. The MQTG must be updated with current objective test results in accordance with § 60.15(b)(5) and appropriate flight test data in accordance with § 60.13, each time a simulator is modified and an objective test is affected by the modification. If this update is initiated by an FSD Directive, the direction

to make the modification and the record of the modification completion must be filed in the MQTG.

End Rule Language (§ 60.23)

Begin QPS Requirements

h. The notification described in paragraph 17.c.(1) of this appendix will include a statement signed by a pilot, qualified in the helicopter type being simulated and designated by the sponsor, that, with the modification proposed—

(1) the simulator systems and sub-systems function equivalently to those in the helicopter being simulated;

(2) the performance and flying qualities of the simulator are equivalent to those of the helicopter being simulated; and

(3) the cockpit configuration conforms to the configuration of the helicopter being simulated.

End QPS Requirements

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18. Operations With Missing, Malfunctioning, or Inoperative Components

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Begin Rule Language (§60.25)

a. No person may use or allow the use of or offer the use of a simulator with a missing, malfunctioning, or inoperative component for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification during maneuvers, procedures, or tasks that require the use of the correctly operating component.

b. Each missing, malfunctioning, or inoperative component must be repaired or replaced within 30 calendar days unless otherwise authorized by the NSPM. Failure to repair or replace this component within the prescribed time may result in loss of simulator qualification.

c. Each missing, malfunctioning, or inoperative component must be placarded as such on or adjacent to that component in the simulator and a list of the currently missing, malfunctioning, or inoperative components must be readily available in or immediately adjacent to the simulator for review by users of the device.

End Rule Language (§ 60.25)

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19. Automatic Loss of Qualification and Procedures for Restoration of Qualification.

Begin Rule Language (§60.27)

a. A simulator is not qualified if any of the following occurs:

(1) The simulator is not used in the sponsor's FAA-approved flight training program in accordance with § 60.9(b)(4).

(2) The simulator is not maintained and inspected in accordance with § 60.19.

(3) The simulator is physically moved from one location to another, regardless of distance.

(4) The simulator is disassembled (*e.g.*, for repair or modification) to such an extent that it cannot be used for training, evaluation, or experience activities.

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

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

(1) The simulator successfully passes an evaluation:

(i) For initial qualification, in accordance with § 60.15 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 approved as necessary by the NSPM.

(2) The NSPM or the TPAA 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 inspections and recurrent evaluations missed, the amount of disassembly and re-assembly of the simulator that was accomplished, and the care that had been taken of the device since the last evaluation.

End Rule Language (§ 60.27)

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20. Other Losses of Qualification and Procedures for Restoration of Qualification

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Begin Rule Language (§60.29)

a. Except as provided in paragraph (c) of this section, when the NSPM or the TPAA notifies the sponsor that the simulator no longer meets qualification standards, the following procedure applies:

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

(2) The NSPM or the TPAA sets a reasonable period (but not less than 7 days) within which the sponsor may submit written information, views, and arguments on the simulator qualification.

(3) After considering all material presented, the NSPM or the TPAA notifies the sponsor of the simulator qualification.

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

(i) The NSPM or the TPAA find under paragraph (c) of this section that there is an emergency requiring immediate action with respect to safety in air transportation or air commerce; or

(ii) The sponsor petitions for reconsideration of the NSPM or the TPAA finding under paragraph (b) of this section.

b. When a sponsor seeks reconsideration of a decision from the NSPM or the TPAA concerning the simulator 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 simulator is no longer qualified.

(2) The sponsor must address its petition to the Director, Flight Standards Service.

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

c. If the NSPM or the TPAA find that an emergency exists requiring immediate action with respect to safety in air transportation or air commerce that makes the procedures set out in this section impracticable or contrary to the public interest:

(1) The NSPM or the TPAA withdraws qualification of some or all of the simulator 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 or the TPAA 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.

End Rule Language (§ 60.29)

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21. Recordkeeping and Reporting

Begin Rule Language (§60.31)

a. The simulator sponsor must maintain the following records for each simulator it sponsors:

(1) The MQTG and each amendment thereto.

(2) A copy of the programming used during the evaluation of the simulator for initial qualification and for any subsequent upgrade qualification, and a copy of all programming changes made since the evaluation for initial qualification.

(3) A copy of all of the following:

(i) Results of the evaluations for the initial and each upgrade qualification.

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

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

(iv) Comments obtained in accordance with § 60.9(b)(1) for a period of at least 18 months.

(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.

(5) A record of all modifications to simulator hardware configurations made since initial qualification.

b. The simulator sponsor must keep a current record of each certificate holder using the simulator. The sponsor must provide a

copy of this list to the NSPM at least semiannually.

c. 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.

d. The sponsor must submit an annual report, in the form of a comprehensive statement signed by the quality assurance primary contact point, certifying that the simulator continues to perform and handle as qualified by the NSPM.

End Rule Language (§ 60.31)

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22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements

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Begin Rule Language (§60.33)

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 or the QPS.

(2) A fraudulent or intentionally false statement in or omission from any record or report that is kept, made, or used to show compliance with this part or the QPS, 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 or the QPS.

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 simulator qualification and approval for use in a training program.

c. The following may serve as a basis for removal of qualification of a simulator including the withdrawal of authorization for use of a simulator; 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 a simulator qualification or an approval for use.

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23. [Reserved]

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24. [Reserved]

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25. [Reserved]

End Rule Language (§60.33)

Attachment 1 to Appendix C to Part 60—General Simulator Requirements

1. General

Begin QPS Requirements

a. Requirements.

(1) Certain simulator and visual system requirements included in this appendix must be supported with a Statement of Compliance and Capability (SOC) and, in designated cases, simulator performance must be recorded and the results made part of the QTG. In the following tabular listing of simulator standards, requirements for SOC's are indicated in the ''Additional Details'' column.

(2) Airports (or landing areas) represented in visual scenes required by this document must be representations of real-world, operational airports (or landing areas) or representations of fictional airports (or landing areas), designed specifically for use in training, testing, and/or checking of flight crewmembers.

(a) If real-world, operational airports (or landing areas) are simulated, the visual representation and scene content is compared to that of the actual airport (or landing area). This comparison requires accurate simulation of that airport (or landing area) to the extent set out in this document and as required by the qualification level sought. It also requires the visual scene to be modified when the airport (or landing area) 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 landing area are changed; when significant and recognizable changes are made to the landing area or surrounding terrain; etc.

(b) If fictional airports (or landing areas) are used, the navigational aids and all appropriate maps, charts, and other navigational reference material for such airports (or landing areas 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 (or landing area) 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

Begin Information

b. Discussion.

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

(2) The material contained in this attachment is divided into the following categories:

(a) General cockpit configuration.

(a) Simulator programming.

(a) Equipment operation.

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

(a) Motion system.

(a) Visual system.

(g) Sound system.

End Information

TABLE OF MINIMUM SIMULATOR REQUIREMENTS

General simulator requirements	QPS requirement				Additional details	Information notes
	Simulator level					
	A	B	C	D		
2. 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	Pilot seats must afford the capability for the occupant to be able to achieve the design ''eye position'' established for the helicopter being simulated.	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.
b. Those circuit breakers that affect procedures and/or result in observable cockpit indications must be properly located and functionally accurate.		X	X	X	.....	
3. Programming						
a. The effect of aerodynamic changes 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, center of gravity location, and configuration.		X	X	X	.....	
b. The simulator must have the computer capacity, accuracy, resolution, and dynamic response needed to meet the qualification level sought.		X	X	X		
c. Simulator hardware and programming must be updated within 6 months of any helicopter modifications or appropriate data releases unless, with prior coordination, the NSPM authorizes otherwise.		X	X	X	An SOC is required. Simulator performance must be recorded and the results made part of the QTG.	
d. Ground handling and aerodynamic programming must include the following:						
(1) Ground effect.					Level B does not require hover programming. Flare and touch down from a running landing as well as for in-ground-effect (IGE) hover.	
(2) Ground reaction.					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.	Data is required to identify the flight condition and helicopter configuration.
(3) Ground handling characteristics.					Control inputs required during operations in crosswind, during braking and deceleration, and for turning radius.	
e. The simulator must include a means for quickly and effectively testing simulator programming and hardware.			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.

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

QPS requirement						Information notes
General simulator requirements	Simulator level				Additional details	
	A	B	C	D		
f. The simulator must provide for 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. ..... Simulator to test results must include simulator number, date, time, conditions, tolerances, and appropriate dependent variables portrayed in comparison to the helicopter standard.	Automatic ''flagging'' of out-of-tolerance situations is encouraged.
g. Relative responses of the motion system, visual system, and cockpit instruments must be coupled closely to provide integrated sensory cues.		X	X	X	For Level B, response must be within 150 milliseconds of the helicopter response. For Levels C and D, response must be within 100 milliseconds of the helicopter response.	
(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 150 milliseconds (for a Level B simulator) or 100 milliseconds (for Level C and D simulators) after that time. 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.					Simultaneously record: the analog output from the pilot's cyclic, collective, and pedals; the output from an accelerometer attached to the motion system platform located at an acceptable location near the pilots' seats; the output signal to the visual system display (including visual system analog delays); and 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. Acceleration in the appropriate 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.
(2) Transport Delay: As an alternative to the Latency requirement, above, a transport delay demonstration may be used to demonstrate that the simulator system does not exceed the specified limit of 150 milliseconds for Level B simulators or 100 milliseconds for Level C or D simulators. 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. While transport delay need only be measured once in each axis, independent of flight conditions, 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.	The transport delay is the time between the control input and the individual hardware (*i.e.,* instruments, motion system, visual system) responses.
h. The simulator must accurately reproduce the stopping and directional control forces for at least the following landing surface conditions for a running landing: (1) Wet ..... (2) Icy (3) Patchy Wet. (4) Patch Icy			X	X	An SOC is required Simulator performance must be recorded and the results made part of the OTG.	Objective tests are described in attachment 2 for dry runway conditions.

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirement: Simulator level A	B	C	D	Additional details	Information notes
i. The simulator must accurately simulate brake and tire failure dynamics and decreased brake efficiency due to brake temperatures.			X	X	An SOC is required. A demonstration is required for initial and recurrent evaluations. Simulator performance must be recorded for decreased braking efficiency due to brake temperature and the results made part of the OTG	Simulator pitch, side loading, and directional control characteristics should be representative of the the helicopter.
j. The simulator must have aerodynamic modeling, including ground effect, the effects of airframe icing (if applicable), aerodynamic interference effects between the rotor wake and fuselage, influence of the rotor on control and stabilization systems, and representations on non linearties due to sideslip.			X	X	An SOC is required and must include references to computations of aeroelastic representations and 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.
k. The simulator must have a software and hardware control methodology that is supported by diagnostic analysis program(s) and resulting printouts.				X	An SOC is required.	
4. Equipment Operation						
a. All relevant cockpit instrument indications involved in the simultation 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 for US operations: for example, fuel in pounds, speed in knots, and altitude in feet.	
b. Communications and navigation equipment must be installed and operate within the tolerances applicable for the helicopter.		X	X	X	.....	See Attachment paragraph 1c for further information regarding long-range navigation equipment.
c. Simulated helicopter 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		
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 condition.		X	X	X		
5. Instructor or Evaluator Facilities						
a. In addition to the flight crew member stations, the simulator must have 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 helicopter but must be equipped with similar positive restraint devices.	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 described in the sponsor's pilot operating manual into the simulated helicopter system.		X	X	X		

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirement: Simulator level A	B	C	D	Additional details	Information notes
c. The Simulator must have instructor controls for wind speed and direction.		X	X	X		
d. The simulator must provide the instructor or evaluator the ability to present ground and air hazards.			X	X	.....	For example, another helicopter crossing the active runway and converging airborne traffic; etc.
6. Motion System						
a. The simulator must have motion (force) cues perceptible to the pilot that are representative of the motion in a helicopter.		X	X	X	.....	For example, touchdown cues should be a function of the rate of descent (RoD) of the simulated helicopter.
b. The simulator must have a motion system with a minimum of three degrees of freedom (at least pitch, roll, sway, 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.			X	X	An SOC is required.	
d. The simulator must provide special effects programming that includes the following: (1) Runway rumble, eleo deflections, effects of ground speed and uneven runway characteristics. (2) Buffet due to transverse flow effect. (3) Buffet during extension and retraction of landing gear. (4) Buffet due to retreating blade stall. (5) Buffet due to settling with power. (6) Representative cues resulting from touchdown. (7) Rotor vibrations.		X	X	X	A qualitative assessment is required to determine that the effect is representative of the helicopter simulated.	
e. The simulator must provide characteristic buffet motions that result from operation of the helicopter (for example, retreating blade stall, extended landing gear, settling with power) which can be sensed in the cockpit.				X	Simulator performance (with emphasis on amplitude and frequency) must be recorded and compared to helicopter data. The results must be made a part of the QTG. For air turbulence, general purpose disturbance models that approximate demonstrable flight test data are acceptable.	The simulator should be programmed and instrumented in such a manner that the characteristic buffet modes can be measured and compared to helicopter data.
7. Visual System						
a. The simulator must have a visual system providing an out-of-the-cockpit view.		X	X	X	A demonstration is required for initial and recurrent evaluations.	
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 for each pilot.			X		An SOC is required. Horizontal field of view is centered on the zero degree azimuth line relative to the aircraft fuselage.	
d. The simulator must provide a continuous minimum collimated visual field of view of 180° horizontally and 60° vertically for each pilot.				X	An SOC is required. Horizontal field of view is centered on the zero degree azimuth line relative to the aircraft fuselage.	

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirement				Additional details	Information notes
	Simulator level					
	A	B	C	D		
e. The simulator must have operational landing lights (if applicable) for night scenes.		X	X	X	A demonstration is required for initial and recurrent evaluations. Where used, dusk (or twilight) secenes require operational landing lights.	
f. The simulator provide visual cues to assess rate of change of height, height AGL, as well as translational displacement and rates, during takeoff and landing.		X			An SOC is required.	
g. 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 demonstration is required for initial and recurrent evaluations. 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.
h. The simulator provide visual cues to assess rate of change of height, height AGL, as well as translational displacements and rates, during takeoff, low altitude/low airspeed maneuvering, hover, and landing.			X	X	An SOC is required.	
i. 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) Selection of airport or landing area. (4) Lighting at airport or landing area.		X	X	X	A demonstration is required for initial and recurrent evaluations.	
j. Each airport scene displayed must include the following: (1) Airport runways and taxiways (2) Runway definition. (a) Runway surface and markings. (b) Lighting for the runway in use, including runway threshold, edge, centerline, touchdown zone, VASI (or PAPI), and approach lighting of appropriate colors. (c) Taxiway lights.		X	X	X	A demonstration is required for initial and recurrent evaluations.	

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirement				Additional details	Information notes
	Simulator level					
	A	B	C	D		
k. The distances at which runway features are visible, as measured from a runway threshold to a helicopter aligned with the runway on an extended 3° glide slope must not be less than listed below: (1) Runway definitions, trobe 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 marking within range of landing lights for night scenes; as required by three (3) arc-minutes resolution on day scenes.		X	X	X	A demonstration is required for initial and recurrent evaluations.	
l. The simulator must provide visual system compatibility with aerodynamic programming.		X	X	X	.....	
m. 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 or 100 feet (30 meters) above the touchdown zone. Data submitted must include at least the following: (1) Static helicopter dimensions as follows: (a) Horizontal and vertical distance from main landing gear (MLG) or landing skids to glideslope reception antenna. (b) Horizontal and vertical distance form MLG or skids to pilot's eyepoint. (c) Static cockpit cutoff angle. (2) Approach data as follows: (a) Identification of runway. (b) Horizontal distance from runway threshold to glideslope intercept with runway. (c) Glideslope angle. (d) Helicopter pitch angle on approach. (3) Helicopter data for manual testing: (a) Gross weight. (b) Helicopter configuration. (c) Approach airspeed.		X	X	X	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.	
n. The simulator must provide for: (1) Accurate portrayal of the environment relating to the simulator attitude.		X	X	X	An SOC is required.	Visual attitude vs. simulator is a comparison of pitch and roll of the horizon as displayed in the visual scene compared to the display on the attitude indictor.

