Advisory Circular

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Advisory Circular

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Subject: AIRPLANE FLIGHT TRAINING DEVICE QUALIFICATION

1. PURPOSE. This Advisory Circular (AC) provides an acceptable means, but not the only means, of ensuring compliance with the Federal Aviation Regulations (FAR) regarding the evaluation and qualification of all training devices in which flight training, qualification, or certification of airmen under Title 14, code of Federal Regulations is accomplished. These devices are referred to in this document and other documents published by the Federal Aviation Administration (FAA) as "flight training devices." This AC specifies the criteria to be used by the FAA when qualifying a device and determining what the qualification level should be. While these guidelines are not mandatory, they are derived from extensive FAA and industry experience in determining compliance with the pertinent FAR. Mandatory terms used in this AC such as "shall" or "must" are used only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described herein is used. Applicable regulations must also be referenced to assure compliance with the provisions herein. This AC does not change regulatory requirements or create additional ones, and does not authorize changes in, or deviations from, regulatory requirements. The provisions of the FAR are controlling. This document does not interpret the regulations. Interpretations are issued only under established agency procedures. This AC applies

only to the evaluation and qualification of flight training devices described in this paragraph and further defined in paragraph 6b. Guidance for the evaluation of simulators is published in AC 120-40, Airplane Simulator Qualification, as amended.

2. CANCELLATION. AC 120-45, Advanced Training Devices (Airplane Only) Evaluation and Qualification, dated May 11, 1987, is cancelled. Operators having acquisition or upgrade projects in progress on the effective date of this AC have 90 days from the effective date to notify the National Simulator Program Manager (NSPM) of those projects which the operator desires to complete under the provisions of AC 120-45. AC 61-66, Annual Pilot in Command Proficiency Checks, dated November 2, 1973, is cancelled since its provisions are superseded by this AC and other newly published FAA guidance and directives.

3. RELATED FAR SECTIONS. FAR Part 1; FAR Sections 61.57, 61.58, and 61.157; FAR Part 61 Appendix A; FAR Section 63.39; FAR Part 63 Appendix C; FAR Sections 121.407, 121.409, 121.439, and 121.441; Special Federal Aviation Regulation 58; FAR Part 121 Appendices E, F, and H; FAR Sections 125.285, 125.287, 125.291, and 125.297; FAR Part 127; and FAR Sections 135.293, 135.297, 135.323, and 135.335.

4. RELATED READING MATERIAL. AC 120-28C, Criteria for Approval of Category III Landing Weather Minima; AC 120-29, Criteria for Approving Category I and Category II Landing Minima for FAR 121 Operators; AC 120-35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation; AC 120-41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance systems; AC 120-46, Use of Advanced Training Devices (Airplane Only); and appropriate sections of FAA Order 8400.10, Air Transportation Operations Inspector's Handbook, and of FAA Order 8700.1, General Aviation Operations Inspector's Handbook.

5. INTRODUCTION.

a. The primary objective of flight training is to provide a means for flight crewmembers to acquire the skills and knowledge necessary to perform to a desired safe standard. Flight simulation provides an effective, viable environment for the instruction, demonstration, and practice of the maneuvers and procedures (called training events) pertinent to a particular airplane and crewmember position. Successful completion of flight training is validated by appropriate testing, called checking events. The complexity, operating costs, and operating environment of modern airplanes, together with the technological advances made in flight simulation, have encouraged the expanded use of training devices and simulators in the training and checking of flight crewmembers. These devices provide more indepth training than can be accomplished in the airplane and

provide a very high transfer of skills, knowledge, and behavior to the cockpit. Additionally, their use results in safer flight training and cost reductions for the operators, while achieving fuel conservation, a decrease in noise and otherwise helping maintain environmental quality.

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 FAR Part 61 and Appendix A of that part; FAR Part 121, including Appendices E and F; and in other appropriate sources such as handbooks and guidance documents. These FAR sources, however, refer only to a "training device," with no further descriptive information. Other sources refer to training devices in several categories such as Cockpit Procedures Trainers, Cockpit Systems Simulators, Fixed Base Simulators (commonly referred to as CPT, CSS, and FBS, respectively), as well as other descriptors. These categories and names have had no standard definition or design criteria within the industry and, consequently, have presented communications difficulties and inconsistent standardization in their application. Furthermore, no single source guidance document has 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 has not always been equitable.

c. Recent events have demanded that standard categories and definitions be developed and that improved guidance for use of training devices be provided. These demands have evolved from:

(1) Efforts to develop improved handbooks for FAA inspectors.

(2) The development of a standard method for determining differences training and type rating requirements.

(3) Rulemaking projects which require clear definitions and standards.

(4) The obvious need within industry and government for an ability to communicate clearly concerning training devices, including their required standards and permitted use in the training and checking of airmen.

d. In coordination with a broad cross section of the aviation industry, the FAA has defined seven levels of flight training devices, Level 1 through Level 7. Level 1 is currently

reserved. Levels 2 and 3 are generic in that they are representative of no specific airplane cockpit and do not require reference to a specific airplane. Levels 4 through 7 represent a specific cockpit for the airplane represented. Within the generic or specific category, each higher level of flight training device is progressively more complex. Because of the increase in complexity and more demanding standards when progressing from Level 2 to Level 7, there is a continuum of technical definition across those levels. Above the seven levels of flight training devices there are four levels of simulators which are defined in AC 120-40, as amended. The uses permitted for each level of flight training device in training curricula conducted in accordance with FAR Parts 61, 63, 121, 125, 135, or 141 are tabulated in the applicable FAR Part, FAA Orders 8400.10 and 8700.1, as appropriate, and AC 120-46, as amended.

e. In addition to those flight training devices meeting the prescribed criteria contained in this AC for Level 6, this level will also be the category into which nonvisual simulators (see AC 120-40, as amended) will be placed for reference purposes. The placement of these unique simulators into Level 6 will not affect the standards or criteria of Level 6 flight training devices, nor will these flight training devices affect the standards or criteria of these simulators.

6. DEFINITIONS.

a. An Airplane Simulator is a full size replica of a specific type or make, model, and series airplane cockpit, including the assemblage of equipment and computer software programs necessary to represent the airplane in ground and flight operations, a visual system providing an out-of-the-cockpit view, a force (motion) cueing system which provides cues at least equivalent to that of a three degree of freedom motion system; and is in compliance with the minimum standards for a Level A simulator specified in AC 120-40, as amended.

b. An Airplane Flight Training Device is full scale replica of an airplane's instruments, equipment, panels, and controls in an open flight deck area or an enclosed airplane cockpit, including the assemblage of equipment and computer software programs necessary to represent the airplane in ground and flight conditions to the extent of the systems installed in the device; does not require a force (motion) cueing or visual system; is found to meet the criteria outlined in this AC for a specific flight training device level; and in which any flight training event or flight checking event is accomplished.

c. Approval of the Flight Training Device is authorization by the Principal Operations Inspector (POI) for the device to be used for flight training events or flight checking events, as may be appropriate, based on its assigned qualification level and approved program.

d. Approval Test Guide (ATG) is a document designed to validate that the performance and handling qualities of a flight training device agree within prescribed limits with those of the airplane or set of airplanes and that all applicable regulatory requirements have been met. The ATG includes both approved reference and flight training device comparison data used to support the validation. The Master Approval Test Guide (MATG) is the ATG approved by the FAA. It incorporates the results of FAA witnessed tests, and serves as a reference for future evaluations.

e. A Cockpit (for the purposes of this AC) is an enclosed structure that is a full scale replica of the airplane simulated, including all installed instruments, equipment, panels, systems, and controls. It consists of all space forward of a cross section of the fuselage at the most extreme aft setting of the pilots' seats, including other required crewmember duty stations. Additionally, those bulkheads or portions of bulkheads aft of the pilot seats that serve a procedural or training function are considered part of the cockpit and must replicate the airplane. The back may be open provided the device is located in a suitably isolated environment.

f. Convertible Flight Training Device is a device in which hardware and software can be changed so that it becomes a replica of a different model, usually of the same type airplane.

g. Evaluation of the Flight Training Device is the process in which a Simulator Evaluation Specialist or the POI, as appropriate, compares the device and its performance, functions, and other characteristics to that of the replicated aircraft in accordance with acceptable methods, procedures, and standards.

h. Latency is the additional response time of the flight training device beyond that of the basic aircraft perceivable response time. This includes the update rate of the computer system combined with the time delays of the instruments, and, if installed, the time delays of the motion and visual systems.

i. National Simulator Program Manager (NSPM) is the FAA Manager responsible for the overall administration and direction of the National Simulator Program.

j. Operator, as used in this AC, identifies the person or organization requesting FAA qualification of a flight training device and is responsible for continuing qualification of that device through liaison with the FAA.

k. Qualification of the flight training device is issued by the NSPM or POI, as appropriate, for a specified level and is determined as a result of the evaluation of the device against the established criteria for that level.

l. A Replica (as used in the definition of a flight training device in this AC) does not imply total duplication of all furnishings of the respective airplane. Items such as mounting panels, walls, ceilings, floors, coverings, windows, etc., must present only a representative appearance.

m. A Set of Airplanes, for purposes of this AC, is a grouping of airplanes which all share similar performance (i.e., normal airspeed/altitude operating envelope), similar handling characteristics, and the same number and type of propulsion system(s) (i.e., turbojet engine, reciprocating engine, etc.).

n. Simulation Data are the various types of data used by the flight training device manufacturer and the operator to design, manufacture, and test a flight training device.

o. Simulator Evaluation Specialist is an FAA technical specialist trained to evaluate simulators and flight training devices and to provide expertise on matters concerning aircraft simulation.

p. Snapshot is a presentation of one or more variables at a given instant of time. A snapshot is appropriate for a steady state condition in which the variables are constant with time.

q. Statement of Compliance (SOC) is a certification from the operator that specific requirements have been met. It 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.

r. Time History is a presentation of the change of a variable with respect to time. It is usually in the form of a continuous data plot over the time period of interest or a printout of test parameter values recorded at multiple constant time intervals over the time period of interest.

s. Transport Delay is the total flight training device system processing time required for an input signal from a pilot primary flight control until output response. It does not include the characteristic delay of the airplane simulated.

t. Upgrade, for the purpose of this AC, means the improvement or enhancement of a flight training device for the purpose of achieving a higher qualification level.

