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**SUBPART A – APPLICABILITY****YCAR-STD 2A.001 Applicability**

YCAR-STD 2A applies to those persons, organizations or enterprises (FTD operators) seeking qualification of Flight Training Devices (FTD). FTD users also shall gain approval to use the FTD as part of their approved training programmes despite the fact that the FTD has been previously qualified. Although this document provides guidance for FTD users, precise details of such approvals are contained in YCAR-OPS and other applicable documents.

Note: In the context of this YCAR-STD, the “Authority” means CAMA except whenever a foreign authority is utilized for the qualification of simulators, then the term “Authority” may also apply to this foreign Authority.



SUBPART B – GENERAL

YCAR-STD 2A.005 Terminology

(See AMC STD 2A.005)

Because of the technical complexity of STD Qualification, it is essential that standard terminology is used throughout. The following principal terms and abbreviations shall be used in order to comply with YCAR-STD. Further terms and abbreviations are contained in AMC STD 2A.005.

- (a) *Synthetic Training Device (STD)*. A training device which is either a Flight Simulator (FS), a Flight Training Device (FTD), a Flight & Navigation Procedures Trainer (FNPT), or an Other Training Device (OTD).
- (b) *Flight Simulator*. A full size replica of a specific type or make, model and series aeroplane flight deck, including the assemblage of all equipment and computer programmes necessary to represent the aeroplane in ground and flight operations, a visual system providing an out of the flight deck view, and a force cueing motion system. It is in compliance with the minimum standards for Flight Simulator Qualification.
- (c) *Flight Training Device (FTD)*. A full size replica of an aeroplane's instruments, equipment, panels and controls in an open flight deck area or an enclosed aeroplane flight deck, including the assemblage of equipment and computer software programmes necessary to represent the aeroplane in ground and flight conditions to the extent of the systems installed in the device. It does not require a force cueing motion or visual system. It is in compliance with the minimum standards for a specific FTD Level of Qualification.
- (d) *Flight and Navigation Procedures Trainer – Type II (FNPT II)*. A ground based training device which represents the flight deck environment of a multi-engine aeroplane type or class to the extent that the systems appear to function as in an aeroplane. It incorporates a visual system providing an out of the flight deck view.
- (e) *Flight and Navigation Procedures Trainer – Type I (FNPT I)*. A ground based training device which represents the flight deck environment of a class of aeroplanes.
- (f) *Other Training Device (OTD)*. A training aid other than Flight Simulator, Flight Training Device or Flight and Navigation Procedures Trainer which provides for training where a complete flight deck environment is not necessary.
- (g) *Synthetic Training Device Approval (STD Approval)*. The extent to which an STD of a specified Qualification Level may be used by persons, organisations or enterprises as approved by the Authority. It takes account of aeroplane to STD differences and the operating and training ability of the organisation.
- (h) *Synthetic Training Device Operator (STD Operator)*. That person, organisation or enterprise directly responsible to the Authority for requesting and maintaining the qualification of a particular STD.
- (i) *Synthetic Training Device User (STD User)*. The person, organisation or enterprise requesting training, checking and testing credits through the use of an FTD.
- (j) *Synthetic Training Device Qualification (STD Qualification)*. The level of technical ability of an STD as defined in the compliance document.
- (k) *Qualification Test Guide (QTG)*. A document designed to demonstrate that the performance and handling qualities of an STD agree within prescribed limits with those of the aeroplane and that all applicable regulatory requirements have been met. The QTG includes both the aeroplane and STD Data used to support the validation.

**SUBPART C – AEROPLANE FLIGHT TRAINING DEVICES****YCAR-STD 2A.015 Application for FTD qualification**

(See AMC STD 2A.015)

(See IEM STD 2A.015)

- (a) The operator of an FTD requiring evaluation of this FTD shall apply to the Authority giving 3 months notice.
- (b) An STD (FTD) Qualification Certificate will be issued following satisfactory completion of an evaluation by the Authority.

YCAR-STD 2A.020 Validity of FTD qualification

- (a) An FTD qualification is valid for 12 months unless otherwise specified by the Authority.
- (b) An FTD qualification test for revalidation may take place at any time within the 60 days prior the expiry of the validity of the qualification document. The new period of validity shall continue from the expiry date of the previous qualification document.
- (c) The Authority may refuse, revoke, suspend or vary an FTD qualification, if the provisions of YCAR-STD 2A are not satisfied.