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

QPS requirement						Information notes
General simulator requirements	Simulator level				Additional details	
	A	B	C	D		
(2) Quick confirmation of visual system color, RVR, focus, and intensity.			X	X	An SOC is required. In both of the above cases, a demonstration is required for initial evaluations. However, if there is any question regarding these functions, the NSPM may require the demonstration be repeated during any inspection or subsequent recurrent evaluation.	
o. The simulator must provide a minimum of three 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) Taxiway lighting at airports. (4) Terrain, including ramps and buildings that are in the sponsor's Line Oriented scenarios.			X	X	A demonstration is required for initial and recurrent evaluations.	
p. The simulator must be capable of producing at least 10 levels of occulting.			X	X	A demonstration is required for initial evaluation. However, if there is any question regarding this function, the NSPM may require this demonstration to be accomplished during any inspection or subsequent recurrent evaluation.	
q. 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 demonstration is required for initial and recurrent evaluations. 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.	
r. The surface resolution must be demonstrated by a test pattern of objects shown to occupy a visual angle of three (3) arc-minutes in the visual scene from the pilot's ''eye point.'.			X	X	An SOC is required and must include the relevant calculations. A demonstration is required on initial evaluations. However, if there is any question regarding this function, the NSPM may require this demonstration to be accomplished during any inspection of subsequent recurrent evaluation.	
5. The lightpoint size must not be greater than six (6) arc-minutes.			X	X	An SOC is required and must include the relevant calculations. A demonstration is required on initial evaluations. However, if there is any question regarding this function, the NSPM may require this demonstration to be accomplished during any inspection or subsequent recurrent evaluation.	

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

QPS requirement						Information notes
General simulator requirements	Simulator level				Additional details	
	A	B	C	D		
t. The lightpoint contrast ratio must not be less than 25:1			X	X	An SOC is required and must include the relevant calculations. A 1-degree spot photometer is used to measure a square of at least 1 degree, filled with lightpoints (where lightpoint modulation is just discernible) and compare the results to the measured adjacent background. A demonstration is required on initial evaluations. However, if there is any question regarding this function, the NSPM may require this demonstration to be accomplished during any inspection or subsequent recurrent evaluation.	
u. The simulator must provide operational visual scenes that portray physical relationships known to cause landing illusions to pilots				X	A demonstration is required for initial and recurrent evaluations.	For example: short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path, unique topographic features, etc.
v. 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. The simulator cockpit ambient lighting must be dynamically consistent with the visual scene displayed.				X	A demonstration is required for initial and recurrent evaluations. The daylight visual scene must be a part of a total daylight cockpit environment which at least represents the amount of light in the cockpit on an overcast day. For daylight scenes, such ambient lighting must not ''washout'' the displayed visual scene nor fall below 5 foot-lamberts (17 cd/m^2) of light as reflected from an instrument approach plate at knee height at both pilots' station. 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 measures 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.
(1) The simulator visual system must provide a minimum contrast ratio of 5:1.					A raster-drawn pattern must be displayed that fills the entire visual scene (3 or more channels) consisting of a matrix of black and white squares no larger than 10° and no smaller than 5° per square, with a white square having a minimum threshold value of 2 foot-lamberts, or 7 cd/m^2 in the center of each channel. The contrast ratio is the numerical value of the brightness measures for the center (white) square divided by the brightness value for any adjacent (dark) square.	A 1° spot photometer is used to measure the brightness values.
(2) The simulator visual system must provide a highlight brightness of not less than six (6) foot-lamberts (20 cd/m^2).					The test must use the full pattern described above, measuring the brightness of a white square, superimposed completely with a highlighted area covering the square. Use of calligraphic capabilities to enhance raster brightness is acceptable; however, individual light points or light point arrays are not acceptable.	A 1° spot photometer is used to measure the brightness values.

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirement: Simulator level A	B	C	D	Additional details	Information notes
w. The simulator must provide special weather representations of light, medium, and heavy precipitation near a thunderstorm on takeoff and during approach and landing.					A demonstration is required for initial and recurrent evaluations. Representations need only be present at and below an altitude of 22,000 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.					A demonstration is required for initial and recurrent evaluations.	
y. The simulator must present realistic color and directionality of all landing area lighting.					A demonstration is required for initial and recurrent evaluations.	
8. 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 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 demonstration is required for initial and recurrent evaluations.	
c. The simulator must provide realistic amplitude and frequency of cockpit noises and sounds.				X	Simulator performance must be recorded and must be compared to amplitude and frequency of the same sounds recorded in the helicopter. These results must be made a part of the QTG. These noises and sounds must include, at least, the sound of precipitation, windshield wipers, engine, and airframe sounds. When appropriate, the sounds must be coordinated with the weather representations required in paragraph 4.w.	

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 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 simulator 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 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 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) 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 form 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.

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

TABLE OF OBJECTIVE TESTS

QPS requirements								Information notes
Test	Tolerance	Flight conditions	Simulator level				Test details	
			A	B	C	D		
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	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.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes
Test	Tolerance	Flight conditions	Simulator level				Test details	
			A	B	C	D		
(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..	
(2) Rate of Turn vs. Pedal Deflection or Nosewheel Angle.	±10% or ±2d°/sec. Turn Rate.	Ground Takeoff		X	X	X		
(3) Taxi	Pitch Angle—±1.5°, Torque—±3%, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	Ground		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) Engines	Airspeed—±3 kt, Altitude—±20ft (6.1m), Torque—±3%, Rotor Speed—±1.5%, Vertical Velocity—±100 fpm (0.50m/sec) or 10% Pitch Attitude—±1.5°, Bank Attitude—±2°, Heading—±2°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Ground Takeoff and Initial Segment of Climb.		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 Inoperative	Airspeed—±3 kt, Altitude—±20 ft (6.1m), Torque—±3%, Rotor Speed—±1.5%, Vertical Velocity—±100 fpm (0.50m/sec) or 10%, Pitch Attitude—±1.5°, Bank Attitude—±2°, Heading—±2°, Longitudinal Control Position—±10% Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Ground/Takeoff; and Initial Segment of Climb.		X	X	X	Record takeoff flight path as appropriate to helicopter model simulated. Results must be recorded from the initiation of the takeoff to at least 200 ft (61m) AGL.	
d. Hover								
Performance	Torque—±3%, Pitch Attitude—±1.5°, Bank Attitude—±1.5°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	In Ground Effect (IGE); and Out of Ground Effect (OGE).			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 (0.50m/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.	
f. Level Flight								
Performance and Trimmed Flight Control Positions.	Torque—±3%, Pitch Attitude—±1.5°, Sideslip Angle—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position-±5%, Collective Control Position—±5%.	Cruise (Augmentation On and Off).		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.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes
Test	Tolerance	Flight conditions	Simulator level				Test details	
			A	B	C	D		
g. Climb								
Performance and Trimmed Flight Control Positions.	Vertical Velocity—±100 fpm (61m/sec) or ±10%, Pitch Attitude—±1.5°, Sideslip Angle—±2°, Longitudinal Control Position—±5% Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	All engines operating; One engine inoperative; Augmentation System(s) On and Off.		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—±1.5°, Sideslip Angle—±2°, Longitudinal Control Position—±5% Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	At or near 1,000 fpm 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.	
(2) Autorotation Performance and Trimmed Flight Control Positions.	Torque—±3%, Pitch Attitude—±1.5°, Sideslip Angle—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5.	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—±2°, Roll Attitude—±3°, Yaw Attitude—±5°, 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. (6.1 m), Torque—±3%, Rotor Speed—±1.5%, Pitch Attitude—±1.5°, Bank Attitude—±1.5°, Heading—±2°, Longitudinal Control Position—±10%, Lateral Control Position—±10%, Directional Control Position—±10%, Collective Control Position—±10%.	Approach		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 Levels C and D). For Level B, the criteria apply only to those segments at airspeeds above effective translational lift.	
(2) One Engine Inoperative.	Airspeed-±3 kts., Altitude-±20 ft. (6.1m), Torque—±3%, Rotor Speed-±1.5≠, Pitch Attitude-±1.5°, Bank Attitude-±1.5°, Heading-±2°, Longitudinal Control Position-±10%, Lateral Control Position-±10%, Directional Control Position-±10%, Collective Control Position-±10%..	Approach		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.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes
Test	Tolerance	Flight conditions	Simulator level				Test details	
			A	B	C	D		
(B) Balked Landing	Airspeed-±3 kts, Altitude -±20 ft. (6.1m), Torque-±3%, Rotor Speed-±1.5%, Pitch Atitude-±1.5°, Bank Attitude-±1.5°, Heading-±2°, Longitudinal Control Position-±10%, Lateral Control Position-±10%, Directional Control Position-±10%. Collective Control Position-±10%.	Approach		X	X	X	Record the results for the maneuver initiated from a stablized approach at the landing decision point (LDP).	
(4) Autorotational Landing. ...	Torque-±3%, Rotor Speed-±3%, Vertical Velocity-±100 fpm (0.50m/sec) or 10%, Pitch Attitude-±2°, Bank Attitude-±2°, Heading—±5°, Longitudinal Control Position-±10%, Lateral Control Position-±10%, Directional Control Position-±10%, Collective Control Position-±10%.	Landing			X	X	Record the results of an autorotational deceleration and landing from a stabilized autorotational descent, to touch down.	
3. HANDLING QUALITIES.								
a. Control System Mechanical Characteristics.								
For simulators requiring Static or Dynamic tests at the controls (ie., 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 evaluaiton would then satisfy this test requirement. For initial and upgrade evaluaitons, 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 clarificaiton 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	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 lbs. (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..	
(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.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes
Test	Tolerance	Flight conditions	Simulator level				Test details	
			A	B	C	D		
(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—±1.5° Bank Attitude—±2° Longitudinal Control Position—±5% Lateral Control Position—±5% Directional Control Position—±5% Collective Control Position—±5%.	Transitional Flight IGE-Sideward, rearward, and forawrd 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+±1.5°, Bank Attitude—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	Stationary Hover Augmentation On and Off.			X	X	Record results for three relative wind directions (including the most critical case) in the critical quadrant. May be a series of snapshot tests.	
(3) Control Response: (a) Longitudinal	Pitch Rate—±10% or ±2°/sec. Pitch Attitude Change—±10% or 1.5°.	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 ±3°/sec. Roll Attitude Change—±10% or ±3°.	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 ±2°/sec. Heading Change—±10% or ±2°.	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 ..	Hover			X	X	Record results for a step control input. The Off-axis response must show correct trend for unaugmented cases.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes
Test	Tolerance	Flight conditions	Simulator level				Test details	
			A	B	C	D		
c. Longitudinal Handling Qualities:								
(1) Control Response	Pitch Rate—±10% or ±2°/sec., Pitch Attitude Change—±10% or ±1.5°.	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.	
(2) Static Stability	Longitudinal Control Position: ±10% of change from trim or ±0.25 in. (6.3 mm) or Longitudinal Control Force: ±0.5lb. (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.	±1.5° Pitch or ±2°/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. (6.3 mm) or Longitudinal Control Forces—±0.5 lb. (0.232 daN) or ±10%.	Cruise or Climb. Augmentation On and Off..		X	X	X	Record results for at least two airspeeds. Record results for Approximately 30°–45° 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:								
(1) Control Response								
(a) Lateral	Roll Rate—±10% or ±3°/sec., Roll Attitude Change—±10% or ±3°.	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 ±2°/sec., Yaw Attitude Change—±10% or ±2°.	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.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes
Test	Tolerance	Flight conditions	Simulator level				Test details	
			A	B	C	D		
(2) Directional Static Stability.	Lateral Control Position—±10% of change from trim or ±0.25 in, (6.3 mm) or Lateral Control Force—±0.5 lb. (0.223 daN) or 10%, Roll Attitude—±1.5, Directional Control Position—±10% of change from trim or ±0.25 in. (6.3 mm) or Directional Control Force—±1 lb. (0.448 daN) or 10%., Longitudinal Control Position—±10% of change from trim or ±0.25 in. (6.3 mm), Vertical Velocity—±100 fpm (0.50m/sec) or 10%.	Cruise; or Climb (may use Descent instead of Climb if desired), Augmentation On and Off.		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.
(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 of ±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, ±2° 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, ±2° 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.	
4. Motion System:								
a. Motion Envelope:								
(1) Pitch								
(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		
(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		

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes
Test	Tolerance	Flight conditions	Simulator level				Test details	
			A	B	C	D		
(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								
(a) Displacement—								
±45 in					X	X		
3(b) Velocity—								
±28 in/sec					X	X		
(c) Acceleration—								
±0.6 g					X	X		
(6) Longitudinal								
(a) Displacement—								
±34 in					X	X		
(b) Velocity—								
±28 in/sec					X	X		
(c) Acceleration—								
±0.6 g					X	X		
(7) Initial Rotational Acceleration Ratio. All axes:								
TBD°/sec²/sec				X				
All axes:								
300°/sec²/sec					X	X		
(8) Initial Linear Acceleration Ratio								
(a) Vertical—								
±TBD g/sec				X				
±6g/sec					X	X		
(b) Lateral—								
±3g/sec					X	X		
(c) Longtudial—								
±3g/sec							X	X
b. Frequency Response:								
Band, Hz Phase, deg.	Amplitude Ratio, db			X	X	X		
0.10 to 0.5 −15 to −20.	±2							
0.51 to 1.0 −15 to −20.	±2							
1.1 to 2.0 −20 to −40.	±4							
2.1 to 5.0 −20	±4							
c. Leg Balance:								
Leg Balance	1.5°			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 (150 mm) peak to peak at a frequency of 0.5 Hz. Deviation from the desired sinusoidal acceleration must be measured.	

Begin Information

5. 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 $T(A_d)$ 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 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):

$T(P_0)$ ±10% of P_0
$T(P_1)$ ±20% of P_1
$T(A)$ ±10% of A_1, ±20% of Subsequent Peaks
$T(A_d)$ ±10% 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 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.

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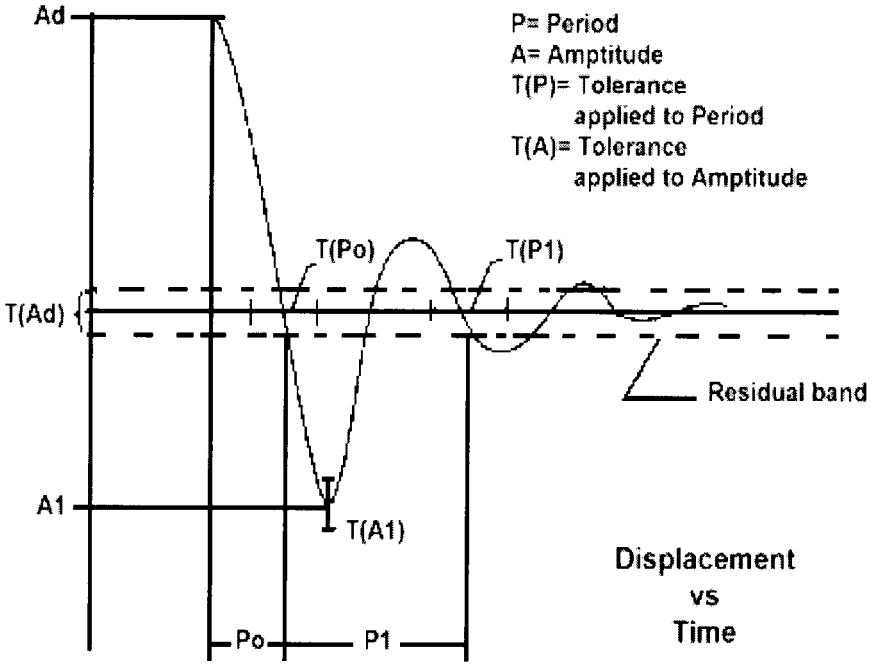
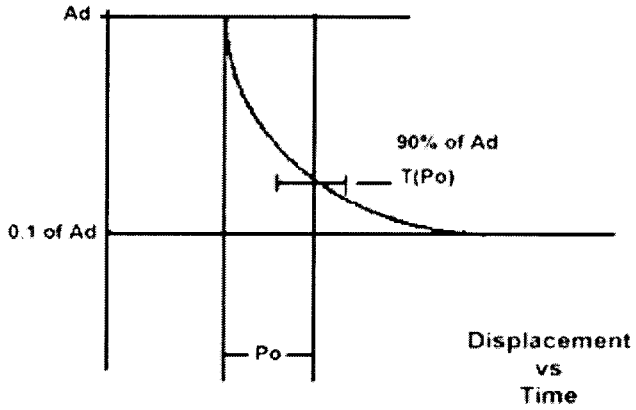
Attachment 2 to Appendix C to Part 60—
Figure 1. Under-Damped Step Response



Attachment 2 to Appendix C to Part 60—
Figure 2. Critically-Damped Step Response



6. 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 T_0—T_1 , must be of sufficient duration to ensure steady initial conditions.