7. EVALUATION POLICY.

a. The methods, procedures, and standards defined in this

AC constitute one means acceptable to the Administrator for the evaluation and qualification of flight training devices that are or may be used in the following:

(1) A training program approved under FAR Parts 61, 63, 121, 125, 135, or 141;

(2) The course of conducting the pilot-in-command proficiency check required by FAR Section 61.58;

(3) The issuance of an airline transport pilot certificate or type rating in accordance with the provisions of FAR Section 61.157; or

(4) The satisfactory completion of the provisions of FAR Sections 61.55, 61.57, 61.65, 61.129, or 141.41.

b. If an applicant chooses to utilize the approach described in this AC, the applicant must adhere to all of the methods, procedures, and standards herein. However, this position is not intended to suppress innovation and imaginative development of flight training devices. Those flight training devices, which for one reason or another, do not, or cannot meet the provisions described in this AC for a specific level, may be evaluated on a case-by-case basis, especially when it appears that such a device could offer valuable or otherwise unique benefits. If an applicant desires to have a flight training device evaluated on this case-by-case basis, or desires to use a means other than that described in this AC to evaluate a flight training device, a proposal must be submitted to the FAA for review and approval prior to the submittal of a detailed ATG.

c. It is the responsibility of the NSPM to evaluate and qualify all Level 6 and Level 7 flight training devices. The POI, certificate holding district office (CHDO), or responsible Flight Standards District Office (FSDO), as appropriate, will evaluate and qualify Levels 2-5 flight training devices in accordance with the standards herein. Assistance may be obtained from the NSPM on a case-by-case basis.

d. An operator may contract for use of a Levels 2-5 flight training device currently qualified by a POI, CHDO, or FSDO and need not obtain separate qualification of the device prior to obtaining FAA approval to use the device in that operator's FAA-approved training program.

e. The flight training device must be assessed in those areas which are essential to accomplishing airman training and checking events. This includes aerodynamic responses and control checks, as well as performance in the takeoff, climb, cruise, descent, approach, and landing phases of flight. Crewmember station checks, instructor station functions checks, and certain

additional requirements depending on the complexity of the device (i.e., touch activated cathode ray tube instructor controls; automatic lesson plan operation; selected mode of operation for "fly-by-wire" airplanes; etc.) must be thoroughly assessed. Should a motion system or visual system be contemplated for installation on any level of flight training device, the operator or the manufacturer should contact the NSPM for information regarding an acceptable method for measuring motion and/or visual system operation and applicable tolerances. The motion and visual systems, if installed, will be evaluated to ensure their proper operation.

f. The intent is to evaluate flight training devices as objectively as possible. Pilot acceptance, however, is also an important consideration. Therefore, the device will be subjected to the validation tests listed in appendix 2 of this AC and the functions and subjective tests from appendix 3. These tests include a qualitative assessment by an FAA pilot who is qualified in the respective airplane, or set of airplanes in the case of Levels 2 or 3. Validation tests are used to compare objectively flight training device data and airplane data (or other approved reference data) to assure that they agree within a specified tolerance. Functions tests provide a basis for evaluating flight training device capability to perform over a typical training period and to verify correct operation of the controls, instruments, and systems.

g. Tolerances, listed for parameters in appendix 2, should not be confused with design tolerances specified for flight training device manufacture. Tolerances for the parameters listed in appendix 2 are the maximum acceptable to the Administrator for validation of the device.

h. A convertible flight training device will be addressed as a separate device for each model and series to which it will be converted and FAA qualification sought. An FAA evaluation is required for each configuration. For example, if an operator seeks qualification for two models of an airplane type using a convertible device, two ATG's or a supplemented ATG, and two evaluations are required.

i. The airplane manufacturer's flight test data are the accepted standard for initial qualification of Levels 6 and 7 flight training devices due to the specific airplane aerodynamic programming necessary. Exceptions to this policy may be made, but must first be submitted to the NSPM for review and consideration.

j. If flight test data from a source in addition to or independent of the airplane manufacturer's data are to be submitted in support of a flight training device qualification, it must be acquired in accordance with normally accepted

professional flight test methods. Proper consideration for the following must be an intrinsic part of the flight test planning.

(1) Appropriate and sufficient data acquisition equipment or system.

(2) Current calibration of data acquisition equipment and airplane. Performance instrumentation (calibration must be traceable to a recognized standard).

(3) Flight test plan, including:

(i) Maneuvers and procedures.

(ii) Initial conditions.

(iii) Flight condition.

(iv) Aircraft configuration.

(v) Weight and center of gravity.

(vi) Atmospheric ambient and environmental conditions.

(vii) Data required.

(viii) Other appropriate factors.

(4) Appropriately qualified flight test personnel.

(5) Data reduction and analysis methods and techniques.

(6) Data accuracy. The data must be presented in a format that supports the flight training device validation.

(7) Resolution must be sufficient to determine compliance with the tolerances of appendix 2.

(8) Presentation must be clear with necessary guidance provided.

(9) Over-plots must not obscure the reference data.

(10) The flight test plan should be reviewed with the National Simulator Program Staff well in advance of commencing the flight test. After completion of the tests, a flight test report should be submitted in support of the validation data. The report must contain sufficient data and rationale to support qualification of the device at the level requested.

k. For a new type or model of airplane, predicted data validated by flight test data, which has not been finalized and made official by the manufacturer, can be used for an interim period as determined by the FAA. In the event predicted data are used in programming the device, an update should be accomplished as soon as practicable when actual airplane flight test data become available. Unless specific conditions warrant otherwise, this update should occur within 6 months after release of the final flight test data package by the airplane manufacturer.

l. Levels 2, 3, and 5 flight training devices do not require a specific aerodynamic model; however, their performance must be compared to a reference set of validation data for initial qualification and for repeated recurrent evaluations. (Note: Level 4 requires no aerodynamic model.) In the absence of a specific model, these devices may use a generic model typical of the set of airplanes as described in this AC. For example, a twin engine, turbojet transport airplane flight training device must demonstrate the performance and handling typical of that set of airplanes. Similarly, a light twin or single engine airplane flight training device must demonstrate performance typical of the respective set of airplanes. The aerodynamic model may be one representing an actual airplane within that set of airplanes or it may be created or derived using the same mathematical expressions as those used in a specific model, but with coefficient values which are not obtained from flight test results for a particular airplane. Instead, the coefficient values could be fictitious, but be typical of the set of airplanes replicated. The reference validation data could then be created by doing a computer simulation using these fictitious coefficients. A generic model may also be acquired from public domain resources or it may be a composite of various models, none of which is complete within itself.

(1) It is the responsibility of the operator to demonstrate that the reference data used represent the appropriate set of airplanes. To assure that it continues to comply with its original qualification status, each flight training device will be compared to the accepted reference data for subsequent recurrent evaluations.

(2) The NSPM is the acceptance authority for adequacy and suitability of this data and will resolve questions which may arise over its application. Once reference data for a specific set of airplanes is accepted by the NSPM, this data will be considered accepted for that set of airplanes without a requirement for further review and approval.

m. If a problem with a validation test result is detected by the FAA evaluator, the test may be repeated. If it still does not meet the test tolerance, the operator may demonstrate

alternative test results which relate to the test in question. In the event a validation test does not meet specified criteria, but is not considered critical to the level of evaluation being conducted, the NSPM, or the POI in consultation with the NSPM, may conditionally qualify the training device at that level and the operator will be given a specified period of time to correct the problem and submit the ATG changes for evaluation. Alternatively, if it is determined that the results of a validation test would have a detrimental effect of the level of qualification being sought or is a firm regulatory requirement, the device may be qualified to a lesser level or restricted from training and checking events affected by the failed test. For example, if a Level 5 qualification is requested and the device fails to meet a Level 5 requirement, the device could be qualified at Level 4 provided all Level 4 requirements have been met.

n. Within 20 working days of receiving an acceptable ATG, the POI or NSPM, as appropriate, will coordinate with the operator to set a mutually acceptable date for the evaluation. Evaluation dates will not be established until the ATG has been reviewed and determined to be acceptable. To avoid unnecessary delays, operators are encouraged to work closely with the POI, and the NSPM if appropriate, during the ATG development process prior to making formal application. All Levels 6 and 7 devices must be evaluated by the NSPM, and POI's must forward the ATG to the NSPM with the appropriate transmittal memorandum. For devices not requiring NSPM qualification (Levels 2-5), the POI will evaluate the ATG in accordance with the guidance of this AC and may seek assistance from the NSPM.

o. At the discretion of the FAA Simulator Evaluation Specialist, the operator's pilots may assist during evaluations in completing the functions and validations tests. However, only FAA personnel should manipulate the pilot controls during the functions check portion of an FAA evaluation.

p. FAA evaluations of flight training devices located outside the United States will be performed if the device is used by a U.S. operator in satisfying any training event or checking event requirements, including certification of U.S. airmen. Evaluations may be conducted otherwise as deemed appropriate by the Administrator on a case-by-case basis.

q. Upon qualification of the flight training device (whether by the NSPM, the POI, the CHDO, or the FSDO), approval for the use of the device in an FAA-approved training program is the responsibility of the POI, the CHDO, or the FSDO, as appropriate.

8. INITIAL OR UPGRADE EVALUATIONS.

a. An operator seeking flight training device initial or upgrade evaluation must submit a request in writing to the POI or responsible FSDO. Evaluations will normally be accomplished by a representative of the POI or a FSDO inspector for Levels 2 through 5 and must be accomplished by the NSPM for Levels 6 and 7. If the flight training device is proposed to be Level 6 or 7, the POI or FSDO will promptly forward the ATG to the NSPM with a transmittal memorandum. All requests should contain a compliance statement certifying that the device meets all of the provisions of this AC, that the cockpit configuration conforms to that of the airplane, that specific hardware and software configuration control procedures have been established, and that the pilot(s) designated by the operator confirm that it is representative of the airplane in all appropriate functions test areas. A sample letter of request is included in appendix 4.

b. The operator should submit an ATG which includes:

(1) A title page with the operator and FAA signature blocks.

(2) A flight training device information page, for each configuration in the case of convertible devices, providing the following information, if applicable:

(i) The operator's flight training device identification number or code.