YCAR-STD 2A.025 Rules governing FTD Operators

(See AMC STD 2A.025)

The operator of an FTD shall demonstrate his capability to maintain the performance, functions and other characteristics specified for the FTD qualification Level:

- (a) *Quality system*
 - (1) A Quality System shall be established and a Quality Manager designated to monitor compliance with, and the adequacy of, procedures required to ensure the maintenance of the Qualification Level of STDs. Compliance monitoring shall include a feed-back system to the Accountable Manager to ensure corrective action as necessary.
 - (2) The Quality System shall include a Quality Assurance Programme that contains procedures designed to verify that the specified performance, functions and characteristics are being conducted in accordance with all applicable requirements, standards and procedures.
 - (3) The Quality System and the Quality Manager shall be acceptable to the Authority.
 - (4) The Quality System shall be described in relevant documentation.
- (b) *Updating.* Maintain a link with manufacturers to incorporate important modifications, especially:
 - (1) *Aeroplane modifications.* Aeroplane modifications whether or not enforced by an airworthiness directive, and which are essential for training and checking shall be introduced into all affected Flight Training Devices.
 - (2) Modification of FTDs, including motion and visual systems (if applicable):
 - (i) Where applicable and essential for training and checking, STD operators shall update their Flight Training Devices (for example in the light of data revisions). Modifications of the FTD hardware and software which affect flight, ground handling and performance or any major modifications of the motion or visual system (if applicable) shall be evaluated to determine the impact on the original qualification criteria. If necessary, STD operators shall prepare amendments for any affected Validation Tests. The STD operator shall test the FTD to the new criteria.
 - (ii) The Authority shall be advised in advance of any major changes to determine whether or not a special evaluation of the STD may be necessary prior to returning it to training following the modification.



- (c) *Installations.* Ensure that the STD is located in a suitable environment which supports safe and reliable operation.
 - (1) The STD operator shall ensure that the STD and its installation comply with the local, country or state regulations for Health and Safety. However as a minimum the following shall be addressed:
 - (i) STD occupants and maintenance personnel shall receive adequate briefing on STD safety.
 - (ii) Adequate fire/smoke detection, warning and suppression arrangements to ensure the safe passage of personnel from the STD.
 - (iii) Adequate protection against electrical, mechanical, hydraulic and pneumatic hazards - including those arising from the control loading & motion systems (if applicable).
 - (iv) Other items:
 - (A) Emergency lighting.
 - (B) Escape exits & facilities.
 - (C) Danger area markings.
 - (D) Guard rails and gates.
 - (E) Control Loading Emergency stop controls (if applicable) accessible from either pilot and instructor seats.
 - (F) A manual or automatic electrical power isolation switch.
 - (2) The STD safety features such as emergency stops and emergency lighting shall be checked regularly by the STD operator but in any case at least annually. These tests shall be recorded.

YCAR-STD 2A.030 Requirements for STDs qualified on or after 1 January 2005

(See Appendix 1 to YCAR-STD 2A.030)

(See AMC STD 2A.030)

- (a) Any STD submitted for initial evaluation on or after 1 January 2005, will be evaluated against YCAR-STD criteria for Qualification Levels 1 or 2.
- (b) An STD shall be assessed in those areas which are essential to completing the flight crew member training and checking process, (where applicable) including:
 - (1) longitudinal, lateral and directional handling qualities, and
 - (2) performance on the surface and in the air, and
 - (3) specific operations where applicable, and
 - (4) flight deck configuration, and
 - (5) functioning during normal, abnormal, emergency and, where applicable, non normal operation, and
 - (6) instructor station function and FTD control, and
 - (7) certain additional requirements depending on the qualification level and the installed equipment.
- (c) The STD shall be subjected to:
 - (1) Validation tests, and
 - (2) Functions & Subjective tests as found in the Qualification Test Guide (QTG).
- (d) Data which is used to ensure the fidelity of an STD shall be of a standard that satisfies the Authority, before the STD can gain a Qualification Level.