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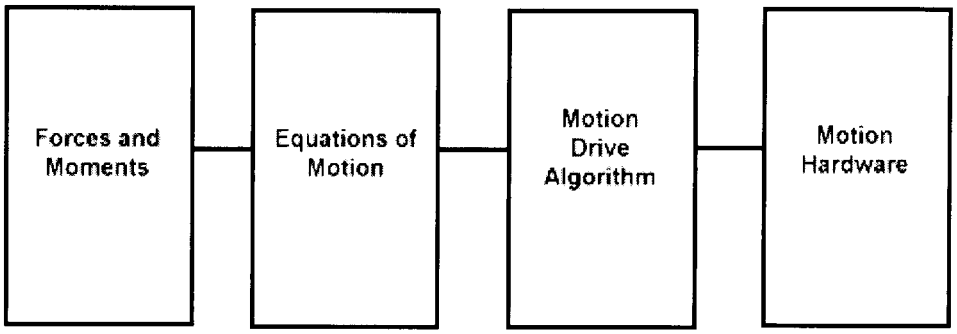
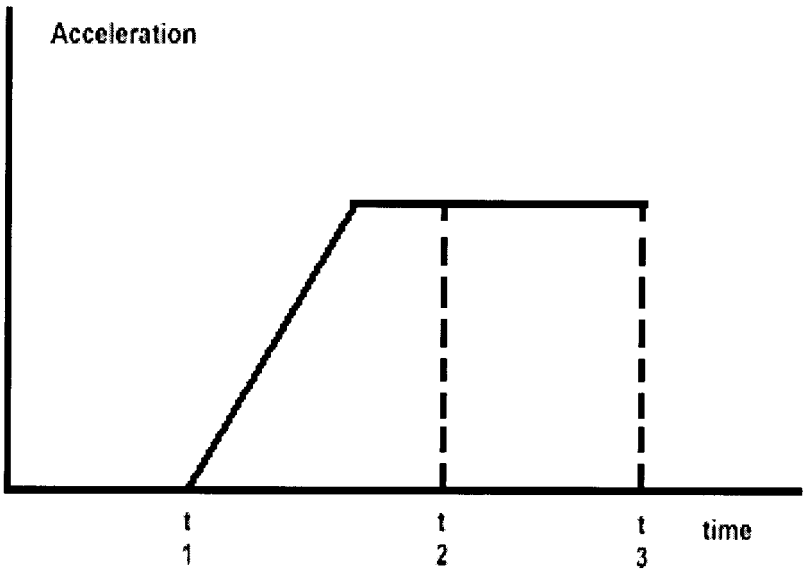
Attachment 2 to Appendix C to Part 60—Figure 3. Acceleration Test Signals



Attachment 2 to Appendix C to Part 60—Figure 4. Test Signal Characteristics



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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. 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

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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

A. 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.

3. FTD Systems

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 10

Attachment 4 to Appendix C to Part 60—Definitions and Abbreviations

1. Definitions

Begin Regulatory Language (14 CFR Part 1 and §60.3)

(From Part 1—Definitions)

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

Flight simulator means a full size replica of a specific type or make, model, and series aircraft cockpit. It includes the assemblage of equipment and computer programs necessary to represent the aircraft in ground and flight operations, 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 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 standards (QPS) for a specific qualification level.

Flight training device (FTD) means a full size 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 the aircraft or set of aircraft 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 qualification level.

(From Part 60—Definitions)

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.

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

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

Master Qualification Test Guide (MQTG). The FAA-approved Qualification Test Guide with the addition of the FAA-witnessed test, performance, or demonstration results, applicable to each individual FSD.

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 comparison of simulator performance data to actual or predicted aircraft performance data to ensure FSD performance is within the tolerances prescribed in the QPS.

Predicted data. Aircraft performance data derived from sources other than direct physical measurement of, or flight tests on, the subject aircraft. Predicted data may include engineering analysis and simulation, design data, wind tunnel data, estimations or extrapolations based on existing flight test data, or data from other models.

Qualification level. The categorization of the FSD, based on its demonstrated technical and operational capability as set out in the QPS.

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 FSD requirements, for establishing FSD qualification levels.

Qualification Test Guide (QTG). The primary reference document used for evaluating an aircraft FSD. It contains test results, performance or demonstration results, statements of compliance and capability, the configuration of the aircraft simulated, and other information for the evaluator to assess the FSD against the applicable regulatory criteria.

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.

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

Subjective test. A qualitative comparison to determine the extent to which the FSD performs and handles like the aircraft being simulated.

Training Program Approval Authority (TPAA). A person authorized by the Administrator to approve the aircraft flight training program in which the FSD will be used.

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

End Regulatory Language (14 CFR Part 1 and §60.3)

Begin QPS Requirements

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.

Automatic Testing—is simulator testing wherein all stimuli are under computer control.

Bank—is the helicopter 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.

Closed Loop Testing—is a test method for which the input stimuli are generated by controllers which drive the simulator to follow a pre-defined target response.

Computer Controlled Helicopter—is a helicopter 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 Flight Simulator—is a simulator in which hardware and software can be changed so that the simulator becomes a replica of a different model, usually of the same type helicopter. The same simulator 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.

Driven—is a test method where the input stimulus or variable is positioned by automatic means, generally a computer input.

Free Response—is the response of the simulator after completion of a control input or disturbance.

Frozen—is a test condition where one or more variables are held constant with time.

Fuel used—is the amount or mass of fuel used (kilograms or pounds).

Ground Effect—is the change in aerodynamic characteristics due to modification of the air flow past the aircraft caused by the proximity of the earth's surface to the helicopter.

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 simulator 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 simulator such that all helicopter 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 simulator testing wherein the pilot conducts the test without computer inputs except for initial setup and all modules of the simulation are active.

Medium—is the normal operational weight for a given flight segment.

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 Helicopters 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 Helicopters and is the state where the intended control, augmentation, and protection functions are fully working.

Pitch—is the helicopter 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.

Protection Functions—are systems functions designed to protect a helicopter from exceeding its flight maneuver limitations.

Pulse Input—is a step input to a control followed by an immediate return to the initial position.

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 helicopter attitude with respect to or around the longitudinal axis expressed in degrees.

Sideslip—is the angular difference between the helicopter heading and the direction of movement in the horizontal plane.

Simulation Data—are the various types of data used by the simulator manufacturer and the applicant to design, manufacture, and test the simulator.

Simulator Approval—is the extent to which a simulator may be used by a certificate holder as authorized by the FAA. It takes account of helicopter to simulator differences and the training ability of the organization.

Simulator Latency—is the additional time beyond that of the response time of the helicopter due to the response of the simulator.

Snapshot—is a presentation of one or more variables at a given instant of time.

Source Data—are, for the purpose of this document, performance, stability and control, and other necessary test parameters electrically or electronically recorded in a helicopter using a calibrated data acquisition system of sufficient resolution and verified as accurate by the company performing the test to establish a reference set of relevant parameters to which like simulator parameters can be compared.

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 simulator 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.

Surge—is simulator movement with respect to or along the longitudinal axis.

Sway—is simulator 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)—is the person who exercises authority on behalf of the Administrator in approving the aircraft flight training program for the appropriate helicopter in which the simulator will be used. This person is the principal operations inspector (POI) for programs approved under 14CFR parts 63, 121, 125, or 135; or the training center program manager (TCPM) for programs approved under part 141 or 142.

Transport Delay or ''Throughput''—is the total simulator 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 helicopter simulated.

Validation Data—are data used to determine if the simulator performance corresponds to that of the helicopter.

Validation Test—is a test by which simulator parameters are compared to the relevant validation data.

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 helicopter attitude with respect to or around the vertical axis expressed in degrees.

End QPS Requirements

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2. Abbreviations

Begin QPS Requirements

AFM—Approved Flight Manual.
AGL—Above Ground Level (meters or feet).
AOA—Angle of Attack (degrees).
APD—Aircrew Program Designee.
CCA—Computer Controlled Aircraft.
cd/m^2—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
EPR—Engine Pressure Ratio.
FAA—Federal Aviation Administration (U.S.).
ft—foot/feet, 1 foot = 0.304801 meters.
ft-Lambert—foot-Lambert, 1 ft-Lambert = 3.4263 candela/m^2.
fpm—feet per minute.
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.
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.
M,m—Meters, 1 Meter = 3.28083 feet.
Min(s)—Minute, minutes.
MLG—Main Landing Gear.
Mpa—MegaPascals (1 psi = 6894.76 pascals).
ms—millisecond(s).
N—NORMAL CONTROL Used in reference to Computer Controlled Aircraft.
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.
nm—Nautical Mile(s) 1 Nautical Mile = 6,080 feet.
NN—NON-NORMAL CONTROL Used in reference to Computer Controlled Aircraft.
NWA—Nosewheel Angle (degrees).
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.
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.
Vr—Rotate Speed.
Vs—Stall Speed or minimum speed in the stall.
WAT—Weight, Altitude, Temperature.

End QPS Requirements 11

Attachment 5 to Appendix C to Part 60—Sample Documents

Begin Information

Table of Contents

Title of Sample

End Information

BILLING CODE 4910–13–P

Attachment 5 to Appendix C to Part 60—
Figure 1 – Sample Letter of Request.

INFORMATION

Date

Name, POI, _____(Certificate Holder)

FAA FSDO _____

Address

City, State, Zip

Dear Mr./Ms. _____:

(Sponsor's name) _____ requests evaluation of our (type) _____ helicopter simulator for Level _____ qualification. The (name) _____ simulator with (name) _____visual system is fully defined on page _____ of the accompanying qualification test guide (QTG). We have completed tests of the simulator 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 Simulator 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 simulator 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 simulator 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 simulator and state that it represents the helicopter. He/She(They) has(have) not subjectively tested the simulator 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 5 to Appendix C 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 5 to Appendix C to Part 60—

Figure 3 – Sample FTD 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

Note to Figure 3: Information in Figure 3 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 5 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 5 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:		
☐ Electro-Mechanical:		
☐ Display (CRT, LCD, etc.)		July 12, 1988
☐ Combination		
☐ Heads-Up Display		
Flight Director:		
☐ Single Cue	Sperry	July 12, 1988
☐ Dual Cue		
☐ None		
Engine Instruments:		
☐ Electro-Mechanical		
☐ Display (CRT, LCD, etc.)		July 12, 1988
☐ Combination		
Navigation Type(s):		
☐ ADF		July 12, 1988
☐ VOR/ILS		July 12, 1988
☐ GPS		July 12, 1988
☐ INS		
☐ IRS		
Weather Radar:	Jones Industries, Inc.	July 12, 1988
TCAS		
ACARS		

Attachment 5 to Appendix C to Part 60—
Figure 4B – Sample Statement of Qualification; Qualified/Non-Qualified Tasks

INFORMATION

STATEMENT of QUALIFICATION
Qualified/Non-Qualified Tasks
Go-Fast Training Center
Vertiflite AB-320 -- Level C -- FAA ID# 888

The following are those items listed in the Helicopter Flight Simulator Qualification Performance Standards (QPS), FAA-S-120-63, dated (May 1, 2000) Appendix 3, Subjective Tests, indicating what tasks and systems are qualified **(Q)** *and what tasks and systems are not qualified* **(NQ).**

NQ	Q	TASK		NQ	Q	TASK
		A. Preparation for flight.		X		(e) Stability system failure.
	X	1. Preflight.			X	(f) Directional control malfunction.
		2. APU/Engine start.			X	(g) Other.
	X	(a) Normal start procedure.				**D. Translational Flight.**
	X	(b) Alternate start procedure.			X	1. Forward.
	X	(c) Abnormal start/shutdown.			X	2. Sideward.
	X	(d) Rotor engagement.			X	3. Rearward.
	X	(e) System checks.				**E. Takeoff.**
	X	(f) Other.		X		1. Day.
		B. Ground Taxi.			X	2. Dusk (Twilight).
	X	1. Power required to taxi.			X	3. Night.
	X	2. Brake effectiveness.				4. Normal.
	X	3. Ground handling.			X	(a) From ground.
	X	4. Abnormal/emer. procedures.				(b) From hover.
	X	5. Brake system failure.			X	(1) Cat A
	X	6. Ground resonance.			X	(2) Cat B
	X	7. Other.			X	(c) Running.
		C. Hover			X	(d) Crosswind/tailwind.
	X	1. Takeoff to a hover.			X	(e) Maximum performance.
		2. Instrument response.			X	(f) Instrument.
	X	(a) Engine instruments.		X		(g) Confined area.
	X	(b) Flight instruments.		X		(h) Pinnacle/platform.
	X	3. Hovering turns.		X		(i) Slope.
		4. Hover power checks.		X		(j) External load operations.
	X	(a) In ground effect.				5. Abnormal/Emergency.
	X	(b) Out of ground effect.				(a) Takeoff, engine fail prior to DCP.
	X	5. Crosswind/tailwind hover.			X	(1) Cat A
		6. Abnormal/emer. procedures.			X	(2) Cat B
	X	(a) Engine failure.				(b) Rejected takeoff.
	X	(b) Hovering autorotation.			X	(1) Over land.
	X	(c) Fuel governing system failure.			X	(2) Over water.
	X	(d) Settling with power.			X	(c) Other.

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	TASK (Con't.)		NQ	Q	TASK (Con't.)
		F. Climb.		X		(5) SDF.
	X	1. Normal.		X		(6) ASR.
	X	2. Obstacle clearance.		X		(7) Circling.
	X	3. Vertical.			X	(8) Helicopter only.
	X	4. Engine inoperative.			X	(9) Other.
	X	5. Other.				(d) Missed approach.
		G. Cruise.			X	(1) All engines operating.
	X	1. Performance.			X	(2) Engine inoperative.
	X	2. Flying qualities.				2. Precision.
		3. Turns.			X	(a) All engines operating.
	X	(a) Timed.			X	(b) Engine inoperative.
	X	(b) Normal.				(c) Approach procedures:
	X	(c) Steep.		X		(1) PAR
	X	4. Accelerations/Decelerations.		X		(2) MLS
	X	5. High speed vibrations.				(3) ILS
X		6. External load operations.			X	(i) Manual/raw data.
		7. Abnormal/emergency			X	(ii) Flight director only.
	X	(a) Engine fire.			X	(iii) Autopilot coupled.
	X	(b) Engine failure.			X	(iv) Cat I
	X	(c) Inflight shutdown/restart.			X	(v) Cat II
	X	(d) Fuel governing system fail.				(d) Missed approach.
	X	(e) Direction control malfunction.			X	(1) All engines operating.
	X	(f) Hydraulic failure.			X	(2) Engine inoperative.
X		(g) Stability system failure.				(3) Visual.
	X	(h) Rotor vibrations.			X	(i) Normal.
	X	(i) Other.			X	(ii) Steep.
		H. Descent.			X	(iii) Shallow.
	X	1. Normal.			X	(iv) Cat A profile.
	X	2. Maximum rate.			X	(v) Cat B profile.
		3. Autorotative.			X	(vi) Visual segment from ILS.
	X	(a) Straight in.			X	(vii) Visual segment from circle.
	X	(b) Turn.				(vii) Abnormal/emergency
	X	4. Other.			X	A. Directional control failure.
		I. Approach.			X	B. Hydraulic failure.
		1. Non-precision.			X	C. Fuel governing system failure.
	X	(a) All engines operating.			X	D. Autorotation.
	X	(b) Engine inoperative.		X		E. Stability system failure.
		(c) Approach procedures:			X	F. Other.
	X	(1) NDB				**J. Landing**
	X	(2) VOR				1. Normal.
	X	(3) RNAV			X	(a) From a hover.
X		(4) TACAN			X	(b) Running.