(ii) Airplane, or set of airplanes, as appropriate, being simulated.

(iii) Source of aerodynamic data and any appropriate revision reference.

(iv) Engine model (and data revision, as applicable), if appropriate.

(v) Flight control data revision, if appropriate.

(vi) Flight Management System identification (and revision level), if appropriate.

(vii) Flight training device model and manufacturer.

(viii) Date of device manufacture.

(ix) Computer identification, if appropriate.

(x) Visual system model and manufacturer, if installed.

(xi) Motion system type and manufacturer, if installed.

(3) Table of contents.

(4) Log of revision and/or list of effective pages.

(5) Listing of all other reference or source data, if applicable.

(6) Glossary of terms and symbols used.

(7) Statements of Compliance (SOC) as may be required in appendix 1, "Flight Training Device Standards," comments column, for SOC requirements.

(8) A list of equipment required to accomplish the validation tests and a description of the appropriate procedures to be followed to record the test results. If testing and recording are to be accomplished automatically, a listing of the equipment and appropriate procedures should be included.

(9) The following is needed for each validation test designated in appendix 2 of this AC:

(i) Name of the test.

(ii) Objective of the test.

(iii) Initial conditions.

(iv) Method for evaluating validation test results.

(v) Tolerances for relevant parameters.

(vi) Source of validation reference data.

(vii) Copy of validation reference data.

(viii) Validation test results as obtained by the operator.

(ix) A means, acceptable to the FAA, of easily comparing the training device test results to validation reference data.

c. Test results should be labeled using terminology common to airplane parameters as opposed to computer software identifications or other references. These results should be easily compared with the supporting data by employing cross-plotting, overlays, transparencies, or other acceptable means. Use of multichannel recorder, line printer, or similar recording media is encouraged for all flight training device levels; however, regardless of the media used, it must be acceptable to the FAA. Data reference documents included in an ATG may be reduced photographically only if such reduction will not alter

the graphic scaling or cause difficulties in scale interpretation or resolution. Incremental scales on graphical presentations must provide the resolution necessary for evaluation of the parameters shown in appendix 2. The test guide will provide the documented proof of compliance with the validation tests in appendix 2. In the case of an upgrade, an operator should run the validation tests for the requested qualification level. Validation test results offered in a test guide for a previous initial or upgrade evaluation should not be used to validate flight training device performance in a test guide offered for a current upgrade. Flight training device test results should be clearly marked with appropriate reference points to ensure an accurate comparison between training device ad validation reference data with respect to time when tests involve time history parameters. Operators using line printers to record time histories should clearly mark that information taken from the line printer data output for cross-plotting on the airplane data. The cross-plotting of the operator's flight training device data to the reference data is essential to verify performance in each test. During an evaluation, the FAA will devote its time to detailed checking of selected tests from the ATG. The FAA evaluation serves to validate the operator's test results.

d. The completed ATG, as well as the operator's compliance letter and request for the evaluation, will be submitted to the operator's POI. For ATG's requiring NSPM review, the POI will submit the total package with a letter or memorandum of transmittal to the NSPM. The ATG will be reviewed and determined to be acceptable prior to scheduling an evaluation of the device. Should the POI desire NSPM assistance with ATG evaluation for devices not requiring NSPM review, a request should be prepared and forwarded with the ATG to the NSPM.

e. The operator may elect to accomplish the ATG validation tests while the flight training device is at the manufacturer's facility. Test at the manufacturer's facility should be accomplished at the latest practical time prior to disassembly and shipment. The operator must then validate the performance of the device at the final location by repeating at least one-third of the validation tests in the ATG and submitting those tests to the POI, and to the NSPM, if appropriate. After review of these tests, the FAA will schedule an initial evaluation. The ATG must be clearly annotated to indicate when and where each test was accomplished.

f. In the event an operator moves a flight training device to a new location and its level of qualification is not changed, the following procedures shall apply:

(1) Advise the POI (and NSPM if appropriate) prior to the move.

(2) Prior to returning the flight training device to

service at the new location, the operator should perform a typical recurrent validation and functions test. The results of such tests will be retained by the operator and be available for inspection by the FAA at the next evaluation or as requested.

(3) The FAA may schedule an evaluation prior to return to service.

g. When there is a change of operator, the new operator must accomplish all required administrative procedures including the submission of the currently approved ATG to the POI, or through the POI to the NSPM for Levels 6 and 7 flight training devices. The ATG must be identified with the new operator by displaying the operator's name or logo. The POI will then submit the package as described in paragraph 7d above. The flight training device may, at the discretion of the POI or NSPM, be subject to an evaluation in accordance with the original qualification criteria.

h. The scheduling priority for initial and upgrade evaluations will be based on the sequence in which acceptable ATG's and evaluation requests are received by the FAA.

i. The ATG will be approved after the completion of the initial or upgrade evaluation and all discrepancies in the ATG have been corrected. This document, after inclusion of the FAA witnessed test results, becomes the MATG. The MATG will then remain in the custody of the operator for use in future recurrent evaluations.

j. A copy of an MATG for each type flight training device (Levels 6 and 7 only) by each manufacturer will be required for the NSPM's file. The NSPM may elect not to retain copies of the ATG for subsequent devices of the same type by a particular manufacturer but will determine the need for copies on a case-by-case basis. Data updates to an original ATG should be provided to the NSPM in order to keep FAA file copies current.

9. RECURRENT EVALUATIONS.

a. For a flight training device to retain its qualification, it will be evaluated on a recurrent basis using the approved MATG. Evaluations will normally be accomplished by a representative of the POI or a FSDO inspector for Levels 2 through 5 and must be accomplished by the NSPM for Levels 6 and 7. Each recurrent evaluation will consist of functions tests and at least a portion of the validation tests in the MATG.

b. The recurrent evaluations will be planned for every 4 months with approximately one-third of the validation tests in the MATG accomplished each time. This will allow all MATG tests to be accomplished annually. However, with appropriate arrangement and understanding between the operator and the FAA,

and extended interval recurrent evaluation schedule can be arranged. This decision may be made at the conclusion of the initial evaluation and the operator notified within 30 days.

(1) For Levels 2, 3, and 4, the extended interval may be based on annual evaluations by the FAA with all MATG tests accomplished at each successive evaluation.

(2) For Levels 5, 6, and 7, the extended interval may be based on semiannual evaluations by the FAA with the operator accomplishing quarterly checks.

c. Dates of recurrent evaluations normally will not be scheduled beyond 30 days of the due date. Exceptions to this policy will be considered by the FAA on a case-by-case basis to address extenuating circumstances.

d. In the interest of conserving training device time, the following Optional Test Program (OTP), applicable to Levels 6 and 7, is an alternative to the standard recurrent evaluation procedure:

(1) Operators having the appropriate automatic recording and plotting capabilities may for evaluation under the OTP.

(2) Operators must notify the POI and NSPM in writing of their intent to enter the OTP. If the FAA determines that the evaluation can be accommodated with 4 hours or less of training device time, recurrent evaluations for that device will be planned for 4 hours. If the 4-hour period is or will be exceeded and the operator cannot extend the period, then the evaluation will be terminated and must be completed within 30 days to maintain qualification status. The FAA will then reassess the appropriateness of the OTP.

(3) Under the OTP, at least one-third of all the validation tests will be performed and certified by operator personnel between FAA recurrent evaluations. Complete coverage will be required through any three consecutive recurrent evaluations. These tests and the recording of the results should be accomplished within the 30 days prior to the scheduled evaluation or accomplished on an evenly distributed basis during the 4-month period preceding the scheduled evaluation. This information will be reviewed by the FAA Simulator Evaluation Specialist at the outset of each recurrent evaluation. At least 20 percent of those tests conducted by the operator for each recurrent evaluation will then be selected and repeated by the Simulator Evaluation Specialist along with at least 10 percent of those tests not performed by the operator.

e. In instances where an operator plans to remove a flight

training device from active status for prolonged periods, the following procedures shall apply to requalify the flight training device pursuant to this AC:

(1) The FAA shall be advised in writing. The notice shall contain an estimate of the period that the device will be inactive.

(2) Recurrent evaluations will not be scheduled during the inactive period. The FAA will remove the flight training device from qualified status on a mutually established date not later than the date on which the first missed recurrent evaluation would have been scheduled.

(3) Before a device can be restored to FAA-qualified status, it will require an evaluation by the FAA. The evaluation content and time required for accomplishment will be based on the number of recurrent evaluations missed during the inactive period. For example, if the training device were out of service for 1 year, it would be necessary to complete the entire test guide since under the recurrent evaluation program, the MATG is to be completed annually.

(4) The operator will notify the FAA of any changes to the original scheduled time out of service.

(5) The flight training device will normally be requalified using the FAA-approved MATG and criteria that was in effect prior to its removal from qualification; however, inactive periods exceeding 1 year will require a review of the qualification basis.

(6) If these procedures are not possible, the establishment of a new qualification basis will be necessary.

10. SPECIAL EVALUATIONS.

a. Between recurring evaluations, if deficiencies are discovered or it becomes apparent that the flight training device is not being maintained to initial qualification standards, a special evaluation may be conducted by the POI, or NSPM if appropriate, to verify its status.

b. The flight training device will lose its qualification when the POI or NSPM can no longer ascertain maintenance of the original validation criteria based on a recurrent or special evaluation. Additionally, the POI shall advise the operator and the NSPM, if appropriate, if a deficiency is jeopardizing training requirements, and arrangements shall be made to resolve the deficiency in the most effective manner, including the

withdrawal of approval by the POI.

11. MODIFICATION OF FLIGHT TRAINING DEVICES.

a. Operators must notify the POI (and NSPM if appropriate) at least 21 days prior to making software program or hardware changes which impact flight or ground dynamics. A complete list of these planned changes and identification of proposed updates to the MATG must be provided in writing. Operators should maintain a configuration control system to ensure the continued integrity of the device and to account for changes incorporated. The configuration control system may be examined by the FAA on request.

b. Modifications which impact flight or ground dynamics, systems functions, and significant ATG revisions may require an FAA evaluation of the flight training device.

12. QUALIFICATION BASIS. The FAR require that training devices must maintain their performance, functions, and other characteristics as originally evaluated and qualified. Except as provided for in paragraph 2, all recurrent evaluations of those flight training devices using the acceptable methods of compliance described in this AC for initial or upgrade evaluation (including any visual or motion systems installations) will be conducted in accordance with the provisions herein.