- (e) The STD operator shall submit a QTG in a form and manner which is acceptable to the Authority.
- (f) The QTG will only be approved after completion of an initial or upgrade evaluation, and when all the discrepancies in the QTG have been addressed to the satisfaction of the Authority. After inclusion of the results of the tests witnessed by the Authority, the approved QTG becomes the Master QTG (MQTG), which is the basis for the STD qualification and subsequent recurrent STD evaluations.
- (g) The STD operator shall:
 - (1) Run the complete MQTG progressively between each annual evaluation by the Authority. Results shall be dated and retained in order to satisfy both the STD operator as well as the Authority that STD standards are being maintained and,
 - (2) Establish a Configuration Control System to ensure the continued integrity of the hardware

**Appendix 1 to YCAR-STD 2A.030****Technical requirements**

- (a) This Appendix describes the minimum technical requirements for qualifying STD Levels 1 and 2.
- (b) Each of those levels carries an appropriate technical description and maximum training, checking and testing credits.
- (c) The training, checking and testing credits do not imply an automatic level of Approval for any STD user.
- (d) Table 1 indicates in broad terms the maximum credits possible for each technical Qualification Level. Specific requirements for the use of the aeroplane or STD is determined by the Authority. Specialised training courses (e.g. ETOPS, TCAS, AWOPS, Windshear etc.) require an adequate standard of simulation which will be evaluated by the Authority.

NOTE: Certain STD and visual system requirements included in this Appendix shall be supported with a Statement of Compliance (SOC) and, in some designated cases, an Objective Test. Compliance statements shall describe how the requirement was met, such as gear modelling approach, coefficient of friction sources, etc. Where additional equipment including Motion and Visual System has been added to an STD even though not required for qualification, it will be assessed to ensure that it does not adversely affect the qualification of a training device. Any subsequent removal or unserviceability could affect the qualification of the device.

**Table 1 – Minimum STD requirements for qualifying FTD level 1 and 2**

<i>Qualification Level</i>	<i>General Technical Requirements</i>	<i>Maximum Credits</i>
1	<p>Type specific with at least 1 system fully represented</p> <p>Closed or open flight deck</p> <p>(Note: Choice of systems simulated is the responsibility of the organisation seeking approval or re-approval for the course)</p>	<p>Suitable for:</p> <ul style="list-style-type: none"> – Selective system management credits (except for pilot manual control handling skills) as follows: <ul style="list-style-type: none"> • part of an approved conversion/transition course, • recurrent training/checking.
2	<ul style="list-style-type: none"> – Type specific – All applicable systems fully represented – Closed flight deck – Type specific or Generic Flight Dynamics (but shall be representative of aircraft performance) – On board Instructor station – Significant sounds – Control of atmospheric conditions – Navigation Data Base (sufficient to support aeroplane systems) – Adequate test capability – Primary flight controls which control the flight path and be broadly representative of aeroplane control characteristics. 	<p>Suitable for:</p> <ul style="list-style-type: none"> – Systems Management Initial and Recurrent training, checking and testing, (except pilot manual control handling skills i.e. those flight manoeuvres executed via the pilots primary flying controls). – CRM Training, as part of approved course. – LOFT (Route and area familiarisation only where at least Level A simulator visual system fitted). (See also Appendix 1 to YCAR–STD 2A.030 and standards.)

YCAR–STD 2A.035 Requirements for FTDs approved or qualified before 1 January 2005

(See AMC STD 2A.035)

- (a) Flight Training Devices approved or qualified in accordance with national regulations of ICAO Members States before 1 January 2005 either will be recategorised or will continue to maintain their approval under the Grandfather Rights provision, in accordance with YCAR–STD 2A.035(c) and YCAR–STD 2A.035(d).
- (b) Recategorised STDs will be qualified in accordance with YCAR–STD 2A.030.
- (c) Flight Training Devices that are not recategorised but that have a primary reference document used for their testing may be qualified by the Authority to an equivalent YCAR–STD Qualification Level, either 1G or 2G. These Qualification Levels refer to similar credits achieved by YCAR–STD 2A Level 1 and 2.
 - (1) To gain and maintain an equivalent Qualification Level, these Flight Training Devices shall be assessed in those areas which are essential to completing the flight crew member training and checking process, including:
 - (i) Longitudinal, lateral and directional handling qualities (where applicable);
 - (ii) performance on the ground and in the air;
 - (iii) specific operations where applicable;
 - (iv) flight deck configuration;
 - (v) functioning during normal, abnormal, emergency and, where applicable non normal operation;
 - (vi) instructor station function and STD control, and



- (vii) certain additional requirements depending on the Qualification Level and the installed equipment.
- (2) The STD shall be subjected to:
 - (i) Validation Tests, and
 - (ii) Functions and Subjective Tests.
- (d) STDs that are not recategorised and that do not have a primary reference document used for their testing shall be qualified by special arrangement.
 - (1) Such STDs will be issued with Special Categories.
 - (2) These STDs shall be subjected to the same Functions and Subjective Tests referred to in YCAR-STD 2A.035(c) (2) (ii).
 - (3) In addition any previously recognised Validation Test shall be used.