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	TASK (Con't.)		NQ	Q	TASK (Con't.)
X		(c) Pinnacle/platform.				**L. Engine Shutdown / Parking**
X		(d) Confined area.			X	1. Engine and systems operations.
X		(e) Slope.			X	2. Parking brake operation.
	X	(f) Crosswind/tailwind.			X	3. Rotor brake operation.
		2. Abnormal/emergency			X	4. Abnormal/emergency.
	X	(a) From autorotation.				
	X	(b) Engine inoperative.				
	X	(c) Directional control failure.				
	X	(d) Hydraulic failure.				
X		(e) Stability system failure.				
	X	(f) Other.				
		K. Any Flight Phase.				
		1. Helicopter systems operation.				
	X	(a) Air conditioning.				
	X	(b) Anti-icing/deicing.				
	X	(c) Auxiliary power plant.				
	X	(d) Communications.				
	X	(e) Electrical.				
	X	(f) Fire detection/supression.				
	X	(g) Flight controls.				
	X	(h) Fuel and oil.				
	X	(i) Hydraulic.				
	X	(j) Landing gear.				
	X	(k) Oxygen.				
	X	(l) Pneumatic.				
	X	(m) Powerplant.				
	X	(n) Flight control computers.				
X		(o) Stability/control augmentation.				
	X	(p) Other.				
		2. Flight management/guidance.				
	X	(a) Airborne radar.				
X		(b) Automatic landing aids.				
	X	(c) Autopilot.				
X		(d) TCAS				
	X	(e) Flight data displays.				
	X	(f) Flight management computer.				
X		(g) Head-up displays.				
	X	(h) Navigation systems.				
	X	(i) Other.				

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	SIMULATOR SYSTEM		NQ	Q	SIMULATOR SYSTEM
		A. Inst. Ops. Station (IOS).				**B. Sound Controls.**
	X	1. Power switch(es).			X	-- On / off / rheostat
		2. Airplane conditions.				**C. Motion/Cont. Load. System.**
	X	(a) GW, CG, Fuel weight, etc.			X	1. On / off / emergency stop.
	X	(b) Airplane systems status.			X	2. Crosstalk
	X	(c) Ground crew functions			X	3. Smoothness
	X	(d) Other.				**D. Observer Stations.**
		3. Airports.			X	1. Position.
	X	(a) Number and selection.				
	X	(b) Runway selection.				
	X	(c) Runway surface condition				
	X	(d) Preset positions				
	X	(e) Lighting controls.				
	X	(f) Other.				
		4. Environmental controls.				
	X	(a) Clouds (base and tops).				
	X	(b) Visibility				
	X	(c) Runway visual range				
	X	(d) Temperature.				
	X	(e) Climate conditions				
	X	(f) Wind speed and direction.				
X		(g) Windshear.				
	X	(h) Other.				
		5. Airplane system malfunctions.				
	X	(a) Insertion / deletion.				
	X	(b) Problem clear.				
	X	(c) Other				
		6. Locks, freezes, repositioning.				
	X	(a) Problem freeze / release.				
	X	(b) Position freeze / release.				
	X	(c) Repositioning				
	X	(d) Ground speed control				
	X	(e) Other				
X		7. Remote IOS.				
	X	8. Other.				

Initials _____ Date_____

-- End --

Attachment 5 to Appendix C to Part 60—
Figure 5 – Sample Recurrent 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 5 to Appendix C to Part 60—
Figure 6 – Sample Request for Initial, Upgrade, or Reinstatement Evaluation Date

INFORMATION

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

Dear Mr. Cook:

RE: Request for Initial [Upgrade / Reinstatement] Evaluation Date

This is to advise you of our intent to request an evaluation of our (Aircraft Type/Level) Simulator located in (City/State) at the (Facility) on (proposed evaluation date). [The proposed evaluation date shall not be more than 180 days following the date of this letter.] This simulator [has / has not] been previously qualified by the FAA [and had been issued FAA identification number XXX]. [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.

[Added comments from Operator/Sponsor, if any]

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

A copy of this letter of intent has been provided to our Principal Operations Inspector (POI) and/or Training Center Program Manager (TCPM).

Sincerely,

(Signature)

Acknowledgement:

____ We concur with your proposed dates.

____ The date requested is not available, however, we propose the following date:

____ Please provide us with the following information:

_____ _____
Scheduler, National Simulator Program Date

Attachment 5 to Appendix C to Part 60— Figure 7 – 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....

BILLING CODE 4910–13–C

Attachment 6 to Appendix C to Part 60— Record of FSD Directives

Begin QPS Requirements

When the FAA determines that modification of an FTD is necessary for safety reasons, all affected FTDs must be modified accordingly, regardless of the original qualification standards applicable to any specific FTD.

a. A copy of the notification to the sponsor from the TPAA or NSPM that a modification is necessary will be filed in and maintained as part of this appendix.

b.The effective FSD Directives, including the date of the directive, the direction to make these changes, and the date of completion of any resulting modification must be maintained in a separate section of the MQTG and index accordingly. The MQTG must also be updated to include the information described in § 60.15(b)(4) as may be appropriate as a result of the FSD Directive. See Appendix 5 for a sample Index of Effective FSD Directives.

End QPS Requirements

Appendix D to Part 60—Qualification Performance Standards for Helicopter Flight Training Devices

This appendix establishes the standards for Helicopter 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 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 evaluations.

Table of Contents

1. Introduction

a. This appendix contains background information as well as information that is either directive or guiding in nature. Information considered directive is described in this document in terms such as ''will,'' ''shall,'' and ''must,'' and means that the actions are mandatory. Guidance information is described in terms such as ''should,'' or ''may,'' and indicate actions that are desirable, permissive, or not mandatory and provide for flexibility.

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 sections, separated by horizontal lines; headings associated with these horizontal lines will indicated that a particular section begins or ends. All of the text falls into one of three sections: a direct quote or a paraphrasing of the Part 60 rule language; additional requirements that are also regulatory but are found only in this appendix; and advisory or informative material.

(2) The text presented between horizontal lines beginning with the heading ''Begin Rule Language'' and ending with the heading ''End Rule Language,'' is a direct quote or is paraphrased from Part 60 of the regulations. For example: the rule uses the terms ''flight simulation device (FSD)'' and ''aircraft;'' however, in this appendix the rule is paraphrased and the term ''simulator'' is used instead of FSD, and ''airplane'' is used instead of aircraft. Additionally, the rule uses the terms ''this part'' and ''appropriate QPS;'' however, in this appendix the rule is paraphrased and the terms ''Part 60'' and ''this appendix,'' respectively, are used instead. (Definitions are not paraphrased or modified in any way.) For ease of referral, the Part 60 reference is noted at the beginning and the end of the bordered area.

(3) The text presented between horizontal lines beginning with the heading ''Begin QPS Requirements'' and ending with the heading ''End QPS Requirements,'' is also regulatory but is found only in this appendix.

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

5. 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.

Important Note: While this appendix contains quotes and paraphrasing directly from the rule, the reader is cautioned *not* to rely solely on this appendix for regulatory requirements regarding flight simulators. For regulatory references for airplane flight simulators, the reader is referred to paragraphs 3. a through h of this appendix.

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: *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.

End Information

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2. Definitions

See Attachment 4 of this appendix for a list of definitions and abbreviations. Attachment 4 of this appendix contains definitions directly quoted from Part 1 or Part 60, contained within a bordered area with Red-colored left hand columns, indicating they are quoted from 14 CFR Part 1 or Part 60 and are regulatory. Additional definitions and abbreviations used in reading and understanding this document are contained within bordered areas with Blue-colored left hand columns, indicating they are also regulatory but appear only within this document. For purposes of accuracy, the definitions listed are directly quoted, and are not paraphrased.

End Information

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3. Related Reading References.

Begin Information

a. 14 CFR part 60
b. 14 CFR part 61.
c. 14 CFR part 63.
d. 14 CFR part 121.
e. 14 CFR part 125
f. 14 CFR part 135.
g. 14 CFR part 141
h. 14 CFR part 142
i. Advisory Circular (AC) 120–28C, Criteria for Approval of Category III Landing Weather Minima.
j. AC 120–29, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.
k. AC 120–35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.
l. AC 120–41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.
m. AC 120–57A, Surface Movement Guidance and Control System (SMGS).
n. AC 150/5300–13, Airport Design.
o. AC 150/5340–1G, Standards for Airport Markings.
p. AC 150/5340–4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.
q. AC 150/5340–19, Taxiway Centerline Lighting System.
r. AC 150/5340–24, Runway and Taxiway Edge Lighting System.
s. AC 150/5345–28D, Precision Approach Path Indicator (PAPI) Systems
t. International Air Transport Association document, ''Flight Simulator Design and Performance Data Requirements,'' Fifth Edition (1996).
u. AC 29–2B, Flight Test Guide for Certification of Transport Category Rotorcraft.
v. AC 27–1A, Flight Test Guide for Certification of Normal Category Rotorcraft.
x. International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, First Edition, 1994 Doc 9625–AN/938.
y. Airplane Flight Simulator Evaluation Handbook, Volume I (February, 1995) and Volume II (July, 1996), The Royal Aeronautical Society, London, UK.
z. FAA Publication FAA-S–8081 series (Practical Test Standards for Airline Transport Pilot Certificate, Type Ratings, Commercial Pilot, and Instrument Ratings).

End Information

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4. Background [Reserved]

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5. Quality Assurance Program

Begin Rule Language (§ 60.5)

a. After [date 6 months after the effective date of the final rule], no sponsor may use or allow the use of or offer the use of an FTD for flightcrew member training or for obtaining flight experience to meet any requirement of this chapter unless the sponsor has established and follows a quality assurance (QA) program, acceptable to the NSPM, for the continuing surveillance and analysis of the sponsor's performance and effectiveness in providing a satisfactory FTD for use on a regular basis as described in the appropriate QPS.

b. The QA 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 QA 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.

d. Each sponsor of an FTD must identify to the NSPM and to the TPAA, by name, one individual, who is an employee of the

sponsor, to be the management representative (MR) and the primary contact point for all matters between the sponsor and the FAA regarding the qualification of that FTD as provided for in this part.

End Rule Language (§ 60.5)

Begin QPS Requirements

e. 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 QA program for the recurring qualification of, and the day-to-day use of, each FTD.

f. An acceptable Quality Assurance (QA) Program must contain a complete, accurate, and clearly defined 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 and the importance of establishing and meeting the requirements of a QA Program as defined in this paragraph f.

(2) The method(s) used by management to determine that the regulatory standards and the QA 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 FTD.

(4) The criteria for and a definition or description of the workmanship expected for normal upkeep, repair, parts replacement, modification, etc., on the FTD and how, when, and by whom such workmanship is determined to be satisfactorily accomplished.

(5) The method used to maintain and control appropriate technical and reference documents, appropriate training records, and other documents for—

(a) continuing FTD qualification; and

(b) the QA program.

(6) The criteria the sponsor uses (*e.g.*, training, experience, etc.) to determine who may be assigned to duties of inspection, testing, and maintenance (preventive and corrective) on FTD's.

(7) The method used to track inspection, testing, and maintenance (preventive and corrective) on each FTD.

(8) The method used by the sponsor to inform the TPAA in advance of each scheduled NSPM-conducted evaluation and after the completion, the results of each such evaluation.

(9) The method used to ensure that instructors, check airmen, and those who conduct the daily preflight, are capable of determining what circumstance(s) constitute(s) a discrepancy regarding the FTD and its operation.

(10) The method used to ensure that instructors, check airmen, and those who conduct the daily preflight, record in the FTD discrepancy log each FTD discrepancy and each missing, malfunctioning, or inoperative FTD component.

(11) The method used to ensure that instructors and check airmen are completely and accurately logging the number of disruptions and time not available for training or for obtaining flight experience during a scheduled FTD use-period, including the cause(s) of the disruption.

(12) The method used by the sponsor to notify users of the FTD of missing, malfunctioning, or inoperative components that restrict the use of the FTD.

(13) The method of recording NSPM-conducted evaluations and other inspections (*e.g.*, daily preflight inspections, NASIP inspections, sponsor conducted quarterly inspections, etc.), including the evaluation or inspection date, test results, discrepancies and recommendations, and all corrective actions taken.

(14) The method for ensuring that the FTD is configured the way the helicopter it represents is configured and that if the configuration is authorized to be changed that the newly configured system(s) function(s) correctly.

(15) The method(s) for:

(a) determining whether or not proposed modifications of the helicopter will affect the performance, handling, or other functions or characteristics of the helicopter; and

(b) determining whether or not proposed modifications of the FTD will affect the performance, handling, or other functions or characteristics of the FTD;

(c) coordinating and communicating items 5.f.(15)(a) and (b) of this appendix, as appropriate, with the sponsor's training organization, other users (*e.g.*, lease or service contract users), the TPAA, and the NSPM.

(16) How information found in the discrepancy log is used to correct discrepancies and how this information is used to review and, if necessary, modify existing procedures for FTD maintenance.

(17) The method for how and when software or hardware modifications are accomplished and tracked, documenting all changes made from the initial submission.

(18) The method used for determining that the FTD meets appropriate standards each day that it is used.

(19) The method for acquiring independent feedback regarding FTD operation (from persons recently completing training or obtaining flight experience; instructors and check airmen using the FTD for training or flight experience sessions; and FTD technicians and maintenance personnel) including a description of the process for addressing these comments.

(20) How devices used to test, measure, and monitor correct FTD 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.

(21) How, by whom, and how frequently internal audits of the QA 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

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g. Additional Information.

Begin Information

(1) In addition to specifically designated QA evaluations, the NSPM will evaluate the sponsor's QA program as part of regularly scheduled recurrent FTD evaluations and no-notice FTD evaluations, focusing in large part on the effectiveness and viability of the QA program and its contribution to the overall capability of the FTD to meeting the requirements of this part.

(2) The sponsor, through the MR, may delegate duties associated with maintaining the qualification of the FTD (*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 initial and day-to-day qualification and quality of the FTD. One person may serve in this capacity for more than one FTD, but one FTD would not have more than one person serving in this capacity.

(3) Should a sponsor include a ''foreign FTD'' (*i.e.*, one maintained by a non-US certificate holder) under their sponsorship, the sponsor remains responsible for the QA program for that FTD. However, if that foreign FTD is maintained under a QA program accepted by that foreign regulatory authority and that authority and the NSPM have agreed to accept each other's QA programs (*e.g.*, the Joint Aviation Authorities, JAA, of Europe), the sponsor will be required only to perform an ''external audit'' of the non-US certificate holder's compliance with the accepted foreign QA program, with the results of that audit submitted to and accepted by the NSPM.

End Information

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6. Sponsor Qualification Requirements

Begin Rule Language (§ 60.7)

a. A person is eligible to apply to be a sponsor of an FTD 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 FTD will be used, or will be offered for use, in the sponsor's FAA-approved flight training program for the helicopter being simulated as evidenced in a request for evaluation submitted to the NSPM through the TPAA.

b. A person is a sponsor of the FTD 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 operations specifications authorizing the use of the helicopter type being simulated by the FTD or has training specifications or a course of training authorizing the use of an FTD for that helicopter type.