13. DOWNGRADE OF AN AIRPLANE SIMULATOR TO AN AIRPLANE FLIGHT TRAINING DEVICE. An operator may elect to have a currently qualified airplane simulator reclassified as a flight training device. This may be accomplished through one of two methods.

a. Normal. The operator would follow the steps outlined in this AC for the evaluation and qualification of a flight training device irrespective of the device's current status as an airplane simulator.

b. Administrative. The operator would request that the currently qualified airplane simulator be downgraded to a flight training device. This process would not require an on-site evaluation of the device and would be in accordance with the following:

(1) Conditions.

(i) A Level C or D airplane simulator may be administratively reclassified as a Level 6 or 7 airplane flight training device at the operator's option. A Level A or B airplane simulator may be administratively reclassified as a

Level 6 airplane flight training device.

(ii) The existing qualification basis for the simulator will remain the basis for qualification of the flight training device, including all aspects of the MATG, except for those tests applicable to the motion or visual systems. The motion and visual systems should be deactivated, although physical removal from the device is not required. Should the operator wish to have the availability of either the motion or visual systems, those appropriate tests would remain a part of the MATG for the flight training device.

(iii) Frequency and content of recurrent evaluations would remain unchanged except for MATG modifications that may occur under (1)(ii), above.

(2) Procedures.

(i) The operator must notify the NSPM, in writing, through the POI, of the desire to administratively downgrade their airplane simulator.

(ii) This notification must include appropriate page changes to the current MATG indicating, at least, the change in status and the elimination of appropriate tests as described under (1)(ii), above.

(iii) After review of this notification package and concluding that the modified MATG would support the flight training device qualification level sought, the NSPM may issue a qualification letter.

c. Situations that may not be addressed by either of the above two methods will be considered on a case-by-case basis.

14. PREVIOUSLY APPROVED FLIGHT TRAINING DEVICES.

a. Those flight training devices which, for any reason, are not capable of meeting, or it is not desired that they meet, the qualification standards for a specified level as described in this AC, but which have been previously approved for use in accordance with FAR Parts 61, 63, 121, 125, 135, or 141, and/or have been issued an authorization letter from the Flight Standards Service, General Aviation and Commercial Division, AFS-800, 800 Independence Avenue, S.W., Washington D.C. 20591, will be eligible for qualification under a temporary status. This temporary status will be automatically conferred with issuance of this AC, will remain valid for a period not to exceed a date 5 years after the effective date of this AC, and will allow

continued use of the device as authorized for this time period.

b. Any such device which is physically modified with the intent of meeting a qualification standard set out in this AC, but which, for any reason, has not demonstrated that it meets the standards for a specific level, will have this temporary status conferred, or continued, only if the following conditions are met:

(1) The device was manufactured and has been approved prior to the effective date of this AC;

(2) Local FSDO personnel are notified that such a modification is planned; and

(3) The performance of the modified device is determined by local FSDO personnel, in consultation with the NSPM and AFS-800, to meet, or exceed, that of the original equipment. this determination would be solely subjective in nature and would be based on those maneuvers/procedures for which the device has been previously approved. In the interest of information gathering, the FAA would request that the person(s) involved in the design and/or installation of such modifications provide documentation, test results, conclusions, etc., to the FAA.

/s/ William J. White

Acting Director, Flight Standards Service

APPENDIX 1. FLIGHT TRAINING DEVICE STANDARDS

1. DISCUSSION. This appendix describes the minimum flight training device requirements for qualification at Levels 1 through 7. The appropriate FAR, as indicated in paragraph 3 of this AC, must be consulted when considering particular training device requirements. The validation and functions tests listed in appendices 2 and 3 must also be consulted when determining the requirements of a specific level training device. In the following tabular listing of training device requirements, needed statements of compliance and statements of explanation are indicated in the comment column.

	LEVEL							
2. GENERAL	1	2	3	4	5	6	7	Comments
a. A cockpit which will have	.	.	X	.	.	X	X	Level 3 must be representative of a

actuation of controls and switches which replicate those in the airplane.							single set of airplanes, and must have navigation controls, displays, and instrumentation as set out in FAR Section 91.33 for operation in accordance with instrument flight rules (IFR).
b. Instruments, equipment, panels, systems, and controls sufficient for the training/ checking events to be accomplished must be located in a spatially correct open flight deck area. Actuation of these controls and switches must replicate those in the airplane.	.	X	.	X	X	.	.	Level 2 must be representative of a single set of airplanes. Levels 2 and 5 require simulated aerodynamic capability and and control forces and travel sufficient to manually fly an instrument approach.
c. Daily preflight documentation.	.	X	X	X	X	X	X	
d. Lighting environment for panels and instruments must be sufficient for the operation being conducted.	.	X	X	X	X	X	X	Lighting must be as per airplane lighting for Level 7.
e. Circuit breakers should function accurately when they are involved in operating procedures or malfunctions requiring or	.	X	X	X	X	X	X	Must be properly located in Levels 6 and 7.

involving flight crew response.								
f. Effect of aerodynamic changes for various combinations of drag and thrust normally encountered in flight, including the effect of change in airplane attitude, thrust, drag, altitude, temperature, and configuration.	.	X	X	.	X	X	X	Levels 3, 6, and 7 require additionally, the effects of gross weight and center of gravity.
g. Digital or analog computing or sufficient capacity to conduct complete operation of the device including its evaluation and testing.	.	X	X	X	X	X	X	
h. All relevant instrument indications involved in the simulation of the applicable airplane entirely automatic in response to control input.	.	X	X	.	X	X	X	
i. Navigation equipment corresponding to that installed in the replicated airplane with operation within the tolerances prescribed for the actual airborne equipment.	.	X	X	.	X	X	X	Levels 3, 6, and 7 must also include communication equipment (interphone and air/ground) corresponding to that installed in the replicated aircraft, and, if appropriate, to the operation being conducted, an oxygen mask microphone/ communication

								system. Levels 2 and 5 need have operational only that navigation equipment sufficient to fly a non-precision instrument approach.
j. Crewmember seats must afford the capability for the occupant to be able to achieve the design eye reference position for specific airplanes, or to approximate such a position for a generic set of airplanes.	.	.	X	.	X	X	X	Level 7 crewmember seats must accurately simulate those installed in the airplane.
k. In addition to the flight crewmember stations, suitable seating arrangements for an instructor/check airman and FAA inspector. These seats must provide adequate view of crewmember's panel(s).	.	X	X	X	X	X	X	These seats need not be a replica of an aircraft seat and can be as simple as an office chair placed in an appropriate position.
l. Installed system(s) must simulate the applicable airplane system operation, both on the ground and in flight. At least one airplane system must be represented. System(s) must be operative to the extent that applicable normal, abnormal, and emergency operating procedures included	.	X	X	X	X	X	X	Levels 6 and 7 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 FAR Section 91.33 for IFR operation. Levels 2 and 5 must have functional

in the operator's training programs can be accomplished.							flight and navigational controls, displays, and instrumentation.
m. 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	X	
n. Control forces and control travel which correspond to that of the replicated airplane, or set of airplanes. Control forces should react in the same manner as in the airplane, or set of airplanes, under the same flight conditions.	.	X	X	.	X	X	X	Levels 2 and 5 need control forces and control travel only of sufficient precision to manually fly an instrument approach.
o. Significant cockpit sounds which result from pilot actions corresponding to those of the airplane.	.	.	X	.	.	X	X	
p. Sound of precipitation, windshield wipers, and other significant airplane noises precipitable to the	.	.	.	.	.	.	X	Statement of Compliance.

pilot during normal, abnormal, or emergency operations, as may be appropriate.			
q. Aerodynamic modeling which, for airplanes issued an original type certificate after June 1980, includes low-altitude level-flight ground effect, Mach effect at high altitude, effects of airframe icing, normal dynamic thrust effect on control surfaces, aeroelastic representations, and representations of nonlinearities due to sideslip based on airplane flight test data provided by the manufacturer.	. . . . .	X	Statement of Compliance. Tests required. See appendix 2 for further information. The statement must address ground effect, Mach effect, aeroelastic representations, and nonlinearities due to sideslip. Separate tests for thrust effects and demonstration of icing effects are required.
r. Control feel dynamics which replicate the airplane simulated. Free response of the controls shall match that of the airplane within the tolerance given in appendix 2. Initial and upgrade evaluation will include control free response (column, wheel, and pedal) measurements recorded at the controls. The measured responses must correspond to those of the airplane in	. . . . .	X	Statement of Compliance Tests required. See appendix 2, par. 3.

takeoff, cruise, and landing configurations.

(1) For airplanes with irreversible control systems, measurements may be obtained on the ground if proper pilot static inputs are provided to represent conditions typical of those encountered in flight. Engineering validation or airplane manufacturer rationale will be submitted as justification to ground test or omit a configuration.

(2) For flight training devices requiring static and dynamic tests at the controls, special test fixtures will not be required during initial evaluations if the operator's ATG shows both test fixture results and alternate test method results, such as computer data plots, which were obtained concurrently. Repeat of the alternate method during the initial evaluation may then satisfy this test requirement.

s. Aerodynamic and ground reaction modeling for the effects of reverse thrust on directional control.	.	.	.	.	.	X	Statement of Compliance. Tests required.
t. Timely permanent update of flight training device hardware and programming consistent with airplane modifications.	.	X	X	X	X	X	X	
u. Visual system; if installed (not required).	.	X	X	X	X	X	X	Visual system standards set out in AC 120-40, as amended, for at least Level A simulators will be acceptable.
v. Motion system; if installed (not required).	.	X	X	X	X	X	X	Motion system standards set out in AC 120-40, as amended, for at least Level A simulators will be acceptable.

APPENDIX 2. FLIGHT TRAINING DEVICE VALIDATION TESTS

1. DISCUSSION. Performance must be objectively evaluated by comparing the results of tests conducted in the training device to aircraft flight test data unless specifically noted otherwise. Test requirements listed in the table may not be applicable in cases in which the flight training device does not include the system or function to be checked. In other cases a system or function may be included and evaluated in the flight training device which would normally not be required for the level of qualification being sought.