YCAR-STD 2A.040 Changes to qualified STDs

- (a) *Requirement to notify major changes to an STD.* The operator of a qualified STD shall inform the Authority of proposed major changes such as:
 - (1) Aeroplane modifications which could affect STD qualification;
 - (2) STD hardware and/or software modifications which could affect the handling qualities, performances or system representations;
 - (3) relocation of the STD, and
 - (4) any deactivation of the STD.

NOTE: The Authority may complete a special evaluation following major changes or when an STD appears not to be performing at its initial Qualification Level.

- (b) *Upgrade of an STD.* An STD may be upgraded to a higher Qualification Level. Special evaluation is required before the issue of a higher level of qualification.
 - (1) If an Upgrade is proposed the STD operator shall seek the advice of the Authority and give full details of the modifications. If the Upgrade evaluation does not fall upon the anniversary of the original qualification date, a special evaluation is required to permit the STD to continue to qualify even at the previous level.
 - (2) In the case of an STD Upgrade, an STD operator shall run all Validation Tests for the requested Qualification Level. Validation Test results offered in a test guide for previous initial or Upgrade evaluation shall not be used to validate STD performance in a test guide offered for a current Upgrade.
- (c) *Relocation of an STD*
 - (1) In instances where an STD is moved to a new location, the Authority shall be advised before the planned activity along with a schedule of events related thereto.
 - (2) Prior to returning the STD to service at the new location the STD operator shall perform at least one third of the Validation Tests (if any) and, Functions and Subjective Tests to ensure that the STD performance meets its original qualification standard. A copy of the test documentation shall be retained with the STD records for review by the Authority.
 - (3) At the discretion of the Authority, the STD shall be subject to an evaluation in accordance with its original qualification criteria.
- (d) *Deactivation of a currently qualified STD*
 - (1) In the event an STD operator plans to remove an STD from active status for prolonged periods, the Authority shall be notified and suitable controls established for the period the STD is inactive.
 - (2) The STD operator shall arrange an understanding with the Authority to ensure that the STD can be restored to active status at its original Qualification Level.

**YCAR-STD 2A.045 Interim FTD qualification**

(See AMC STD 2A.045)

(See IEM STD 2A.045)

In case of new aeroplane programmes special arrangements shall be made to enable an interim Qualification Level to be achieved. Requirements, details relating to the issue, and the period of validity of an interim Qualification Level will be decided by the Authority.

YCAR-STD 2A.050 Transferability of FTD qualification

- (a) When there is a change of STD operator, the new STD operator shall advise the Authority in advance in order to agree upon a plan of transfer of the STD.
- (b) At the discretion of the Authority, the STD shall be subject to an evaluation in accordance with its original qualification criteria.
- (c) Provided that the STD performs to its original standard, its original Qualification Level shall be restored.

SECTION 2 – ACCEPTABLE MEANS OF COMPLIANCE (AMC) / INTERPRETATIVE AND EXPLANATORY MATERIAL (IEM)

1 GENERAL

- 1.1 This Section contains Acceptable Means of Compliance and Interpretative/Explanatory Material that has been agreed for inclusion in YCAR–STD 2A.
- 1.2 Where a particular YCAR paragraph does not have an Acceptable Means of Compliance or any Interpretative/Explanatory Material, it is considered that no supplementary material is required.

2 PRESENTATION

- 2.1 The Acceptable Means of Compliance and Interpretative and Explanatory Material are presented in full page width, each page being identified by the date of issue or the Change number under which it is amended or reissued.
- 2.2 A numbering system has been used in which the Acceptable Means of Compliance or Interpretative/Explanatory Material uses the same number as the YCAR paragraph to which it refers. The number is introduced by the letters AMC or IEM to distinguish the material from the YCAR itself.
- 2.3 The acronyms AMC and IEM also indicate the nature of the material and for this purpose the two types of material are defined as follows:

Acceptable Means of Compliance (AMC) illustrate a means, or several alternative means, but not necessarily the only possible means by which a requirement can be met. It should however be noted that where a new AMC is developed, any such AMC (which may be additional to an existing AMC) will be amended into the document following consultation under the NPA procedure.