(3) The person has an approved quality assurance program in accordance with § 60.5.

(4) The NSPM has approved the person as the sponsor of the FTD and that approval has not been withdrawn by the FAA.

c. A person continues to be a sponsor of an FTD, if the following conditions are met:

(1) Beginning 12 calendar months after the initial qualification and every 12 calendar months thereafter, the FTD must have been used within the sponsor's FAA-approved flight training program for the helicopter type for a minimum of 600 hours.

(2) The use of the FTD described in paragraph (c)(1) of this section must be dedicated to meeting the requirements of parts 61, 63, 91, 121, or 135 of this chapter.

(3) If the use requirements of paragraphs (c)(1) and (2) of this section are not met, the person will continue to sponsor the FTD on a provisional basis for a period not longer than 12 calendar months; and—

(i) If the FTD is used as described in paragraphs (c)(1) and (2) of this section within this additional 12 calendar month period, the provisional status will be removed and regular sponsorship resumed; or

(ii) If the FTD is not used as described in paragraphs (c)(1) and (2) of this section within the additional 12 calendar month period, the FTD is not qualified and the sponsor will not be eligible to apply to sponsor that FSD for at least 12 calendar months.

End Rule Language (§ 60.7)

7. Additional Responsibilities of the Sponsor

Begin Rule Language (§ 60.9)

a. The sponsor must not allow the FTD to be used for flightcrew member training or evaluation or for attaining flight experience for the flightcrew member to meet any of the requirements under this chapter unless the sponsor, upon request, allows the NSPM to inspect immediately the FTD, including all records and documents relating to the FTD, to determine its compliance with this part.

b. The sponsor must, for each FTD ''

(1) Establish a mechanism for the following persons to provide comments regarding the FTD and its operation and provide for receipt of those comments:

(i) Flightcrew members recently completing training or evaluation or recently obtaining flight experience in the FTD;

(ii) Instructors and check airmen using the FTD for training, evaluation, or flight experience sessions; and

(iii) FTD technicians and maintenance personnel performing work on the FTD.

(2) Examine each comment received under paragraph (b)(1) of this section for content and importance and take appropriate action.

(3) Maintain a liaison with the manufacturer of the helicopter being simulated by the FTD to facilitate compliance with § 60.13(f) when necessary.

(4) Post in or adjacent to the FTD the Statement of Qualification issued by the NSPM.

End Rule Language (§ 60.9)

8. FTD Use

Begin Rule Language (§60.11)

No person may use or allow the use of or offer the use of an FTD for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification unless, in accordance with the QPS for the specific device—

a. It has a single sponsor who is qualified under § 60.9. The sponsor may arrange with another person for services of document preparation and presentation, as well as FTD 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. It is qualified as described in the Statement of Qualification that is required to be posted pursuant to § 60.9(b)(4)—

(1) For the make, model, and series of helicopter; and

(2) For all tasks and configurations.

c. It remains qualified, through satisfactory inspection, recurrent evaluations, appropriate maintenance, and use requirements in accordance with this part and the appropriate QPS.

d. Its software and active programming used during the training, evaluation, or flight experience is the same as the software and active programming that was evaluated by the NSPM.

End Rule Language (§ 60.11)

Begin QPS Requirements

e. Only those FTDs that are used by a certificate holder (as defined for use in Part 60 and this QPS) 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.

End QPS Requirements

Begin Information

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

(1) Aerodynamic responses, including control responses in the longitudinal, lateral-directional, and vertical directions; as well as low airspeed responses (see attachment 2 of this appendix);

(2) Performance in authorized portions of the simulated helicopter's operating envelope, to include tasks suitable to the NSPM in the areas of ground operations, takeoff, climb, cruise, descent, approach, landing, and vertical climb, as well as abnormal and emergency operations (see paragraph 23 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 and instructor station functions checks (see attachment 1 and attachment 3 of this appendix);

(6) Helicopter, or set of helicopters, systems and sub-systems (as attachment) as compared to the helicopter or set of helicopters 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.

g. 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 are used to compare FTD and helicopter data objectively to ensure that the FTD performance and handling qualities are within specified tolerances.

(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 meets the appropriate training/testing/checking objectives and competently simulates each required maneuver, procedure, or task; and

(c) verifying correct operation of the FTD controls, instruments, and systems.

h. 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 applicabletolerances for each test.

i. In addition to the scheduled recurrent evaluation (see paragraph 13 of this appendix), 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. While the intent is to observe the operation and interaction of the device and not the check airman, instructor, APD, FAA inspector, or student(s), the FTD evaluator is a qualified FAA operations inspector and must, without question, report any obvious lack of proficiency to the appropriate POI or TCPM.

End Information

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9. FTD Objective Data Requirements

Begin Rule Language (§ 60.13)

a. Except as provided in paragraph (b) and (c) of this section, for the purposes of validating FTD performance and handling qualities during evaluation for qualification, the sponsor must submit the helicopter manufacturer's flight test data to the NSPM.

b. The sponsor may submit flight test data from a source in addition to or independent of the helicopter manufacturer's data to the NSPM in support of an FTD 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 sponsor may submit alternative data acceptable to the NSPM for consideration, approval and possible use in particular applications for FTD 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 flight testing to support certain FTD qualification requirements.

f. When an FTD sponsor learns, or is advised by a helicopter manufacturer or supplemental type certificate (STC) holder, that an addition to, an amendment to, or a revision of the data used to program and operate an FTD used in the sponsor's training program is available, the sponsor must immediately notify the NSPM.

End Rule Language (§ 60.13)

Begin QPS Requirements

g. 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)B The atmospheric and environmental conditions.

(iii)C The initial flight conditions.

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

(v)E The data that is to be gathered.

(vi)F 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.

h. The data presented, 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 attacment 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.

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

End QPS Requirements

Begin Information

j. Any necessary data and the flight test plan should be reviewed with the NSP staff well in advance of commencing the flight test.

End Information

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10. Special Equipment and Personnel Requirements for Qualification of the FTD

Begin Rule Language (§ 60.14)

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

End Rule Language (§ 60.14)

Begin Information

b. Examples of a special evaluation would be an evaluation conducted at the request of the TPAA or 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.

c. The NSPM will notify the sponsor at least 24 hours in advance of the evaluation if special equipment or personnel will be required to conduct the evaluation. Examples of special equipment include spot photometers, flight control measurement devices, sound analyzer, etc. Examples of special personnel would be those specifically qualified to install or use any special equipment when its use is required.

End Information

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11. Initial (and Upgrade) Qualification Requirements

Begin Rule Language (§ 60.15)

a. For each FTD, the sponsor must submit a request through the TPAA to have the NSPM evaluate the FTD for initial qualification at a specific level. The request must be submitted in the form and manner described in the appropriate QPS.

b. The request must include all of the following:

(1) A statement that the FTD meets all of the applicable provisions of this part.

(2) A statement that the sponsor has established a procedure to verify that the configuration of hardware and software present during the evaluation for initial qualification will be maintained, except where modified as authorized in § 60.23. The statement must include a description of the procedure.

(3) A statement signed by at least one pilot who meets the requirements of paragraph (c) of this section asserting that each pilot so approved has determined that the following requirements have been met:

(i) The FTD systems and sub-systems function equivalently to those in the helicopter or set of helicopters.

(ii) The performance and flying qualities of the FTD are equivalent to those of the helicopter or set of helicopters.

(iii) For cockpit specific FTDs, the cockpit configuration conforms to the configuration of the helicopter make, model, and series being simulated.

(4) A list of all of the operations tasks or FTD systems in the subjective test appendix of the appropriate QPS for which the FTD has not been subjectively tested (e.g., circling approaches, windshear training, etc.) and for which qualification is not sought.

(5) A qualification test guide (QTG) that includes all of the following:

(i) Objective data obtained from helicopter 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 general FTD performance or demonstration results prescribed in the appropriate QPS.

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

c. The pilot or pilots who make the statement required by paragraph (b)(3) of this section must—

(1) Be designated by the sponsor;

(2) Be approved by the TPAA; and

(3) Be qualified in—

(i) The helicopter or set of helicopters being simulated; or

(ii) For helicopter types not yet issued a type certificate, a helicopter type similar in size and configuration.

d. The subjective tests that form the basis for the statements described in paragraph (b)(3) of this section and the objective tests referenced in paragraph (b)(5) of this section must be accomplished at the sponsor's training facility except as provided for in the appropriate QPS.

e. The person seeking to qualify the FTD must provide the NSPM access to the FTD for the length of time necessary for the NSPM to complete the required evaluation of the FTD for initial qualification, which includes the conduct and evaluation of objective and subjective tests, including general FTD requirements, as described in the appropriate QPS, to determine that the FTD meets the standards in that QPS.

f. When the FTD 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 helicopter, or set of helicopters being simulated.

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

(4) A statement that the FTD is qualified.

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

(6) A list of all of the operations tasks or FTD systems in the subjective test appendix of the appropriate QPS for which the FTD has not been subjectively tested and for which the FTD is not qualified (*e.g.*, circling approaches, windshear training, etc.).

g. 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.

h. Upon issuance of the Statement of Qualification the updated QTG becomes the MQTG and must then be made available to the FAA upon request.

End Rule Language (§ 60.15)

Begin QPS Requirements

i. The QTG described in paragraph 11.b(4)of this appendix must provide the documented proof of compliance with the FTD objective tests in attachment 2 of this appendix.

j. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, through the TPAA 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) statements of how a particular test was accomplished or that certain requirements have been met (see appendices to this document for additional information);

(5) other information appropriate to the qualification level of the FTD.

k. The QTG described in paragraph 11.b.(4) of this appendix must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see attachment 5, Figure 2, of this appendix for a sample QTG cover page).

(2) A recurrent evaluation schedule requirements page—to be used by the NSPM to establish and record the frequency with which recurrent evaluations must be conducted and any subsequent changes that may be determined by the NSPM. See attachment 5, Figure 4, of this appendix for a sample Recurrent Evaluation Schedule Requirements page.

(3) An FTD information page that provides the information listed below (see attachment 5, Figure 3, of this appendix 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 model and series, or set of helicopters, 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, if applicable.

(k) The motion system type and manufacturer, including degrees of freedom, if applicable.

(4) A Table of Contents.

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

(6) The source data.

(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 of this appendix, ''FTD Standards,'' or in the ''Test Details'' column in attachment 2 of this appendix, ''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 of this appendix, as applicable to the qualification level sought.

(a) Name of the test.

(b) Objective of the test.

(c) Initial conditions.

(d) Manual test procedures.

(e) Automatic test procedures (if applicable).

(f) Method for evaluating FTD objective test results.

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

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

(i) Tolerances for relevant parameters.

(j) Source of Helicopter Test Data (document and page number).

(k) Copy of the Helicopter Test 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.

l. 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 helicopter test data (*e.g.*, use of a multi-channel recorder, line printer, cross plotting, overlays, transpariencies, etc.).

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

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

m. 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.

n. 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 and submit a statement to the NSPM that the FTD has not changed from the original determination. The report must clearly indicate when and where these repeated tests were completed, but need not take more than one normal FTD period (e.g., 4 to 8 hours) to complete.

o. The sponsor must maintain a copy of the MQTG at the FTD location. After [date 6 years from the effective date of this rule] all MQTG's, regardless of initial qualification date of the FTD, must be available in an electronic format, acceptable to the NSPM. The electronic MQTG must include all objective data obtained from helicopter testing, or another approved source (reformatted or digitized), together with correlating objective test results obtained from the performance of the FTD (reformatted or digitized) as prescribed in this document, the general FTD performance or demonstration results (reformatted or digitized) prescribed in this document, and a description of the equipment necessary to perform the evaluation for initial qualification and the recurrent evaluations for continuing qualification. This electronic MQTG must include the original helicopter flight test 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 flight test time-history plots that were provided by the data supplier. An electronic copy of MQTG must be provided to the NSPM.

End QPS Requirements

Begin Information

p. 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.

q. 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 helicopter flight training program.

r. 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 5, figure 5, of this appendix Sample Request for Initial Evaluation Date.

s. A convertible FTD is addressed as a separate FTD for each model and series helicopter or set of helicopters 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 FTD, two QTG's, or a supplemented QTG, and two evaluations are required.

t. 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.

End Information

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12. Additional Qualifications for a Currently Qualified FTD

Begin Rule Language (§60.16)

a. A currently qualified FTD is required to undergo an additional qualification process if a user intends to use the FTD for meeting training, evaluation, or flight experience requirements of this chapter beyond the qualification issued to the sponsor. 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 FTD that are required to support the additional qualification.

(iii) Must submit a statement to the NSPM that a pilot, designated by the sponsor in accordance with § 60.15(c) and approved by the TPAA for the user, has subjectively evaluated the FTD in those areas not previously evaluated.

(2) The FTD must successfully pass an evaluation ''

(i) For initial qualification, in accordance with § 60.15, 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 (e.g., objective tests, performance demonstrations, 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 FTD, any modifications to the FTD hardware or software that are involved, and any additions or modifications to the MQTG.

c. The FTD is qualified for the additional uses when the NSPM issues an amended Statement of Qualification in accordance with § 60.15(f).

d. The sponsor may not modify the FTD except as described in § 60.23.

End Rule Language (§ 60.16)

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13. Previously Qualified FTDs

Begin Rule Language (§60.17)

a. Unless otherwise specified by an FSD Directive, further referenced in the appropriate QPS, or as specified in paragraph (e) of this section, an FTD qualified before [the effective date of the final rule] will retain its qualification as long as it continues to meet the standards, including the performance demonstrations and the objective test results recorded in the MQTG, under which it was originally evaluated, regardless of sponsor, and as long as the sponsor complies with the applicable provisions of this part.

b. If the FTD qualification is lost under § 60.27 and not restored under § 60.27 for two (2) years or more, the qualification basis for the re-qualification will be those standards in effect and current at the time of re-qualification application.

c. Except as provided in paragraph (d) of this section, any change in FTD qualification level initiated on or after [the effective date of this rule] requires an evaluation for initial qualification in accordance with this part.

d. The NSPM may downgrade a qualified FTD without requiring and without conducting an initial evaluation for the new qualification level. Subsequent recurrent evaluations will use the existing MQTG, modified as necessary to reflect the new qualification level.

e. 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 FTD. The updated test(s) and tolerance(s) must be made a permanent part of the MQTG.

End Rule Language (§ 60.17)

Begin Information

f. 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 a helicopter type, or set of helicopters, 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, above.

Note: The reader is reminded of the requirement that each FTD user obtain approval for use of each FTD in an FAA-approved flight training program from the appropriate TPAA.

End Information

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14. Inspection, Maintenance, and Recurrent Evaluation Requirements

Begin Rule Language (§ 60.19)

a. Inspection. No sponsor may use or allow the use of or offer the use of an FTD for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification unless the sponsor does the following:

(1) Accomplishes all appropriate QPS Attachment 1 performance demonstrations and all appropriate QPS Attachment 2 objective tests each year. To do this, the sponsor must conduct a minimum of four evenly spaced inspections throughout the year, as approved by the NSPM. The performance demonstrations and objective test sequence and content of each inspection in this sequence will be developed by the sponsor and submitted to the NSPM for approval. In deciding whether to approve the test sequence and the content of each inspection, the NSPM looks for a balance and a mix from the performance demonstrations and objective test requirement areas listed as follows:

(i) Performance.
(ii) Handling qualities.
(iii) Motion system.
(iv) Visual system.
(v) Sound system (where appropriate).
(vi) Other FTD systems.

(2) Completes a functional preflight check in accordance with the appropriate QPS each calendar day prior to the start of the first FTD period of use that begins in that calendar day.

(3) Completes at least one functional preflight check in accordance with the appropriate QPS in every 7 consecutive calendar days.

(4) Maintains a discrepancy log.