The ATG provided by the operator must describe clearly and distinctly how the flight training device will be set up and operated for each test. Use of a driver program designed to automatically accomplish the tests is encouraged for all flight training devices. A manual test procedure with explicit and detailed steps for completion of each test must also be provided. The tests and tolerances contained in this appendix must be

included in the operator's ATG.

The Table of Validation Tests of this appendix generally indicates the test results required. Unless noted otherwise, tests should 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 midconditions or as close as possible to the other extreme should be included. Certain tests which are relevant only at one extreme CG or weight condition need not be repeated at the other extreme. It should be recognized that the tests listed in the table merely sample, on a very limited basis, the flight training device performance and handling qualities. The results of these tests for Levels 3, 6, and 7 are expected to be indicative of the device's performance and handling qualities throughout the airplane weight and CG envelope, the operational envelope, and for varying atmospheric ambient and environmental conditions to the extremes authorized for the respective airplane or set of airplanes. It is not sufficient, nor is it acceptable, to program these flight training devices so that the modelling is correct only at the validation test points.

Test of handling qualities must include validation of augmentation devices. Flight training devices 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 operator and the NSPM on a case-by-case basis.

2. TEST REQUIREMENTS. The ground and flight tests required for qualification are listed in the Table of Validation Tests. Results of these tests should be available in a form which can be compared to validation reference data. For those devices listed in the following table requiring "generic" aerodynamic modeling, the FAA-approved data supplied by the manufacturer or the operator sponsoring the device will be used as the comparison basis for objective testing.

Flight test data which exhibit rapid variations of the measured parameters may require engineering judgment when making assessments of flight training device validity. Such judgment must not be limited to a single parameter. 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 data throughout a time history, differences must be justified by providing a comparison of other related variables for the condition being assessed.

a. Parameters, Tolerances, and Flight Conditions. The

Table of Validation Tests in this appendix describes the parameters, tolerances, and flight conditions for training device validation. If a flight condition or operating condition is shown which does not apply to the qualification level sought, it should be disregarded. Results must be labeled using the tolerances and units given.

b. Flight Conditions Verification. When comparing the parameters listed to those of the airplane, sufficient data must also be provided to verify the correct flight condition. For example, to show that control force is within +5 1b (2.224 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 should 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. All airspeed values should be clearly annotated as to indicated, calibrated, etc., and like values used for comparison.

TABLE OF VALIDATION TESTS

Test	Tolerance	Flight Conditions
1. PERFORMANCE	+- 5%	
a. TAKEOFF		
(1) Ground Acceleration Time	+- 5% Time or +- 1 Second	Ground/ Takeoff
(2) Minimum Unstick Speed or equivalent as provided by the aircraft manufacturer	+- 3 Kts Airspeed +- 1.5 Pitch	Ground/ Takeoff
(3) Normal Takeoff	+- 3 Kts Airspeed +- 1.5 Pitch, +- 1.5 degrees Angle of Attack +- 20 Feet (6 Meters)	Ground/ Takeoff and First Segment Climb

		Altitude	
(4) Critical Engine Failure on Takeoff	+- 3 Kts degree pitch Airspeed +- 1.5 Pitch or +- 1.5 degrees Angle of Attack +- 20 Feet	Ground/ Takeoff and First Segment Climb	
	(6 Meters)		
	Altitude		
	+- 2 degrees Bank and Sideslip Angle		

Test	Qualification Requirement LEVEL							Comments
	1	2	3	4	5	6	7	
1. PERFORMANCE								Level 7 devices will require distance measures also. Tolerance will be +- 5% times and distance or +- 5% time and +- 200 feet (60 meters) of distance. Acceleration time (and distance for level 7) should be recorded for a minimum of 80% of total segment (brake release to V sub r).
a. TAKEOFF								
(1) Ground Acceleration Time	.	.	X	.	.	X	X	
(2) Minimum Unstick Speed	.	.	.	.	.	.	X	V sub mu is defined as

or equivalent as provided by the aircraft manufacturer								that speed at which the last main landing gear leaves the ground.
(3) Normal Takeoff	.	.	.	.	.	.	X	
(4) Critical Engine Failure on Takeoff	.	.	.	.	.	.	X	

Test	Tolerance	Conditions
1. PERFORMANCE		
(5) Crosswind Takeoff	+- 3 kts Airspeed +- 1.5 degrees Pitch, +- 1.5 degrees Angle of Attack +- 20 Feet (6 Meters) Altitude +- 2 degrees Bank and Sideslip Angle	Ground/ Takeoff and First Segment Climb
b. CLIMB		
(1) Normal Climb All Engines Operating	+- 3 Kts Airspeed +- 5% or +- 100 FPM (0.5 Meters/Sec) Climb Rate	Climb With all Engines Operating
(2) One Engine Inoperative Second Segment Climb	+- 3 Kts Airspeed +- 5% or +- 100 FPM (0.5 Meters/Sec) Climb Rate but not less than the FAA Approved Flight Manual Rate of Climb	Second Segment Climb With One Engine Inoperative

(3)	One Engine Inoperative Approach Climb for Airplanes With Icing Accountability per Approved Airplane Flight Manual (AFM)	+- 3 Kts Airspeed +- 5% or +- 100 FPM (0.5 Meters/Sec) Climb Rate but not less than the FAA Approved Flight Manaul Rate of Climb	Approach Climb With One Engine

Test	Qualification Requirement LEVEL							Comments
	1	2	3	4	5	6	7	
1. PERFORMANCE								
(5) Crosswind Takeoff							X	
b. Climb								
(1) Normal Climb All Engines Operating		X	X		X	X	X	May be a snapshot test.
(2) One Engine Inoperative Second Segment Climb							X	
(3) One Engine Inoperative Approach Climb for Airplanes with Icing Accountability per Approved Airplane Flight Manual (AFM)							X	

Test	Tolerance	Conditions
1. PERFORMANCE		
c. In Flight		
(1) Stall Warning, Stall Speeds	+- 3 Kts Airspeed +- 2 degrees Bank	Second Segment Climb and Approach or Landing
(2) Stall Warning (actuation of stall warning device)	+- 3 Kts Airspeed +- 2 degrees Bank	Second Segment Climb and Approach or Landing
d. STOPPING		
(1) Stopping Time, Wheel Brakes Dry Runway	+- 5% time or +- 1 Second	Landing
(2) Stopping Time, Reverse Thrust Dry Runway	+- 5% Time or +- 1 Second	Landing

Test	Qualification Requirement LEVEL							Comments
	1	2	3	4	5	6	7	
1. PERFORMANCE								
c. In Flight								
(1) Stall Warning, Stall Speeds							X	
(2) Stall Warning (actuation of stall warning device)		X	X		X	X		

d. Stopping								Level 7 devices will
(1) Stopping Time, Wheel Brakes Dry Runway			X			X	X	require distance measurements also. Tolerances will be +- 5% time and the smaller of +- 10% of distance or 200 feet (60 meters). Time (and distance for Level 7) should be recorded for at least 80% of total segment. (Initiation of Rejected Take Off ›RTO| to full stop).
(2) Stopping Time, Reverse Thrust Dry Runway			X			X	X	Level 7 devices will require distance measurements also. Tolerance will be +- 5% time and the smaller of +- 10% of distance or 200 feet (60 meters). Time (and Distance for level 7) should be recorded for at least 80% of total segment. (Initiation of RTO to full stop.)

Test		Tolerance	Conditions
1. PERFORMANCE (STOPPING cont'd)			
	(3) Stopping Time and Distance, Wheel Brakes Only Wet Runway	Representative Stopping Time and Distance	Landing
	(4) Stopping Time and Distance, Wheel Brakes Only Icy Runway	Representative Stopping Time and Distance	Landing
e. ENGINES			
	(1) Acceleration	+- 10% Time	Approach or Landing
	(2) Deceleration	+- 10% Time	Ground/ Takeoff

Test	Qualification Requirement LEVEL 1	2	3	4	5	6	7	Comments
1. PERFORMANCE (STOPPING cont'd)								
(3) Stopping Time and Distance, Wheel Brakes Only Wet Runway							X	Time and Distance should be recorded for at least 80% of total segment. (Initiatiion of RTO to full stop.) FAA approved AFM data is acceptable.
(4) Stopping Time and Distance, Wheel Brakes							X	Time and Distance should be recorded for at least 80%

Only Icy Runway								of total segment. (Initiation of RTO to full stop.) FAA approved AFM data is acceptable.
e. ENGINES								Test from flight idle to go-around power
(1) Acceleration		X	X		X	X	X	Tolerances of +- 1 second authorized for Levels 2, 3, and 5.
(2) Deceleration		X	X		X	X	X	Test from maximum takeoff power to 10% of maximum takeoff power (90% decay in power available above idle). Tolerance of +- 1 second authorized for Levels 2, 3, and 5.

Test	Tolerance	Conditions
2. HANDLING QUALITIES		
a. STATIC CONTROL CHECKS **		
(1) Column Position vs. Force and Surface Position Calibration	+- 2 lb. (0.89 daN) Breakout +- 5 lb. (2.224 daN) or +- 10% Force +- 2 degrees Elevator	Ground

	Column Position vs. Force	+- 2 lb (0.89 daN) Breakout +- 5 lb (2.223 daN) or +- 10% Force	Ground
(2)	Wheel Position vs. Force and Surface Position Calibration	+- 2 lb (.89 daN) Breakout +- 3 lb (1.334 daN) or +- 10% Force +- 1 degree Aileron +- 2% Spoiler	Ground
	Wheel Position vs. Force	+- 2 lb (.89 daN) Breakout +- 3 lb (1.334 daN) or +- 10% Force	
(3)	Pedal Position vs. Force and Surface	+- 5 lb (2.332 daN) Breakout	Ground
	Position Calibration	+- 5 lb (2.224 daN) or +10% Force +- 2 Rudder	

Test	Qualification Requirement LEVEL							Comments
	1	2	3	4	5	6	7	
2. HANDLING QUALITIES								
a. STATIC CONTROL CHECKS **						X	X	Uninterrupted control sweep.
(1) Column Position vs. Force and Surface Position Calibration								
Column Position vs. Force		X	X		X			

(2) Wheel Position vs. Force and Surface Position Calibration						X	X	Uninterrupted control sweep.
Wheel Position vs. Force		X	X		X			
(3) Pedal Position vs. Force and Surface Position Calibration						X	X	Uninterrupted control sweep.