Interpretative/Explanatory Material (IEM) helps to illustrate the meaning of a requirement.

- 2.4 **[New, amended or corrected text is enclosed within heavy brackets.]**



AMC/IEM B – GENERAL

AMC STD 2A.005 Terminology, Abbreviations

See YCAR-STD 2A.005

1 Terminology

1.1 In addition to the principal terms defined in the requirement itself, additional terms used in the context of YCAR-STD 2(A) have the following meanings:

- a. Automatic Testing. Synthetic Training Device (STD) testing wherein all stimuli are under computer control.
- b. Breakout. The force required at the pilot's primary controls to achieve initial movement of the control position.
- c. Closed Loop Testing. A test method for which the input stimuli are generated by controllers which drive the FTD to follow a pre-defined target response.
- d. Computer Controlled Aeroplane. An aeroplane where the pilot inputs to the control surfaces are transferred and augmented via computers.
- e. Control Sweep. A movement of the appropriate pilot's control from neutral to an extreme limit in one direction (Forward, Aft, Right, or Left), a continuous movement back through neutral to the opposite extreme position, and then a return to the neutral position.
- f. Convertible STD. An STD in which hardware and software can be changed so that the STD becomes a replica of a different model or variant, usually of the same type aeroplane. The same STD platform, flight deck shell, motion system, visual system, computers, and necessary peripheral equipment can thus be used in more than one simulation.
- g. Critical Engine Parameter. The engine parameter which is the most appropriate measure of propulsive force.
- h. Damping (critical). The CRITICAL DAMPING is that minimum Damping of a second order system such that no overshoot occurs in reaching a steady state value after being displaced from a position of equilibrium and released. This corresponds to a relative Damping ratio of 1:0.
- i. Damping (overdamped). An OVER-DAMPED response is that Damping of a second order system such that it has more Damping than is required for Critical Damping, as described above. This corresponds to a relative Damping ratio of more than 1:0.
- j. Damping (underdamped). An UNDER-DAMPED response is that Damping of a second order system such that a displacement from the equilibrium position and free release results in one or more overshoots or oscillations before reaching a steady state value. This corresponds to a relative Damping ratio of less than 1:0.
- k. Deadband. The amount of movement of the input for a system for which there is no reaction in the Output or state of the system observed.
- l. Driven. A state where the input stimulus or variable is 'driven' or deposited by automatic means, generally a computer input. The input stimulus or variable may not necessarily be an exact match to the flight test comparison data – it is simply driven to certain predetermined values.
- m. Flight Test Data. Actual aeroplane data obtained by the aeroplane manufacturer (or other supplier of acceptable data) during an aeroplane flight test programme.
- n. Free Response. The response of the aeroplane after completion of a control input or disturbance.
- o. Frozen/Locked. A state where a variable is held constant with time.