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

(i) Each discrepancy entry must be maintained in the log until the discrepancy is corrected as specified in § 60.25(b) and for at least 30 days thereafter.

(ii) The corrective action taken for each discrepancy and the date that action is taken must be entered in the log. This entry concerning the corrective action must be maintained for at least 30 days thereafter.

(iii) The discrepancy log is kept in a form and manner acceptable to the Administrator and is kept in or immediately adjacent to the FTD.

b. Recurrent evaluation.

(1) This evaluation consists of performance demonstrations, objective tests, and subjective tests, including general FTD requirements, as described in the appropriate QPS or as may be amended by an FSD Directive.

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

(3) The sponsor must provide the NSPM access to the objective test results and general FTD performance or demonstration results in the MQTG, and access to the FTD for the length of time necessary for the NSPM to complete the required recurrent evaluations, weekdays between 6 o'clock AM (local time) and 6 o'clock PM (local time).

(4) No sponsor may use, or allow the use of, or offer the use of, an FTD for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of this chapter unless the FTD has passed an NSPM-conducted recurrent evaluation within the previous 12 calendar months or as otherwise provided for in the MQTG.

(5) Recurrent evaluations conducted in the calendar month before or after the calendar month in which these recurrent evaluations are required will be considered to have been conducted in the calendar month in which they were required.

c. *Maintenance.* The sponsor is responsible for continuing corrective and preventive maintenance on the FTD to ensure that it continues to meet the requirements of § 60.15(b).

End Rule Language (§ 60.19)

Begin QPS Requirements

d. The preflight inspections described in paragraphs 14.a. (2) and (3), of this appendix, must consist of, as a minimum ''

(1) an exterior inspection of the FTD for appropriate hydraulic (if applicable), pneumatic, and electrical connections (*e.g.*, in place, not leaking, appear serviceable);

(2) a check that the area around the FTD is free of potential obstacles throughout the motion system range (if applicable);

(3) a review of the FTD discrepancy log;

(4) a functional check of the major FTD systems and simulated helicopter, or set of helicopters, systems (*e.g.*, cockpit instrumentation, control loading, and adequate air flow for equipment cooling) by doing the following:

(i) Turn on main power, including motion system (if applicable), and allow to stabilize.

(ii) Connect helicopter power. This may be connected through ''quick start'' of helicopter engines, auxiliary power unit, or ground power. Helicopter operations will require operating engines.

(iii) A general look for light bulb function, lighted instruments and switches, etc., as well as inoperative ''flags'' or other such indications.

(iv) Check Flight Management System(s) (and other date-critical information) for proper date range.

(v) Select takeoff position and from either pilot position, if applicable, observe the visual system, for proper operation (including light-point color balance and convergence, edge-matching and blending, etc.).

(vi) If applicable, adjust visibility value to inside of the far end of the runway and release ''position freeze or flight freeze.'' From either pilot position, advance power to taxi/ hover taxi (as applicable) down the runway (if applicable), observe visual system (if applicable); check sound system and engine instrument response(as applicable) and apply wheel brakes (if applicable); check normal operation and continued deceleration.

(vii) Select position on final approach, at least five (5) miles out (if applicable, observe visual scene). From either pilot position, adjust helicopter configuration appropriately (if applicable, check for normal landing gear operation). If applicable, adjust visibility to see entire airport. Release ''position freeze'' or ''flight freeze.'' Make a rapid left and right bank (check control feel and freedom; observe proper helicopter response; and exercise motion system, if applicable). Observe simulated helicopter systems operation.

(viii) Extend landing gear,

(ix) Fly to and land at airport, or select takeoff position.

(x) Shut down engines, turn off lights, turn off main power supply and motion system, as applicable.

(xi) Record ''functional preflight'' in the FTD discrepancy log book, including any item found to be missing, malfunctioning, or inoperative.

End QPS Requirements

Begin Information

e. If the NSP evaluator plans to accomplish specific tests during a normal recurrent evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; usually not less than 24 hours. These tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests as may be applicable.

f. The recurrent evaluations described in paragraph 13.a.(7), of this appendix, require approximately eight (8) hours of FTD time and consist of the following:

(1) a review of the results of the objective tests and all the designated FTD performance demonstrations conducted by the sponsor since the last scheduled recurrent evaluation.

(2) at the discretion of the evaluator, a selection of approximately 20 percent of those objective tests conducted since the last scheduled recurrent evaluation and a selection of approximately 10 percent of the remaining objective tests in the MQTG. The tests chosen will be performed either automatically or manually, at the discretion of the evaluator.

(3) a subjective test 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.

(4) an examination of the functions of the FTD, including, but not necessarily limited to the motion, visual, and sound system as applicable, and the instructor operating station, including the normal and simulated malfunctions of the simulated helicopter systems.

End Information

15. Logging FTD Discrepancies

Begin Rule Language (§60.20)

Each instructor, check airman, or representative of the Administrator conducting training or evaluation, or

observing flight experience for flightcrew member certification or qualification, and each person conducting the preflight inspection (§ 60.19(a)(2), (3), and (4)), who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the FTD, must write or cause to be written a description of that discrepancy into the discrepancy log at the end of the FTD preflight or FTD use session.

End Rule Language (§ 60.20)

16. [Reserved]

17. Modifications to FTDs

Begin Rule Language (§60.23)

a. When the sponsor or the FAA determines that any of the following circumstances exist and the FAA determines that the FTD cannot be used adequately to train, evaluate, or provide flight experience for flightcrew members, the sponsor must modify the FTD accordingly:

(1) The helicopter manufacturer or another approved source develops new data regarding the performance, functions, or other characteristics of the helicopter being simulated;

(2) A change in helicopter performance, functions, or other characteristics occurs;

(3) A change in operational procedures or requirements occurs; or

(4) Other circumstances as determined by the NSPM.

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

c. Before modifying a qualified FTD, the sponsor must notify the NSPM and the TPAA as follows:

(1) The notification must include a complete description of the planned modification, including a description of the operational and engineering effect the proposed modification will have on the operation of the FTD.

(2) The notification must be submitted in a form and manner as specified in the appropriate QPS.

d. If the sponsor intends to add additional equipment or devices intended to simulate helicopter appliances; modify hardware or software which would affect flight or ground dynamics, including revising FTD programming or replacing or modifying the host computer; or if the sponsor is changing or modifying the control loading system (or motion, visual, or sound system for FTD levels requiring these tests and measurements), the following applies:

(1) The sponsor must meet the notification requirements of paragraph (c) of this section and must include in the notification the results of all objective tests that have been re-run with the modification incorporated, including any necessary updates to the MQTG.

(2) However, the sponsor may not use, or allow the use of, or offer the use of, the FTD with the proposed modification for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of this chapter unless or until the sponsor receives written notification from the NSPM approving the proposed modification. Prior to approval, the NSPM may require that the modified FTD be evaluated in accordance with the standards for an evaluation for initial qualification or any part thereof before it is placed in service.

e. The sponsor may not modify a qualified FTD until one of the following has occurred:

(1) For circumstances described in paragraph (b) or (d) of this section, the sponsor receives written approval from the NSPM that the modification is authorized.

(2) For circumstances other than those described in paragraph (b) or (d) of this section, either:

(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 the NSPM or TPAA; or

(ii) The NSPM or TPAA approves the proposed modification in fewer than 21 days since the sponsor notified the NSPM and the TPAA of the proposed modification.

f. When a modification is made to an FTD, the sponsor must notify each certificate holder planning to use that FTD of that modification prior to that certificate holder using that FTD the first time after the modification is complete.

g. The MQTG must be updated with current objective test results in accordance with § 60.15(b)(5) and appropriate flight test data in accordance with § 60.13, each time an FTD is modified and an objective test is affected by the modification. If this update is initiated by an FSD Directive, the direction to make the modification and the record of the modification completion must be filed in the MQTG.

End Rule Language (§ 60.23)

Begin QPS Requirements

h. The notification described in paragraph 17.c.(1), of this appendix, will include a statement signed by a pilot, qualified in the helicopter type, or set of helicopters, being simulated and designated by the sponsor, that, with the modification proposed—

(1) the FTD systems and sub-systems function equivalently to those in the helicopter, or set of helicopters, being simulated;

(2) the performance and flying qualities of the FTD are equivalent to those of the helicopter, or set of helicopters, being simulated; and

(3) the cockpit configuration conforms to the configuration of the helicopter, or set of helicopters, being simulated.

End QPS Requirements

18. Operations with Missing, Malfunctioning, or Inoperative Components

Begin Rule Language (§60.25)

a. No person may use or allow the use of or offer the use of an FTD with a missing, malfunctioning, or inoperative component for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification during maneuvers, procedures, or tasks that require the use of the correctly operating component.

b. Each missing, malfunctioning, or inoperative component must be repaired or replaced within 30 calendar days unless otherwise authorized by the NSPM. Failure to repair or replace this component within the prescribed time may result in loss of FTD qualification.

c. Each missing, malfunctioning, or inoperative component must be placarded as such on or adjacent to that component in the FTD and a list of the currently missing, malfunctioning, or inoperative components must be readily available in or immediately adjacent to the FTD for review by users of the device.

End Rule Language (§ 60.25)

19. Automatic Loss of Qualification and Procedures for Restoration of Qualification

Begin Rule Language (§60.27)

a. An FTD is not qualified if any of the following occurs:

(1) The FTD is not used in the sponsor's FAA-approved flight training program in accordance with § 60.9(b)(4).

(2) The FTD is not maintained and inspected in accordance with § 60.19.

(3) The FTD is physically moved from one location to another, regardless of distance.

(4) The FTD is disassembled (*e.g.*, for repair or modification) to such an extent that it cannot be used for training, evaluation, or experience activities.

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

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

(1) The FTD successfully passes an evaluation:

(i) For initial qualification, in accordance with § 60.15 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 approved as necessary by the NSPM.

(2) The NSPM or the TPAA 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 inspections and recurrent evaluations missed, the amount of disassembly and re-assembly of the FTD that was accomplished, and the care that had been taken of the device since the last evaluation.

End Rule Language (§ 60.27)

20. Other Losses of Qualification and Procedures for Restoration of Qualification

Begin Rule Language (§60.29)

a. Except as provided in paragraph (c) of this section, when the NSPM or the TPAA notifies the sponsor that the FTD no longer meets qualification standards, the following procedure applies:

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

(2) The NSPM or the TPAA sets a reasonable period (but not less than 7 days) within which the sponsor may submit written information, views, and arguments on the FTD qualification.

(3) After considering all material presented, the NSPM or the TPAA notifies the sponsor of the FTD qualification.

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

(i) The NSPM or the TPAA find under paragraph (c) of this section that there is an emergency requiring immediate action with respect to safety in air transportation or air commerce; or

(ii) The sponsor petitions for reconsideration of the NSPM or the TPAA finding under paragraph (b) of this section.

b. When a sponsor seeks reconsideration of a decision from the NSPM or the TPAA concerning the FTD 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 FTD is no longer qualified.

(2) The sponsor must address its petition to the Director, Flight Standards Service.

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

c. If the NSPM or the TPAA find that an emergency exists requiring immediate action with respect to safety in air transportation or air commerce that makes the procedures set out in this section impracticable or contrary to the public interest:

(1) The NSPM or the TPAA withdraws qualification of some or all of the FTD 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 or the TPAA 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.

End Rule Language (§ 60.29)

21. Recordkeeping and Reporting

Begin Rule Language (§60.31)

a. The FTD sponsor must maintain the following records for each FTD it sponsors:

(1) The MQTG and each amendment thereto.

(2) A copy of the programming used during the evaluation of the FTD for initial qualification and for any subsequent upgrade qualification, and a copy of all programming changes made since the evaluation for initial qualification.

(3) A copy of all of the following:

(i) Results of the evaluations for the initial and each upgrade qualification.

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

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

(iv) Comments obtained in accordance with § 60.9(b)(1) for a period of at least 18 months.

(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.

(5) A record of all modifications to FTD hardware configurations made since initial qualification.

b. The FTD sponsor must keep a current record of each certificate holder using the FTD. The sponsor must provide a copy of this list to the NSPM at least semiannually.

c. 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.

d. The sponsor must submit an annual report, in the form of a comprehensive statement signed by the quality assurance primary contact point, certifying that the FTD continues to perform and handle as qualified by the NSPM.

End Rule Language (§ 60.31)

22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements

Begin Rule Language (§60.33)

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 or the QPS.

(2) A fraudulent or intentionally false statement in or omission from any record or report that is kept, made, or used to show compliance with this part or the QPS, 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 or the QPS.

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 FTD qualification and approval for use in a training program.

c. The following may serve as a basis for removal of qualification of an FTD including the withdrawal of authorization for use of an FTD; 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 FTD qualification or an approval for use.

End Rule Language (§ 60.33)

23. [Reserved]

24. [Reserved]

25. [Reserved]

Attachment 1 to Appendix D to Part 60—General FTD Requirements

1. General

Begin QPS Reqirements

a. Requirements

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

TABLE OF MINIMUM FTD REQUIREMENTS INFORMATION

General FTD Standards	QPS Requirement						Additional details	Notes
	FTD level							
	1	2	3	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			X	Level 3 must be representative of a single set of helicopters, and must have navigation controls, displays, and instrumentation as set out in 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 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	X		Level 2 must be representative of a single set of helicopters.	
c. Circuit breakers must function accurately when they are involved in operating procedures or malfunctions requiring or involving flight crew response.		X	X		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 helicopters attitude, thrust, drag, altitude, temperature, and configuration.		X	X		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.	
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	X	X		

TABLE OF MINIMUM FTD REQUIREMENTS INFORMATION—Continued

QPS Requirement								Notes
General FTD Standards	FTD level						Additional details	
	1	2	3	4	5	6		
c. The FTD hardware and programming must be updated within 6 months of any helicopters 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	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		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.	
4. Equipment Operations:								
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		X	X		

TABLE OF MINIMUM FTD REQUIREMENTS INFORMATION—Continued

QPS Requirement								Notes
General FTD Standards	FTD level						Additional details	
	1	2	3	4	5	6		
b. Navigation equipment must be installed and operate within the tolerances applicable for the helicopter or set of helicopter.		X	X		X	X	Levels 2 and 5 need have only that navigation equipment necessary to fly an instrument approach. Levels 3 and 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	X	X	Level 6 must simulate all applicable helicopter flight, navigation, and systems operation. Level 3 must have flight and navigational controls, displays, and instrumentation for powered aircraft as set out in part 91, § 91.205 for IFR operation. Levels 2 and 5 must have influenced flight and navigational controls, displays, and instrumentation.	
d. The lighting environmental for panels and instruments must be sufficient for the operation being conducted.		X	X	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 conditions.			X			X		
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			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	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.

TABLE OF MINIMUM FTD REQUIREMENTS INFORMATION—Continued

QPS Requirement								Notes
General FTD Standards	FTD level						Additional details	
	1	2	3	4	5	6		
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	X	X		
6. Motion System:								
a. The FTD may have a motion system; if desired, although it is not required.		X	X	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. (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.		X	X	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 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			X		

Attachment 2 to Appendix D to Part 60—Flight Training Device (FTD) 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 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 document. (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

Begin Information

b. Discussion

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 notes
Test	Tolerence	Flight conditions	Flight training device level						Test details	
			1	2	3	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			X	Record each engine start from the initiation of the start sequence to steady state idle and from steady state idle to operating RPM..	