** Column, wheel, and pedal position vs. force shall be measured at the control. An alternative method acceptable to the NSPM in lieu of the test fixture at the controls would be to instrument the training device in an equivalent manner to the flight test airplane. The force and position data from this instrumentation can be directly recorded and matched to the airplane data. Such a permanent installation could be used repeatedly without any time for installation of external devices.

Test		Tolerance	Conditions
2.	HANDLING QUALITIES (STATIC CONTROL CHECKS cont'd)		
	Pedal Position vs. Force	+- 5 lb. (2.224 daN) Breakout +- 5 lb. (2.224 daN) or +- 10% Force	Ground
(4)	Nosewheel Steering Force	+- 2 lb (0.89 daN) Breakout +- 3 lb (1.334 daN) or +- 10% Force	Ground
(5)	Rudder Pedal Steering Force	+- 2 degrees Nosewheel Angle	Ground

(6)	Pitch Trim Calibration Indicator vs. Computed	+- 0.5 degrees Computed Trim Angle	Ground
(7)	Alignment of Power Lever (or Cross Shaft Angle) vs. Selected Engine Parimeter (i.e., EPR, N sub 1, Torque Manifold Pressure, etc.)	+- 5 degrees Lever Angle or Cross Shaft Angle or Equivalent	Ground

Test		Qualification Requirement LEVEL							Comments
		1	2	3	4	5	6	7	
2. HANDLING QUALITIES (STATIC CONTROL CHECKS cont'd)									
	Pedal Position vs. Force		X	X		X			
(4)	Nosewheel Steering Force			X			X	X	If appropriate to the airplane or set of airplanes being simulated.
(5)	Rudder Pedal Steering Calibration Surface Position Calibration			X			X	X	If appropriate to the airplane or set of airplanes being simulated.
(6)	Pitch Trim Calibration Indicator vs. Computed						X	X	
(7)	Alignment of Power Lever (or						X	X	

Cross Shaft Angle) vs. Selected Engine Parameter (i.e., EPR, N sub 1, Torque Manifold Pressure, etc.)								

Test		Tolerance	Conditions
2.	HANDLING QUALITIES (STATIC CONTROL CHECKS cont'd)		
(8)	Brake Pedal Position vs. Force	+- 2 degrees Pedal Position +- 5 lb. (2.224 daN) or +- 10%	Ground
b.	DYNAMIC CONTROL CHECKS **		
(1)	Pitch Control	+- 10% Time for Each Zero Crossing +- 10% Amplitude of 2nd and Subsequent Overshoots Greater than 5% of Initial Displacement. +- 1 Overshoot. Refer to Paragraph 3 this Appendix.	Takeoff, Cruise,
(2)	Roll Control	Same as (1) above.	Takeoff, Cruise, Landing
(3)	Yaw Control	Same as (1) above.	Takeoff, Cruise, Landing

Test	Qualification Requirement LEVEL 1	2	3	4	5	6	7	Comments
2. HANDLING QUALITIES (STATIC CONTROL CHECKS cont'd)								
(8) Brake Pedal Position vs. Force			X			X	X	Computer output results may be used to show compliance. Levels 3 and 6 only need data points at zero and maximum breaking application.
b. DYNAMIC CONTROL CHECKS **								
(1) Pitch Control							X	Data should be normal control displacement in both directions. Approximately 25% to 50% of full throw. Refer to par. 3 of this Appendix
(2) Roll Control							X	
(3) Yaw Control							X	

** Column, wheel, and pedal position vs. force shall be measured at the control. An alternative method acceptable to the NSPM in lieu of the test fixture at the controls would be to instrument the training device in an equivalent manner to the flight test airplane. The force and position data from this instrumentation can be directly recorded and matched to the airplane data. Such a permanent installation could be used repeatedly without any time for installation of external devices.

Test		Tolerance	Conditions
2. HANDLING QUALITIES			
c. LONGITUDINAL			
(1)	Power Change Dynamics	+- 3 kts Airspeed +- 100 Feet (30 Meters) Altitude +- 20% or +- 1.5 degree Pitch	Cruise or Approach
	Power Change Force	+- 5 lb or +- 20%	Cruise or Approach
(2)	Flap Change Dynamics	+- 3 kt Airspeed +- 100 Feet (30 Meters Altitude +- 20% or +- 1.5 degree Pitch	Takeoff to Second Segment Climb, Approach to Landing
	Flap Change Force	+- 5 lb or +- 20%	Takeoff to Second Segment Climb, Approach to Landing
(3)	Spoiler/Speedbrake Change Dynamics	+- 3 Kts Airspeed +-100 Feet (30 Meters) Altitude +- 20% or +- 1.5 degree Pitch	Cruise and Approach Landing
(4)	Gear Change Dynamics	+- 3 Kts Airspeed +- 100 Feet (30 Meters) Altitude +- 20% or +- 1.5 degree Pitch	Takeoff to Second Segment Climb, Approach to Landing

Gear Change Force	+- 5 lb or +- 20%	Takeoff to Second Segment Climb, Approach to Landing	

Test	Qualification Requirement LEVEL							Comments
	1	2	3	4	5	6	7	
2. HANDLING QUALITIES								
c. LONGITUDINAL								
(1) Power Change Dynamics							X	
Power Change Force		X	X		X	X		Snapshots will be acceptable. Power Change dynamics will be accepted.
(2) Flap Change Dynamics							X	
Flap Change Force		X	X		X	X		Snapshots will be acceptable. Flap change dynamics will be accepted.
(3) Spoiler/ Speedbrake Change							X	
(4) Gear Change Dynamics							X	
Gear Change Force		X	X		X	X		Snapshots will be acceptable. Gear change dynamics will be acceptable.

Test	Tolerance	Conditions
2. HANDLING QUALITIES		

(LONGITUDINAL cont'd)

(5)	Gear and Flap Operating Times	+- 3 Seconds or 10% of Time	Takeoff, Approach
(6)	Longitudinal Trim	+- 1 degree Pitch Control (Stab and Elev) +- 1 degree Pitch Angle +- 2% Net Thrust or equivalent in Cruise +- 5% Net Thrust, or equivalent in Approach and Landing	Cruise Approach, Landing
(7)	Longitudinal Maneuvering Stability (Stick Force/g)	+- 5 lb (2.224 daN) or +- 10% Column Force or Equivalent Surface	Cruise, Approach Landing
(8)	Longitudinal Static Stability	+- 5 lb (+- 2.224) daN) or +- 10% Column Force or Equivalent Surface	Approach
(9)	Phugoid Dynamics	+- 10% of Period +- 10% of Time to 1/2 or Double Amplitude or +- .02 of Damping Ratio	Cruise
		+- 10% of Period With Representative Damping	Cruise

Test	Qualification Requirement LEVEL 1	2	3	4	5	6	7	Comments
2. HANDLING QUALITIES (LONGITUDINAL cont'd)								
(5) Gear and Flap Operating Times		X	X		X	X	X	
(6) Longitudinal Trim		X	X		X	X	X	May be a snapshot. Levels 2, 3, and 5 may use equivalent stick and trim controllers in lieu of stabilizer and elevator.
(7) Longitudinal Maneuvering Stability (Stick Force/g)						X	X	May be a series of snapshot tests. Force or surface deflection must be in the correct direction.
(8) Longitudinal Static Stability		X	X		X	X	X	May be snapshot tests. Levels 2, 3. and 5 must exhibit positive static stability, but need not comply with the numerical tolerance.
(9) Phugoid Dynamics						X	X	Test should include 6 cycles or that sufficient to determine time

								to 1/2 amplitude, whichever is less.

Test	Tolerance	Conditions
2. HANDLING QUALITIES		
(LATERAL DIRECTIONAL Cont'd)		
(10) Short Period Dynamics	+- 1.5 degrees Pitch or 2 degrees/sec Pitch +- .10g Normal Acceleration	Cruise
d. LATERAL DIRECTIONAL		
(1) Minimum control Speed, Air (V sub mca), per device's Applicable Airworthiness Standard, or Low Speed Engine Inoperative Handling Characteristics in Air	+- 3 Kts Airspeed	Takeoff or Landingh, (whichever is most critical in airplane
(2) Roll Response (Rate)	+- 10% or +- 2 degrees/ sec Roll Rate	Cruise and Landing or Approach
(3) Roll Overshoot or Response to Roll	+- 2 degrees or +- 10% of Bank	Approach or Landing
Controler Step Input	+- 10% or +- 2 degrees/sec Roll Rate	
(4) Spiral Stability	Correct Trend Correct Trend +- 3 degrees or Bank Angle or +- 10% in 30 secs.	Cruise, Cruise
	Correct Trend +- 3 degrees of Bank Angle or	Cruise

								+- 10% in 30 secs.
Test	Qualification Requirement							Comments
	LEVEL							
	1	2	3	4	5	6	7	
2. HANDLING QUALITIES (LATERAL DIRECTIONAL Cont'd)								
(10) Short Period Dynamics						X	X	
d. LATERAL DIRECTIONAL								
(1) Minimum Control Speed, Air (V sub mca), per device's Applicable Airworthiness Standards, or Low Speed Engine Inoperative Handling Characteristics in Air							X	
(2) Roll Response (Rate)		X	X		X	X	X	
(3) Roll Overshoot or Response to Roll Controller Step Input			X			X	X	
(4) Spiral Stability		X			X			
			X			X		Data averaged

								from multiple tests in the same direction may be used, less
							X	Level 7 requires tests in both directions.