- p. Functions Test. A quantitative assessment of the operation and performance of an STD by a suitably qualified evaluator. The test can include verification of correct operation of controls, instruments, and systems of the simulated aeroplane under normal, abnormal, emergency and, where applicable, non-normal conditions. Functional performance is that operation or performance that can be verified by objective data or other suitable reference material which may not necessarily be Flight Test Data.
 - q. Grandfather Rights.
 - (i) The right of an STD operator to retain the Qualification Level granted under a previous regulation of an ICAO Member State.
 - (ii) Also the right of an STD user to retain the training and testing/checking credits which were gained under a previous regulation of an ICAO Member State.
 - r. Ground Effect. The change in aerodynamic characteristics due to modification of the air flow past the aeroplane caused by the presence of the ground.
 - s. Hands-off Manoeuvre. A test manoeuvre conducted or completed without pilot control inputs.
 - t. Hands-on Manoeuvre. A test manoeuvre conducted or completed with pilot control inputs as required.
 - u. Highlight Brightness. The maximum displayed brightness which satisfies the appropriate brightness test.
 - v. Icing Accountability. A demonstration of minimum required performance whilst operating in maximum and intermittent maximum icing conditions of the applicable airworthiness requirement.
 - w. Integrated Testing. Testing of the STD such that all aeroplane system models are active and contribute appropriately to the results. None of the aeroplane system models should be substituted with models or other algorithms intended for testing only. This may be accomplished by using controller displacements as the input. These controllers should represent the displacement of the pilot's controls and these controls should have been calibrated.
 - x. Irreversible Control System. A control system in which movement of the control surface will not backdrive the pilot's control on the flight deck.
 - y. Latency. The additional time, beyond that of the basic perceivable response time of the aeroplane due to the response time of the STD.
 - z. Line Oriented Flight Training (LOFT). Refers to flight crew training which involves full mission simulation of situations which are representative of line operations, with special emphasis on situations which involve communications, management and leadership. It means 'real-time', full-mission training.
 - aa. Manual Testing. STD testing wherein the pilot conducts the test without computer inputs except for initial setup. All modules of the simulation should be active.
 - bb. Master Qualification Test Guide (MQTG). The Authority approved QTG which incorporates the results of tests witnessed by the Authority. The MQTG serves as the reference for future evaluations.
 - cc. Non-normal Control. A term used in reference to Computer Controlled Aeroplanes. Non-normal Control is the state where one or more of the intended control, augmentation or Protection Functions are not fully available.
- (NOTE: Specific terms such as ALTERNATE, DIRECT, SECONDARY, BACKUP, etc, may be used to define an actual level of degradation).
- dd. Normal Control. A term used in reference to Computer Controlled Aeroplanes. Normal Control is the state where the intended control, augmentation and Protection Functions are fully available.
 - ee. Objective Test (Objective Testing). A quantitative assessment based on comparison with data.
 - ff. Power Lever Angle. The angle of the pilot's primary engine control lever(s) on the flight deck. This may also be referred to as PLA, THROTTLE, or POWER LEVER.



- gg. Predicted Data. Data derived from sources other than type specific aeroplane flight tests.
- hh. Proof-of-Match. A document which shows agreement within defined tolerances between model responses and flight test cases at identical test and atmospheric conditions.
- ii. Protection Functions. Systems functions designed to protect an aeroplane from exceeding its flight and manoeuvre limitations.
- jj. Pulse Input. An abrupt input to a control followed by an immediate return to the initial position.
- kk. Reversible Control System. A partially powered or unpowered control system in which movement of the control surface will backdrive the pilot's control on the flight deck.
- ll. Snapshot. A presentation of one or more variables at a given instant of time.
- mm. Statement of Compliance (SOC). A declaration that specific requirements have been met.
- nn. STD Data. The various types of data used to design, manufacture, test and maintain the STD.
- oo. STD Evaluation. A detailed appraisal of an STD by the Authority to ascertain whether or not the standard required for a specified Qualification Level is met.
- pp. Step Input. An abrupt input held at a constant value.
- qq. Subjective Test (Subjective Testing). A qualitative assessment based on established standards as interpreted by a suitably qualified person.
- rr. Time History. A presentation of the change of a variable with respect to time.
- ss. Transport Delay. The total STD system processing time required for an input signal from a pilot primary flight control until motion system, visual system, or instrument response occurs. It is the overall time delay incurred from signal input until output response. It does not include the characteristic delay of the aeroplane simulated.
- tt. Upgrade. The improvement or enhancement of an STD for the purpose of achieving a higher qualification.
- uu. Validation Data. Data used to prove that the STD performance corresponds to that of the aeroplane.
- vv. Validation Flight Test Data. Performance, stability and control, and other necessary test parameters electrically or electronically recorded in an aeroplane using a calibrated data acquisition system of sufficient resolution and verified as accurate by the organisation performing the test to establish a reference set of relevant parameters to which like STD parameters can be compared.
- ww. Validation Test. A test by which STD parameters can be compared with the relevant Validation Data.
- xx. Visual System Response Time. The interval from an abrupt control input to the completion of the visual display scan of the first video field containing the resulting different information.