TABLE OF OBJECTIVE TESTS—Continued

QPS Requirement										Information notes
Test	Tolerence	Flight conditions	Flight training device level						Test details	
			1	2	3	4	5	6		
(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	X	Record both steady state idle and operating RPM conditions. May be a series of snapshot tests..	
(2) Power Turbine	±10% of total change of power turbine speed.	Ground			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	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—±1.5°, Sideslip Angle—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%,.	Cruise (Augmentation On and Off).		X	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..	
c. Climb										
Performance and Trimmed Flight Control Positions.	Vertical Velocity—±100 fpm (61m/sec) or ±10%, Pitch Attitude—±1.5%, Sideslip Angle—±2°, Longitudinal Control Position—±5%, Lateral Control Position—±5%, Directional Control Position—±5%, Collective Control Position—±5%.	All engines operating, One engine inoperative, Augmentation System(s) On and Off.		X	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..	
d. Descent										
(1) Descent Performance and Trimmed Flight Control Positions.	Torque-±3%, Pitch Attitude-±1.5°, Sideslip Angle-±2°, Longitudinal Control Position-±5%, Lateral Control Position-±5%, Directional Control Position-±5%, Collective Control Position-±5%.	At or near 1,000 fpm rate of descent (RoD) at normal approach speed. Augmentation System(s) On and Off.		X	X		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-±1.5°, Sideslip Angle-±2°, Longitudinal Control Position-5%, Lateral Control Position-±5%, Directional Control Position-±5%, Collective Control Position-±5%..	Steady descents. Augmentation System(s) On and Off.		X	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.	

TABLE OF OBJECTIVE TESTS—Continued

QPS Requirement									Information notes
Test	Tolerence	Flight conditions	Flight training device level						Test details	
			1	2	3	4	5	6		
d. Autorotation										
Entry	Rotor Speed-±3%, Pitch Attitude ±22°, Roll Attitude-3°, Yaw Attitude-±5°, Airspeed-±5 kts., Vertical Velocity-±200 fpm (1.00m/sec) or 10%.	Cruise; or Climb			X			X	Record results of a rapid throttle reduction to idle. If accomplished in cruise, results must be for the maximim range airspeed. If accomplished in climb, results must be for the maximum rate of climb airspeed at or near maximum continuous power.	
3. Handling Qualities										
a. Control System Mechanical Characteristics For FTDs 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 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 Off.		X	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 and Pedals.	Breakout—±0.5 lbs. (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	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		X	X		
(4) Trim System Rate (all applicable systems).	Rate—±10%	Ground Static conditions. Trim On. Friction Off.		X	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 greater than 5% of initial displacement ±1 overshoot.	Hover/Cruise. Trim On, Friction Off.		.....	.....		.....	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 3 of this appendix for additional information ''N'' is the sequential period of full cycle of oscillation.
(6) Freepay	±0.10 in	Ground; Static conditions.		X	X		X	X	Record and compare results for all controls.	
B. Longitudinal Handling Qualities										
(1) Control Response	Pitch Rate—±10% or ±2°/sec., Pitch Attitude Change—±10% or ±1.5°.	Cruise; Augmentation on and Off.		X	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—Continued

QPS Requirement										Information notes
Test	Tolerence	Flight conditions	Flight training device level						Test details	
			1	2	3	4	5	6		
(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	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	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.	±1.5% Pitch or ±2%/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. (6.3 mm) 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 30°–45° 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	X	.	
d. Lateral and Directional Handling Qualities										
(1) Control Response:										
(a) Lateral	Roll Rate—±10% or ±3°/sec. Roll Attitude Change—±10% or ±3°.	Cruise Augmentation On and Off.		X	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 ±2°/sec., Yaw Attitude Change—±10% or ±2°.	Cruise; Augmentation On and Off.		X	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.	

TABLE OF OBJECTIVE TESTS—Continued

QPS Requirement									Information notes
Test	Tolerence	Flight conditions	Flight training device level						Test details	
			1	2	3	4	5	6		
(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. (0.223daN) 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 change from trim or ±0.25 in. (6.3 mm). Vertical Velocity—±100 fpm (0.50 m/sec) or 10 %.	(1) Cruise; or (2) Climb (may use Descent instead of Climb if desired) Augmentation On and Off.		X	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.
(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	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, which is less. For non-periodic response, the time history must be matched.	
(b) Spiral Stability ..	Correct Trend, ±2° bank or ±10% in 20 sec.	Cruise or Climb. Augmentation On and Off.		X	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, ±2° transient sideslip angle.	Cruise or Climb. Augmentation On and Off.		X	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.	

4. 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. 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 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, of this attachment):

$T(P_0)$ ±10% of P_0
$T(P_1)$ ±20% of P_1
$T(A)$ ±10% of A_1, ±20% of Subsequent Peaks
$T(A_d)$ ±10% 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 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.

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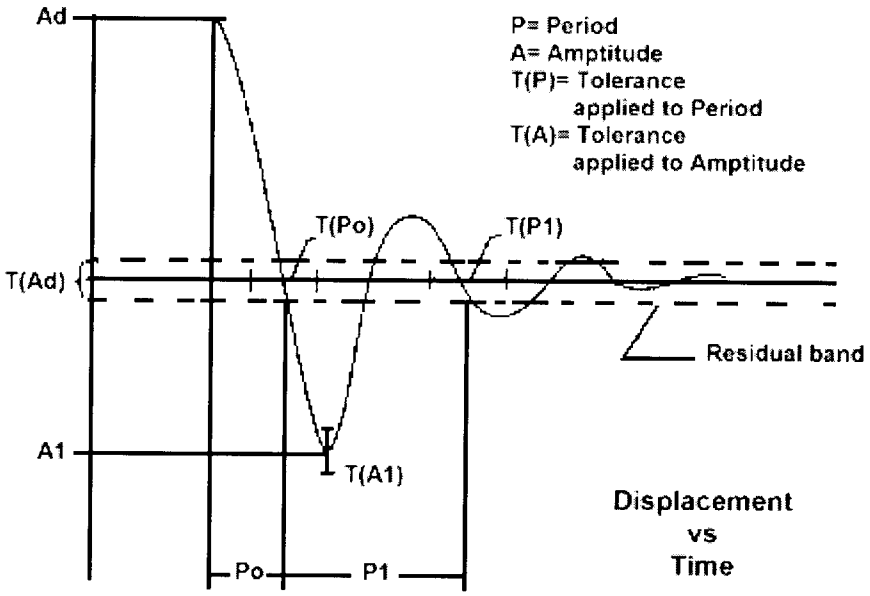
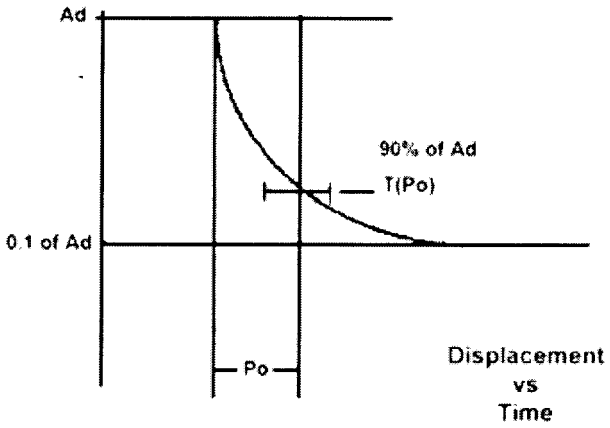
Attachment 2 to Appendix D to Part 60—

FIGURE 1. UNDER-DAMPED STEP RESPONSE



Attachment 2 to Appendix D to Part 60—

FIGURE 2. CRITICALLY-DAMPED STEP RESPONSE



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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

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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.

3. FTD Systems

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 D to Part 60—Definitions and Abbreviations

1. Definitions

Begin Rule Language (14 CFR Part 1 and § 60.3)

(From Part 1—Definitions)

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

Flight simulator means a full size replica of a specific type or make, model, and series aircraft cockpit. It includes the assemblage of equipment and computer programs necessary to represent the aircraft in ground and flight operations, 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 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 standards (QPS) for a specific qualification level.

Flight training device (FTD) means a full size 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 the aircraft or set of aircraft 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 qualification level.

(From Part 60—Definitions)

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.

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

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

Master Qualification Test Guide (MQTG). The FAA-approved Qualification Test Guide with the addition of the FAA-witnessed test, performance, or demonstration results, applicable to each individual FSD.

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 comparison of simulator performance data to actual or predicted aircraft performance data to ensure FSD performance is within the tolerances prescribed in the QPS.

Predicted data. Aircraft performance data derived from sources other than direct physical measurement of, or flight tests on, the subject aircraft. Predicted data may include engineering analysis and simulation, design data, wind tunnel data, estimations or extrapolations based on existing flight test data, or data from other models.

Qualification level. The categorization of the FSD, based on its demonstrated technical and operational capability as set out in the QPS.

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 FSD requirements, for establishing FSD qualification levels.

Qualification Test Guide (QTG). The primary reference document used for evaluating an aircraft FSD. It contains test results, performance or demonstration results, statements of compliance and capability, the configuration of the aircraft simulated, and other information for the evaluator to assess the FSD against the applicable regulatory criteria.

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.

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

Subjective test. A qualitative comparison to determine the extent to which the FSD performs and handles like the aircraft being simulated.

Training Program Approval Authority (TPAA). A person authorized by the Administrator to approve the aircraft flight training program in which the FSD will be used.

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

End Rule Language (14 CFR Part 1 and §60.3)

Begin QPS Requirement

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.

Automatic Testing—is simulator testing wherein all stimuli are under computer control.

Bank—is the helicopter 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.

Closed Loop Testing—is a test method for which the input stimuli are generated by controllers which drive the simulator to follow a pre-defined target response.

Computer Controlled Helicopter—is a helicopter 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 Flight Simulator—is a simulator in which hardware and software can be changed so that the simulator becomes a replica of a different model, usually of the same type helicopter. The same simulator 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.

Driven—is a test method where the input stimulus or variable is positioned by automatic means, generally a computer input.

Free Response—is the response of the simulator after completion of a control input or disturbance.

Frozen—is a test condition where one or more variables are held constant with time.

Fuel used—is the amount or mass of fuel used (kilograms or pounds).

Ground Effect—is the change in aerodynamic characteristics due to modification of the air flow past the aircraft caused by the proximity of the earth's surface to the helicopter.

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 simulator 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 simulator such that all helicopter 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 simulator testing wherein the pilot conducts the test without computer inputs except for initial setup and all modules of the simulation are active.

Medium—is the normal operational weight for a given flight segment.

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 Helicopters 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 Helicopters and is the state where the intended control, augmentation, and protection functions are fully working.

Pitch—is the helicopter 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.

Protection Functions—are systems functions designed to protect a helicopter from exceeding its flight maneuver limitations.

Pulse Input—is a step input to a control followed by an immediate return to the initial position.

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 helicopter attitude with respect to or around the longitudinal axis expressed in degrees.

Sideslip—is the angular difference between the helicopter heading and the direction of movement in the horizontal plane.

Simulation Data—are the various types of data used by the simulator manufacturer and the applicant to design, manufacture, and test the simulator.

Simulator Approval—is the extent to which a simulator may be used by a certificate holder as authorized by the FAA. It takes account of helicopter to simulator differences and the training ability of the organization.

Simulator Latency—is the additional time beyond that of the response time of the helicopter due to the response of the simulator.

Snapshot—is a presentation of one or more variables at a given instant of time.

Source Data—are, for the purpose of this document, performance, stability and control, and other necessary test parameters electrically or electronically recorded in a helicopter using a calibrated data acquisition system of sufficient resolution and verified as accurate by the company performing the test to establish a reference set of relevant parameters to which like simulator parameters can be compared.

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 simulator 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.

Surge—is simulator movement with respect to or along the longitudinal axis.

Sway—is simulator 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)—is the person who exercises authority on behalf of the Administrator in approving the aircraft flight training program for the appropriate helicopter in which the simulator will be used. This person is the principal operations inspector (POI) for programs approved under 14CFR parts 63, 121, 125, or 135; or the training center program manager (TCPM) for programs approved under part 141 or 142.

Transport Delay or ''Throughput''—is the total simulator 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 helicopter simulated.

Validation Data—are data used to determine if the simulator performance corresponds to that of the helicopter.

Validation Test—is a test by which simulator parameters are compared to the relevant validation data.

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 helicopter attitude with respect to or around the vertical axis expressed in degrees.

End QPS Requirements

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2. Abbreviations

Begin QPS Requirements

AFM—Approved Flight Manual.
AGL—Above Ground Level (meters or feet).
AOA—Angle of Attack (degrees).
APD—Aircrew Program Designee.
CCA—Computer Controlled Aircraft.
cd/m2—candela/meter^2, 3.4263 candela/m^2 = 1 ft-Lambert.
CFR—Code of Federal Regulations.
cm(s)—centimeter, centimeters.
daN—decaNewtons, one (1) decaNewton = 2.27 pounds.
deg(s)—degree, degrees.
DOF—Degrees-of-freedom.
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.
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.
M,m—Meters, 1 Meter = 3.28083 feet.
Min(s)—Minute, minutes.
MLG—Main Landing Gear.
Mpa—MegaPascals (1 psi = 6894.76 pascals).
ms millisecond(s).
N—NORMAL CONTROL Used in reference to Computer Controlled Aircraft.
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.
nm—Nautical Mile(s) 1 Nautical Mile = 6,080 feet.
NN—NON-NORMAL CONTROL Used in reference to Computer Controlled Aircraft.
NWA—Nosewheel Angle (degrees).
PAPI—Precision Approach Path Indicator System.
PLA—Power Lever Angle.
Pf—Impact or Feel Pressure, often expressed as ''q.''.
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.
T/O—Takeoff.
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.
Vmc—Minimum Control Speed.

Vmca—Minimum Control Speed in the air.
Vmcg—Minimum Control Speed on the ground.

End QPS Requirements 7

Attachment 5 to Appendix D to Part 60—Sample Documents

Begin Information

Title of Sample

Table of Contents

End Information

BILLING CODE 4910–13–P

Attachment 5 to Appendix D to Part 60—

Figure 1 – Sample Letter of Request

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 5 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 5 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

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 5 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 5 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: ☐ CRT Installation:..... ☐ Projected System:.....	Real World H1, Clear View, Inc. 1 Channel, 2 Window CRT.....	July 12, 1988
Flight Instruments: ☐ Electro-Mechanical:..... ☐ Display (CRT, LCD, etc.)..... ☐ Combination ..... ☐ Heads-Up Display.....	.....	July 12, 1988
Flight Director: ☐ Single Cue..... ☐ Dual Cue..... ☐ None.....	Sperry.....	July 12, 1988
Engine Instruments: ☐ Electro-Mechanical..... ☐ Display (CRT, LCD, etc.)..... ☐ Combination.....	.....	July 12, 1988
Navigation Type(s): ☐ ADF..... ☐ VOR/ILS..... ☐ GPS..... ☐ INS..... ☐ IRS.....	....	July 12, 1988 July 12, 1988 July 12, 1988
Weather Radar:		
TCAS		
ACARS		

Attachment 5 to Appendix D to Part 60—

Figure 4B – Sample Statement of Qualification; Qualified/Non-Qualified Tasks

INFORMATION

STATEMENT of QUALIFICATION
Qualified/Non-Qualified Tasks
Go-Fast Training Center
Vertiflite AB-320 -- Level 6 -- FAA ID# 889

The following are those items listed in the Helicopter Flight Training Device Qualification Performance Standards (QPS), FAA-S-120-63FTD, dated (May 1, 2000) Appendix 3, Subjective Tests, indicating what tasks and systems are qualified **(Q)** *and what tasks and systems are not qualified* **(NQ).**

NQ	Q	TASK		NQ	Q	TASK
		A. Preparation for Flight.			X	(a) Timed.
	X	1. Preflight.			X	(b) Normal.
		2. APU/Engine start and run-up.			X	(c) Steep.
	X	(a) Normal start procedures.				4. Accelerations and decelerations.
	X	(b) Alternate start procedures.		X		5. High speed vibrations.
	X	(c) Abnorm. starts / shutdowns.				6. Abnormal/emergency procedures
	X	(d) Rotor engagement.			X	(a) Engine fire.
	X	(e) System checks			X	(b) Engine failure.
	X	(f) Other.			X	(c) Inflight eng. shutdown and restart.
		B. Takeoff.			X	(d) Fuel governing system failures.
		1. Normal.			X	(e) Directional control malfunction
	X	(a) From ground.			X	(f) Hydraulic failure.
		(b) From hover.		X		(g) Stability system failure.
X		(1) Cat A.		X		(h) Rotor vibrations.
X		(2) Cat B.			X	(i) Other.
	X	(c) Running.				**E. Descent.**
	X	(d) Crosswind/tailwind.			X	1. Normal.
	X	(e) Maximum performance.			X	2. Maximum rate.
	X	(f) Instrument.			X	3. Other.
		2. Abnorm./emer. procedures:				**F. Approach.**
		(a) Takeoff, eng. fail after CDP.				1. Non-precision.
	X	(1) Cat A.			X	(a) All engines operating.
	X	(2) Cat B.			X	(b) Engines inoperative.
	X	(b) Other				(c) Approach procedures:
		C. Climb.			X	(1) NDB
	X	1. Normal.			X	(2) VOR
	X	2. One engine inoperative.		X		(3) RNAV
	X	3. Other.		X		(4) TACAN
		D. Cruise.		X		(5) ASR
	X	1. Performance.			X	(6) Helicopter only.
	X	2. Flying qualities.			X	(7) Other.
		3. Turns.				(d) Missed approach.