Test	Tolerance	Conditions
2. HANDLING QUALITIES (LATERAL DIRECTIONAL Cont'd)		
(5) Engine Inoperative Trim	+- 1 degrees Rudder Angle or +- 1 degrees or Tab Angle or Equivalent Pedal +- 2 degrees Sideslip Angle	Second Segment Approach or Landing
(6) Rudder Response	+- 2 degrees/ sec or +- 10% Yaw Rate or Heading Changes	Approach or Landing
	Roll Rate +- 2 degrees sec. Bank Angle +- 3 degrees	Approach or Landing
(7) Dutch Roll Yaw Dumper OFF	+- 10% of Period.	Cruise, and Approach or Landing
	+- 10% of Time to 1/2 or Double Amplitude	
	+- .02 of Damping Ratio	
	+- 10% of Period With Correct Trend and Number of Overshoots	Cruise and Approach or Landing
(8) Steady State Sideslip or Heading Angle	For given rudder position +- 2 degrees	Approach or Landing

								Bank, +- 1 degrees Sideslip, +- 10% or +- 2 degrees Aileron, +- 10% or +- 5 degrees Spoiler or Equivalent Wheel Position or Force
Test	Qualification Requirement							Comments
	LEVEL							
	1	2	3	4	5	6	7	
2. HANDLING QUALITIES (LATERAL DIRECTIONAL cont'd)								
(5) Engine Inoperative Trim							X	May be snapshot test.
(6) Rudder Response						X	X	Test may be deleted if rudder input and response is shown in dutch roll test.
		X	X		X			Test may be roll response to a given rudder deflection.
(7) Dutch Roll Yaw Dumper Off						X	X	For Level 7, additional requirement of +- 20% or 1 sec. of time difference between peaks of bank and sideslip.
(8) Steady State Sideslip or Heading Angle		X	X		X	X	X	May be a series of snapshot tests.

Test	Tolerance	Conditions
3. TESTING		
a. AUTOMATIC TESTING. A means for quickly and effectively testing training device programming and hardware. This could include an automated system which could be used for conducting at least a portion of the tests in the ATG.		
b. COCKPIT INSTRUMENT RESPONSE		
(1) Instrument Systems response to an abrupt pilot controller input, compared to airplane response for a similar imput. One	150 milliseconds or less after airplane response	Takeoff, Cruise Approach Landing
test is required in each axis (pitch, roll and yaw) for each of the 3 conditions. (Total 9 tests.)	300 milliseconds or less after airplane response	Takeoff, Cruise
Or		
Transport Delay. One test is required in each axis. (Total 3 tests.)	150 milliseconds or less after control movement. 300 milliseconds or less.	Pitch, Roll, Yaw

Test	Qualification Requirement LEVEL 1	2	3	4	5	6	7	Comments
3. TESTING								
a. AUTOMATIC TESTING. A means for quickly and effectively testing training							X	

device programming and hardware. This could include an automated system which could be used for conducting at least a portion of the tests in the ATG.								
b. COCKPIT INSTRUMENT RESPONSE								
(1) Instrument Systems response to an abrupt pilot controller input, compared to airplane response for a similar input. One test is required in each axis (pitch, roll and yaw) for each of the 3 conditions. (Total 9 tests.)		X	X		X	X		A Statement of Compliance referencing computer operation update rates, etc., which describe how the 150/300 millisecond timing is achieved
Or								will be acceptable.
Transport Delay. One test is required in each axis. (Total 3 tests.)		X	X		X	X		

3. CONTROL DYNAMICS. The characteristics of an aircraft flight control system have a major effect on the handling qualities. A significant consideration in pilot acceptability of an aircraft is the "feel" provided through the cockpit controls. Considerable effort is expended on aircraft 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 flight training device to be representative, it too must present the pilot with the proper "feel;" essentially that of the respective airplane.

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 control loading system to the airplane systems is essential.

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.

For airplanes with irreversible control systems, measurement 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 devices requiring static and dynamic tests at the controls, special test fixtures will not be required during initial and upgrade evaluations if the operator's ATG shows both test fixture results and the results of an alternate approach, such as computer plots which were produced concurrently and show satisfactory agreement. Repeat of the alternate method during the initial evaluation would then satisfy this test requirement.

a. Control Dynamics. The dynamic properties of control systems are often stated in terms of frequency, damping, and a number of other classical measures which can be found in texts on control systems. In order to establish a consistent means of showing test results for 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 case of an underdamped system with very light damping, the system may be quantified in terms of frequency and damping. In critically damped or overdamped systems, the frequency and damping are not readily measured from a response time history. Therefore, some other measurement must be used.

Tests to verify that control feel dynamics represent the airplane must show that the dynamic damping cycles (free response of the controls) match that of the airplane within 10 percent of period and 10 percent of damping. The method of evaluating the response is described below for the underdamped and critically damped cases.

(1) Underdamped Response. Two measurements are required for the period, the time to first zero crossing (in case a rate limit is present) and the subsequent frequency of oscillation. It is necessary to measure cycles on an individual basis in case there are nonuniform periods in the response.

The damping tolerance should be applied to overshoots on an individual basis. Care should be taken when applying the tolerance to small overshoots since the significance of such overshoots larger than 5 percent of the total initial

displacement should be considered significant. The results should show the same number of significant overshoots to within one when compared against the aircraft data. This procedure for evaluating the response is illustrated in Figure 1.

(2) Critically Damped or 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 airplane within +10 percent. The flight training device response should be critically damped also. Figure 2 illustrates the procedure.

Tolerances

The following table summarizes the tolerances, T. See Figures 1 and 2 for an illustration of the referenced measurements.

T(P0)	+/- 10% of P0
T(P1)	+/- 10% of P1
T(Pn)	+/- 10% of Pn
T(An)	+/- 10% of A1, 20% of Subsequent Peaks
T(Ad)	+/- 5% of Ad
Overshoots	+/- 1

b. Alternate Method for Control Dynamics. One airplane manufacturer asserts that adjusting a control loading system for column releases may introduce an unnecessary error for normal pilot commands away from neutral. Instead of free response measurements, the system would be validated by measurements of column force as a function of hands on column rate.

For each axis of pitch, roll, and yaw, the control shall be forced to its extreme position at two distinct rates. One that achieves maximum deflection in approximately 2 seconds and one that achieves maximum deflection in approximately 1 second. Tolerances on the total force shall be the same as for the static check with the additional requirement that the dynamic increment be in the correct sense relative to the static force level. Where flight configurations influence the feel forces of the controls, these tests shall be conducted at a typical taxi, takeoff, cruise, and landing condition.

The FAA is open to alternative means such as the one described above. Such alternatives must, however, be justified and appropriate to the application. For example, the method described here would not likely apply to other 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. Should the FAA find that alternative methods do not result in satisfactory performance, then more conventionally

accepted methods must be used.

Figure 1. Under-Damped Step Response

›FIGURE NOT INCLUDED|

Figure 2. Critically-damped Step Response
›FIGURE NOT INCLUDED|

APPENDIX 3. FUNCTIONS AND SUBJECTIVE TESTS

1. DISCUSSION. Accurate replication of the airplane's systems functions will be checked at each flight crewmember position by an FAA specialist. This includes procedures using the operator's approved manuals and checklists. Handling qualities, performance, and systems operation will be subjectively assessed by an appropriately qualified FAA inspector.

The operator may request that the inspector assess the flight training device for a special aspect of an operator's training program during the functions and subjective portion of a recurrent evaluation. For example, such an assessment may include a portion of a Line-Oriented Flight Training scenario or special emphasis items in the operator's training program, if appropriate. Unless directly related to requirement for the current qualification level, the results of such an evaluation would not affect the training device's current status.

Operational principal navigation systems including inertial navigation systems, OMEGA, or other long-range systems, and the associated electronic display systems will be evaluated if installed. The inspector will include in his report the effect of the system operation and system limitations.

2. TEST REQUIREMENTS. The ground and flight tests and other checks required for qualification are listed in the Table of Functions and Subjective Tests. The table includes maneuvers and procedures that are accomplished during the evaluation process to assure that the flight training device functions and performs appropriately. It must be understood that there is no direct correlation between the maneuvers and procedures in this appendix and any maneuver or procedure that may be authorized for a training event or checking event under FAR Parts 61, 63, 121, 125, 135, or 141. Maneuvers and procedures are also included to address some features of advanced technology airplanes and innovative training programs. For example, "high angle of attack maneuvering" is included to provide an alternative to "approach to stalls." Such an alternative is necessary for aircraft

employing flight envelope limiting systems. The portion of the table addressing pilot functions and maneuvers is divided by flight phases.

All systems functions will be assessed for normal and, where appropriate, alternate operations. Normal, abnormal, and emergency procedures associated with a flight phase will be assessed during the evaluation of maneuvers or events within that flight phase. Systems are listed separately under "Any Flight Phase" to assure appropriate attention to systems checks.

The functions and subjective test requirements listed in the Table are not applicable in cases in which the flight training device does not include the system or function to be checked even though it may be indicated by the "X" in the Table. This is particularly true for Levels 2, 4, and 5 which require as little as one functioning system. When using the Tables, one must apply logic to assure the required flexibility for these devices and not require unintended systems.

There are maneuvers that will be subjectively evaluated under asymmetric thrust conditions. For Level 7, this will be applicable only for those highly augmented airplanes in which flight test data verify the absence of motion without pilot input during the maneuver being accomplished. In the absence of this data for Level 7 and for all situations in Levels 1-6, these asymmetric thrust maneuvers are evaluated here only to verify that the procedures for the specific event may be accomplished satisfactorily. This evaluation does not imply that the maneuver itself, or the demonstration of proficiency in the application of the procedures, may be accomplished in any vehicle other than an appropriately qualified simulator or the airplane.

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS

	LEVEL							
	1	2	3	4	5	6	7	Comments
1. FUNCTIONS AND MANEUVERS								
a. PREPARATION FOR FLIGHT								
(1) Preflight. Accomplish a functions check of all installed switches,	.	X	X	X	X	X	X	For Levels 2 and 3 cockpit flight deck area design and functions must be representative of the appropriate set

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.							of airplanes.
b. SURFACE OPERATIONS (PRE-TAKEOFF)							
(1) Engine start.	.	X*	X	X*	X*	X	X	* If appropriate to installed systems.
(i) Normal start.							
(ii) Alternate start procedure.							
(iii) Abnormal starts and shutdowns (hot start, hung start, etc.).							
(2) Pushback.	.	.	X	X*	X	X	X	* If appropriate to installed systems.
(3) Thrust response.	.	X	X	.	X	X	X	
(4) Power lever friction.	.	X	X	.	X	X	X	
(5) Brake operation (normal and alternate/ emergency).	.	X*	X	.	X*	X	X	* If appropriate to installed systems.
(6) Brake fade (if applicable).	.	.	.	.	.	.	X	
(7) Other.	.	.	.	.	.	.	.	
c. TAKEOFF							

(1) Normal.							
(i) Powerplant checks (engine parameter relationships).	.	X*	X	X*	X*	X	X	* If appropriate to installed systems.
(ii) Acceleration characteristics.	.	X*	X	.	X*	X	X	* If appropriate to installed systems.
(iii) Nosewheel and rudder steering.	.	X*	X	.	X*	X	X	* If appropriate to installed systems.
(iv) Effect of crosswind.	.	X	X	.	X	X	X	
(v) Special performance.	.	.	.	.	X	X	X	
(vi) Instrument.	.	X	X	.	X	X	X	
(vii) Landing gear, wing flap leading edge device operation.	.	X*	X	.	X*	X	X	* If appropriate to installed systems.
(viii) Other	.	.	.	.	.	.	.	
(2) Abnormal/ Emergency.								
(i) Rejected.	.	.	X	.	.	X	X	
(ii) Rejected special performance.	.	.	X	.	.	X	X	
(iii) With failure of most critical engine at most critical point along takeoff path (continued takeoff).	.	.	.	.	.	.	X	Applicable only to those highly augmented airplanes in which flight test data verify absence of motion without pilot input during this maneuver.
(iv) Flight control system failure modes.	.	X	X	X	X	X	X	If appropriate for the airplane and the installed systems.

(v) Other.							
d. INFLIGHT OPERATION							
(1) Climb.							
(i) Normal.	.	X	X	.	X	X	X
(ii) One engine inoperative procedures.	.	X	X	.	X	X	X
(iii) Other..							
(2) Cruise.							
(i) Performance characteristics (speed vs. power).	.	X	X	.	X	X	X
(ii) Turns with/without spoilers (speed brake) deployed.	.	X	X	.	X	X	X
(iii) High altitude handling.	.	X	X	.	X	X	X
(iv) High speed handling.	.	X	X	.	X	X	X
(v) Mach effects on control and trim, overspeed warning.	.	X	X	.	X	X	X
(vi) Normal and steep turns.	.	X	X	.	X	X	X
(vii) Performance turns.	.	X	X	.	X	X	X
(viii)	.	X	X	.	X	X	X

If appropriate to the airplane or set of airplanes.

Approach to stalls, i.e., stall warning (cruise, takeoff/approach, and landing configuration).	.	X	X	.	X	X	X	
(ix) High angle of attack maneuvers (cruise, takeoff/approach, and landing).	.	X*	X	X*	X*	X	X	* If appropriate to installed systems.
(x) Inflight engine shutdown.	.	X*	X	X*	X*	X	X	* If appropriate to installed systems.
(xi) Inflight engine restart.	.	X	X	.	X	X	X	Level
(xii) Maneuvering with engine(s) inoperative.	.	.	.	.	.	X	X	7 - Applicable only to those highly augmented airplanes in which flight test data verify the absence of motion without pilot input during this maneuver. In the absence of this data for Level 7 and for Level 6 and below, this test is accomplished only to verify that the procedures for this situation of condition can be accomplished satisfactorily.
(xiii) Specific flight characteristics.	.	.	.	.	.	X	X	
(xiv) Manual flight control reversion.	.	.	.	.	.	X	X	If appropriate for the airplane.
(xv) Flight control system failure modes.	.	.	.	.	.	X	X	

(xvi) Other.	.	.	.	.	.	.	.
(3) Descent.							
(i) Normal.	.	X	X	.	X	X	X
(ii) Maximum rate.	.	X	X	.	X	X	X
(iii) Manual flight control reversion.	.	.	.	.	.	X	X
(iv) Flight control system failure modes.	.	.	.	.	.	X	X
(v) Other.	.	.	.	.	.	.	.
e. APPROACHES							
(1) Nonprecision.							
(i) All engines operating.	.	X	X	.	X	X	X
(ii) One or more engines inoperative.	.	.	X	.		X	X

Level 7 - Applicable only to those highly augmented airplanes in which flight test data verify the absence of motion without pilot input during this maneuver. In the absence of this data for Level 7 and for Levels 6 and 3, this test is accomplished only to verify that the procedures for

							this situation or condition can be accomplished satisfactorily.
(iii) Approach procedures.	.	X	X	.	X	X	X	
-- NDB -- VOR, RNAV TACAN -- DME ARC -- LOC/BC -- LDA, LOC, SDF -- ASR								
(iv) Missed approach.								
-- All engines operating.	.	X	X	.	X	X	X	
-- One or more engines inoperative (as applicable).	.	.	.	.	.	.	X	Applicable only to those highly augmented airplanes in which flight test data verify the absence of motion without pilot input during this maneuver.
(2) Precision.								
(i) PAR - Normal.	.	.	X	.	.	X	X	As applicable.
(ii) ILS.	.	X*	X	.	X*	X	X	As applicable. * Autocoupled approach procedures.
(A) Normal.								
(B) Category I published: Manually controlled with and without flight director to 100 feet below published decision height.								

								(C)
Category II published: With use of autocoupler, autothrottle, and autoland, as applicable.								
								(D)
Category III published:								
								(1)
With electrical power, source failure.								Tests accomplished with maximum tailwing and crosswind authorized if less than 10 knots.
								(2)
With 10 knot tailwind.								
								(3)
With 10 knot crosswind.								
	(iii) MLS.	.	.	X	.	.	X	X	As applicable.
								(A)
Normal.								
								(B)
Steep glide slope.								
	(iv) Effects of crosswind.	.	X	X	.	X	X	X	As applicable.
	(v) With engine(s) inoperative.	.	X	X	.	X	X	X	Level 7 - Applicable only to those highly augmented airplanes in which flight test data verify the absence of motion

							without pilot input during this maneuver. In the absence of this data for Level 7 and for Level 6 and below, this test is accomplished only to verify that the procedures for this situation or condition can be accomplished satisfactorily.
(vi) Missed approach.							
(A) Normal.	.	X	X	.	X	X	X As applicable.
(B) With engine(s) inoperative.	.	X	X	.	X	X	X Level 7 - Applicable only to those highly augmented airplanes in which flight test data verify the absence of motion without pilot input during this maneuver. In the absence of this data for Level 7 and for Level 6 and below, this test is accomplished only to verify that the procedures for this situation or condition can be accomplished satisfactorily.
(C) From steep glide slope.	.	X	X	.	X	X	X As applicable.
f. SURFACE OPERATIONS (POST LANDING)							
(1) Landing roll.							

(i) Spoiler operation.	.	X*	X*	.	X*	X	X	* If applicable to installed systems.
(ii) Reverse thrust operation.	.	.	X	.	.	X	X	
(iii) Other.								
g. ANY FLIGHT PHASE	.	.	.	.	.	.	.	
(1) Aircraft and powerplant systems operation.	.	X	X	X	X	X	X	If applicable to installed systems.
(i) Air conditioning.								
(ii) Antiicing/deicing.								
(iii) Auxiliary powerplant.								
(iv) Communications.								
(v) Electrical.								
(vi) Fire detection and suppression.								
(vii) Flaps.								
(viii) Flight controls (including spoiler/ speedbrake).								
(ix) Fuel and oil.								
(x) Hydraulic.								

(xi) Landing gear.							
(xii) Oxygen.							
(xiii) Pneumatic.							
(xiv) Powerplant.							
(xv) Pressurization.							
(2) Flight management and guidance systems.	.	X	X	X	X	X	X	If applicable to installed systems.
(i) Automatic landing aids.							
(ii) Automatic pilot.							
(iii) Thrust management/ autothrottle.							
(iv) Flight data displays.							
(v) Flight management computers.							
(vi) Flight director/ system displays.							

Head down.

(B)

Head up.

(vii)

Navigation systems.

(viii) Stall

warning/avoidance.

(ix)

Stability and control augmentation.

(x)

Other.

(3) Airborne procedures	X	X	X	X	X	X	If applicable to installed systems.
(i) Holding.							
(ii) Other.							
(4) Engine shutdown and parking.	X	X	X	X	X	X	If applicable to installed systems.
(i) Systems operation.							
(ii) Parking brake operation.							
(5) Other							

FIGURE 1. APPLICATION LETTER 1
FIGURE 2. ATG COVER PAGE 2
FIGURE 3. INFORMATION PAGE 3

Name, POI, _____ Airlines

FAA FSDO _____

Address

City, State, Zip

Dear Mr. _____:

____ (Operator Name) ___ requests evaluation of our ____ (Type) ____ airplane flight training device for qualification at level _____. The

____ (Operator Name) ____ flight training device is fully defined on page _____ of the accompanying approval test guide (ATG). We have completed tests of the flight training device and certify that it meets all applicable requirements and the guidance of Advisory Circular (AC) 120-45A. Appropriate hardware and software configuration control procedures have been established. Pilots we have designated as our representatives have assessed the flight training device and we concur with their finding that it conforms to the ____ Operator Name ____ ____ (Type) ____ airplane cockpit configuration and that the simulated systems and subsystems function equivalently to those in the airplane. These pilots have also assessed the performance and flying qualities of the flight training device and we concur with their finding that it represents the respective airplane.

(Added comments as desired.)

Sincerely,

FIGURE 1. Application Letter

(OPERATOR NAME)

(OPERATOR ADDRESS)

FAA APPROVAL TEST GUIDE

(AIRPLANE MODEL)

(Level of Flight Training Device)

(Training Device Identification Including
Manufacturer, Serial Number)

(Location)

FAA Initial Evaluation

Date: _____

_____ (Operator Approval) ___ Date: _____

_____ Date: _____
FAA, Manager, National

Simulator Program

FIGURE 2. Example ATG Cover Page

OPERATOR

OPERATOR DEVICE CODE:	MTD-441 #1
AIRPLANE MODEL:	MTD-441-B
AERODYNAMIC DATA REVISION:	MTD-441-B CPX-8D July 1988
ENGINE MODEL AND REVISION:	CPX-8D-RPT-1 June 1988
FLIGHT CONTROLS DATA REVISION:	MTD-441-B May 1988
FLIGHT MANAGEMENT SYSTEM:	Berry XP
TRAINING DEVICE MODEL AND MANUFACTURER:	MFD-7X Tinker
DATE OF MANUFACTURE:	1988
COMPUTER:	CIA

FIGURE 3. Information Page