Initials _____ Date _____

-- Continued Next Page --

NQ	Q	TASK (Con't.)	NQ	Q	TASK (Con't.)
	X	(1) All engines operating.	X		(c) Autopilot.
	X	(2) Engine(s) inoperative.	X		(d) TCAS
		2. Precision.		X	(e) Flight data displays.
	X	(a) All engines operating.		X	(f) Flight management computers.
	X	(b) Engine(s) inoperative.	X		(g) Head-up displays.
		(c) Approach procedures		X	(h) Navigation systems.
X		(1) PAR		X	(i) Other.
X		(2) MLS			3. Airborne procedures.
	X	(3) ILS		X	(a) Holding.
	X	(4) Manual	X		(b) Air hazard avoidance.
	X	(5) With Flight director.		X	(c) Retreating blade stall recovery.
		(6) Autopilot coupled	X		(d) Mast bumping.
X		(i) Cat I		X	(e) Other.
X		(ii) Cat II			**H. Engine Shutdown and Parking.**
	X	(7) Other.		X	1. Engine and systems operation.
		(d) Missed approach.		X	2. Parking brake operation.
	X	(1) All engines operating.		X	3. Rotor brake operation.
	X	(2) Engine(s) inoperative.		X	4. Abnorm./emer. procedures.
	X	(3) Stability system failure.			
	X	(e) Other			
		G. Any Flight Phase.			
		1. Systems operation.			
	X	(a) Air conditioning.			
	X	(b) Anti-icing/deicing.			
	X	(c) Auxiliary power plant.			
	X	(d) Communications.			
	X	(e) Electrical			
	X	(f) Fire detect. and suppression.			
X		(g) Stabilizer.			
	X	(h) Flight controls.			
	X	(i) Fuel and oil.			
	X	(j) Hydraulic.			
	X	(k) Landing gear.			
	X	(l) Oxygen.			
	X	(m) Pneumatic.			
	X	(n) Powerplant.			
	x	(o) Flight control computers.			
X		(p) Stability augmentation.			
	X	(q) Other.			
		2. Flight mgmt. and guide. system.			
X		(a) Airborne radar.			
X		(b) Automatic landing aids.			

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	FTD SYSTEM		NQ	Q	FTD SYSTEM
		A. Inst. Ops. Station (IOS).				**B. Sound Controls.**
	X	1. Power switch(es).			X	-- On / off / rheostat
		2. Helicopter conditions.				**C. Observer Stations.**
	X	(a) GW, CG, Fuel weight, etc.			X	1. Position.
	X	(b) Airplane systems status.			X	2. Adjustments.
	X	(c) Ground crew functions				
	X	(d) Other.				
		3. Airports and Landing Areas.				
	X	(a) Number and selection.				
	X	(b) Runway selection.				
	X	(c) Runway surface condition				
	X	(d) Preset positions				
	X	(e) Lighting controls.				
	X	(f) Other.				
		4. Environmental controls.				
	X	(a) Clouds (base and tops).				
	X	(b) Visibility				
	X	(c) Runway visual range				
	X	(d) Temperature.				
	X	(e) Climate conditions				
	X	(f) Wind speed and direction.				
	X	(g) Other.				
		5. Helicopter system malfunctions.				
	X	(a) Insertion / deletion.				
	X	(b) Problem clear.				
	X	(c) Other				
		6. Locks, freezes, repositioning.				
	X	(a) Problem freeze / release.				
	X	(b) Position freeze / release.				
	X	(c) Repositioning				
	X	(d) Ground speed control				
	X	(e) Other				
X		7. Remote IOS.				
	X	8. Other.				

Initials _____ Date_____ -- End --

Attachment 5 to Appendix D to Part 60—

Figure 5 – Sample Recurrent 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 5 to Appendix D to Part 60—

Figure 6 – Sample Request for Initial, Upgrade, or Reinstatement Evaluation Date

INFORMATION

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

Dear Mr. Cook:

RE: Request for Initial [Upgrade / Reinstatement] Evaluation Date

This is to advise you of our intent to request an evaluation of our (Aircraft Type/Level) FTD located in (City/State) at the (Facility) on (proposed evaluation date). [The proposed evaluation date shall not be more than 180 days following the date of this letter.] This FTD [has / has not] been previously qualified by the FAA [and had been issued FAA identification number XXX]. [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.

[Added comments from Operator/Sponsor, if any]

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

A copy of this letter of intent has been provided to our Principal Operations Inspector (POI) and/or Training Center Program Manager (TCPM).

Sincerely,

(Signature)

Acknowledgement:

____ We concur with your proposed dates.

____ The date requested is not available, however, we propose the following date:

____ Please provide us with the following information:

_____ _____
Scheduler, National Simulator Program Date

Attachment 5 to Appendix D to Part 60—

Figure 7 – 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....

BILLING CODE 4910–13–C

Attachment 6 to Appendix D to Part 60—
Record of FSD Directives

Begin QPS Requirements

When the FAA determines that modification of an FTD is necessary for safety reasons, all affected FTDs must be modified accordingly, regardless of the original qualification standards applicable to any specific FTD.

a. A copy of the notification to the sponsor from the TPAA or NSPM that a modification is necessary will be filed in and maintained as part of this attachment.

b. The effective FSD Directives, including the date of the directive, the direction to make these changes, and the date of completion of any resulting modification must be maintained in a separate section of the MQTG and index accordingly. The MQTG must also be updated to include the information described in § 60.15(b)(4) as may be appropriate as a result of the FSD Directive. See Attachment 5 of this appendix for a sample Index of Effective FSD Directives.

End QPS Requirements

Begin QPS Requirements

The following FSD Directives have been issued and are filed in this attachment according to the below-listed Notification Number. (Continue as necessary)

Notification No.	Individual FTDs affected	Sponsors affected	Date of notification

Notification No.	Individual FTDs affected	Sponsors affected	Date of notification

PART 61—CERTIFICATION: PILOTS, FLIGHT INSTRUCTORS, AND GROUND INSTRUCTORS

7. The authority citation for part 61 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44703, 44707, 44709–44711, 45102–45103, 45301–45302.

8. Section 61.1 is amended by revising paragraphs (b)(1) and (b)(15)(iii), and by removing and reserving paragraphs (b)(5) and (b)(7), to read as follows:

§ 61.1 Applicability and definitions.

* * * * *

(b) * * *

(1) Aeronautical experience means pilot time obtained in an aircraft, a flight simulator, a flight training device, or other device approved under § 61.4(b) for meeting the appropriate training and flight time requirements for an airman certificate, rating, flight review or recency of flight experience requirements of this part.

* * * * *

(15) * * *

(iii) In a flight simulator, a flight training device, or other device approved under § 61.4(b) from an authorized instructor.

9. Section 61.4 is revised to read as follows:

§ 61.4 Flight simulators, flight training devices, or other devices.

(a) Each flight simulator and flight training device used for training, and for which an airman is to receive credit to satisfy any training, testing, or checking requirement under this chapter, must be evaluated and qualified under part 60 of this chapter and must be approved by the Administrator for both of the following:

(1) The training, testing, and checking for which it is used.

(2) Each particular maneuver, procedure, or flightcrew member function performed.

(b) The Administrator may approve a device other than a flight simulator or flight training device for the purpose indicated in those sections of this part where the phrase ''other device'' is used.

10. Section 61.23 is amended by revising paragraphs (b)(7) and (b)(8) to read as follows:

§ 61.23 Medical certificates: Requirement and duration.

* * * * *

(b) * * *

(7) When serving as an examiner or check airman during the administration of a test or check for a certificate, rating, or authorization conducted in a flight simulator, a flight training device, or other device approved under § 61.4(*b*); or

(8) When taking a test or check for a certificate, rating, or authorization conducted in a flight simulator, a flight training device, or other device approved under § 61.4(*b*).

* * * * *

11. Section 61.31 is amended by revising the introductory text of paragraph (g)(3) to read as follows:

§ 61.31 Type rating requirements, additional training, and authorization requirements.

* * * * *

(g) * * *

(3) The training and endorsement required by paragraphs (g)(1) and (g)(2) of this section are not required if that person can document satisfactory accomplishment of any of the following in a pressurized aircraft, a flight simulator, a flight training device, or other device approved under § 61.4(b) that is representative of a pressurized aircraft:

* * * * *

12. Section 61.51 is amended by revising paragraphs (b)(1)(iii), (b)(2)(v), (b)(3)(iii), (g)(4), and (h)(1) to read as follows:

§ 61.51 Pilot logbooks.

* * * * *

(b) * * *

(1) * * *

(iii) Location where the aircraft departed and arrived, or for lessons in a flight simulator, a flight training device, or other device approved under § 61.4(b), the location where the lesson occurred.

* * * * *

(2) * * *

(v) Training received in a flight simulator, a flight training device, or other device approved under § 61.4(b) from an authorized instructor.

(3) * * *

(iii) Simulated instrument conditions in flight, a flight simulator, a flight training device, or other device approved under § 61.4(b).

* * * * *

(g) * * *

(4) A flight simulator, a flight training device, or other device approved under § 61.4(b), may be used by a person to log instrument flight time, provided an authorized instructor is present during the simulated flight.

(h) *Logging training time.* (1) A person may log training time when that person receives training from an authorized instructor in an aircraft, flight simulator, a flight training device, or other device approved under § 61.4(b).

* * * * *

13. Section 61.65 is amended by revising paragraphs (a)(5), (a)(8)(ii), the introductory text of paragraph (c), the heading and introductory text of paragraph (e), and (e)(2) to read as follows:

§ 61.65 Instrument rating requirements.

(a) * * *

(5) Receive and log training on the areas of operation of paragraph (c) of this section from an authorized instructor in an aircraft, a flight simulator, a flight training device, or other device approved under § 61.4(b) that represents an airplane, helicopter, or powered-lift appropriate to the instrument rating sought;

* * * * *

(8) * * *

(ii) A flight simulator, a flight training device, or other device approved under § 61.4(b) appropriate to the rating sought and approved for the specific maneuver or procedure performed. If a flight training device or other device approved under § 61.4(b) is used for the practical test, the instrument approach procedures conducted in that device are limited to one precision and one nonprecision approach, provided the flight training device or other device approved under § 61.4(b) is approved for the procedure performed.

* * * * *

(c) *Flight proficiency.* A person who applies for an instrument rating must receive and log training from an authorized instructor in an aircraft, a flight simulator, a flight training device, or other device approved under § 61.4(b) in accordance with paragraph (e) of this

section, that includes the following areas of operation:

* * * * *

(e) *Use of flight simulators, flight training devices, or other devices approved under § 61.4(b).* If the instrument training was provided by an authorized instructor in a flight simulator, a flight training device or other device approved under § 61.4(*b*)—

* * * * *

(2) A maximum of 20 hours may be performed in that flight simulator, flight training device, or other device approved under § 61.4(b) if the training was not accomplished in accordance with part 142 of this chapter.

14. Section 61.109 is amended by revising paragraphs (i) heading and (i)(1) to read as follows:

§ 61.109 Aeronautical experience.

* * * * *

(i) *Permitted credit for use of a flight simulator, a flight training device, or other device approved under § 61.4(b).* (1) Except as provided in paragraph (i)(2) of this section, a maximum of 2.5 hours of training in a flight simulator, a flight training device, or other device approved under § 61.4(b), representing the category, class, and type, if applicable, of aircraft appropriate to the rating sought, may be credited toward the flight training time required by this section, if received from an authorized instructor.

* * * * *

PART 63—CERTIFICATION: FLIGHT CREWMEMBERS OTHER THAN PILOTS

15. The authority citation for part 63 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44703, 44707, 44709–44711, 45102–45103, 45301–45302.

16. Section 63.39 is amended by revising paragraph (b)(3) to read as follows:

§ 63.39 Skill requirements.

* * * * *

(b) * * *

(3) In flight, in an airplane simulator, or in an appropriately equipped cockpit specific flight training device qualified in accordance with part 60 of this chapter, show that he can satisfactorily perform emergency duties and procedures and recognize and take appropriate action for malfunctions of the airplane, engines, propellers (if appropriate), systems and appliances.

17. Appendix C to part 63 is amended by revising the introductory text of paragraph (a)(3)(iv) to read as follows:

Appendix C to Part 63—Flight Engineer Training Course Requirements

(a) * * *

(3) * * *

(iv) If the Administrator finds a simulator or appropriately equipped cockpit specific flight training device qualified in accordance with part 60 of this chapter to accurately reproduce the design, function, and control characteristics, as pertaining to the duties and responsibilities of a flight engineer on the type of airplane to be flown, the flight training time may be reduced by a ratio of 1 hour of flight time to 2 hours of airplane simulator time, or 3 hours of time in an appropriately equipped cockpit specific flight training device qualified in accordance with part 60 of this chapter, as the case may be, subject to the following limitations:

* * * * *

PART 141—PILOT SCHOOLS

18. The authority citation for part 141 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44703, 44707, 44709, 44711, 45102–45103, 45301–45302.

19. Section 141.41 is amended by revising paragraphs (a) and (b) to read as follows:

§ 141.41 Flight simulators, flight training devices, and training aids.

* * * * *

(a) *Flight simulators.* Each flight simulator used to obtain flight training credit allowed for flight simulators in an approved pilot training course curriculum must be evaluated and qualified under part 60 of this chapter and must be approved by the Administrator for use under an approved training program.

(b) *Flight training devices.* Each flight training device used to obtain flight training credit allowed for flight training devices in an approved pilot training course curriculum must be evaluated and qualified under part 60 of this chapter and must be approved by the Administrator for use under an approved training program.

* * * * *

PART 142—TRAINING CENTERS

20. The authority citation for part 142 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 40119, 44101, 44701–44703, 44705, 44707, 44709–44711, 45102–45103, 45301–45302.

21. Section 142.3 is amended by removing the definition for ''Advanced Flight Training Device'' and by revising the definition for ''Flight training equipment'' to read as follows:

§ 142.3 Definitions.

* * * * *

Flight training equipment means flight simulators, flight training devices, and aircraft.

* * * * *

22. Section 142.15 is amended by revising paragraph (d) to read as follows:

§ 142.15 Facilities.

* * * * *

(d) An applicant for, or holder of, a training center certificate must have available exclusively, for adequate periods of time and at a location approved by the Administrator, adequate flight training equipment and courseware, including at least one flight simulator or flight training device.

23. Section 142.59 is amended by revising paragraph (c), by removing and reserving paragraph (d), and by removing paragraph (f) to read as follows:

§ 142.59 Flight simulators and flight training devices.

* * * * *

(c) Each flight simulator or flight training device used by a training center must be evaluated and qualified under part 60 of this chapter and must be approved by the Administrator for use under an approved training program.

* * * * *

Issued in Washington, DC, on June 4, 2002.

Louis C. Cusimano,

Acting Director, Flight Standards Service.

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