2. Abbreviations

AC	=	Advisory Circular
AFM	=	Approved Flight Manual
AGL	=	Above Ground Level (meters or feet)
Airspeed	=	Calibrated airspeed unless otherwise specified (knots)
Altitude	=	Pressure altitude (meters or feet) unless specified otherwise
AOA	=	Angle of Attack (degrees)
Ad	=	Total initial displacement of pilot controller (Initial displacement to final resting amplitude)
An	=	Sequential amplitude of overshoot after initial X axis crossing, e.g. A1 = 1st overshoot.
Bank	=	Bank/Roll angle (degrees)



CCA	=	Computer Controlled Aeroplane
cd/m ²	=	candela/metre ² , 3.4263 candela/m ² = 1 ft-Lambert
cm(s)	=	centimetre, centimetres
CT&M	=	Correct Trend and Magnitude
daN	=	decaNewtons
deg(s)	=	degree, degrees
distance	=	distance in nautical miles unless specified otherwise
DME	=	Distance Measuring Equipment
EPR	=	Engine Pressure Ratio
FAA	=	Federal Aviation Administration (U.S.)
ft	=	feet, 1 foot = 0.304801 metre
ft-Lambert	=	foot-Lambert, 1 ft-Lambert = 3.4263 candela/m ²
fuel used	=	Mass of fuel used (kilos or pounds)
g	=	Acceleration due to Gravity (metres or feet/sec ²), 1g = 9.81 m/sec ² or 32.2 feet/sec ²
G/S	=	Glideslope
Height	=	Height above ground = AGL (metres or feet)
IATA	=	International Air Transport Association
IOS	=	Instructor Operating Station
IQTG	=	International Qualification Test Guide (RAeS Document)
km	=	Kilometres 1 km = 0.62137 Statute Miles
kPa	=	KiloPascal (Kilo Newton/Metres ²). 1 psi = 6.89476 kPa
kts	=	Knots calibrated airspeed unless otherwise specified, 1 Knot = 0.5148 m/sec or 1.689 ft/sec
lb	=	pounds
m	=	Metres, 1 Metre = 3.28083 feet
MCC	=	Multi-Crew Co-operation
Medium	=	Normal operational weight for flight segment
min	=	Minutes
MLG	=	Main Landing Gear
MPa	=	MegaPascals [1 psi = 6894.76 pascals]
ms	=	millisecond(s)
N	=	NORMAL CONTROL Used in reference to Computer Controlled Aeroplanes
NM	=	Nautical Mile 1 Nautical Mile = 6 080 feet = 1 852 m
NN	=	NON-NORMAL CONTROL Used in reference to Computer Controlled Aeroplanes
Nominal	=	Normal operational weight, configuration, speed, etc, for the flight segment specified
N1	=	Engine Low Pressure Rotor revolutions per minute
N2	=	Engine High Pressure Rotor revolutions per minute
NWA	=	Nosewheel Angle (degrees)
n	=	sequential period of a full cycle of oscillation
PAPI	=	Precision Approach Path Indicator System
Pitch	=	Pitch angle (degrees)
PLA	=	Power Lever Angle
P ₀	=	Time from pilot controller release until initial X axis crossing (X axis defined by the resting amplitude)
P ₁	=	First full cycle of oscillation after the initial X axis crossing
P ₂	=	Second full cycle of oscillation after the initial X axis crossing
P _n	=	Sequential period of oscillation
P _f	=	Impact or Feel Pressure



PLF	=	Power for Level Flight
psi	=	pounds per square inch
QTG	=	Qualification Test Guide
RAE	=	Royal Aerospace Establishment
RAeS	=	Royal Aeronautical Society
REIL	=	Runway End Identifier Lights
R/C	=	Rate of Climb (metres/sec or feet/min)
R/D	=	Rate of Descent (metres/sec or feet/min)
RVR	=	Runway Visual Range (metres or feet)
s	=	second(s)
sec(s)	=	second, seconds
1st Segment	=	That portion of the takeoff profile from lift-off to gear retraction
2nd Segment	=	That portion of the takeoff profile from after gear retraction to initial flap/slat retraction
3rd Segment	=	That portion of the takeoff profile after flap/slat retraction is complete
Sideslip	=	Sideslip Angle (degrees)
sm	=	Statute Miles 1 Statute Mile = 5 280 feet = 1 609 m
SOC	=	Statement of Compliance
T(A)	=	Tolerance applied to Amplitude
T(P)	=	Tolerance applied to Period
T/O	=	Takeoff
T _f	=	Total time of the flare manoeuvre duration
T _i	=	Total time from initial throttle movement until a 10% response of a critical engine parameter
T _t	=	Total time from T _i to a 90% increase or decrease in the power level specified
VASI	=	Visual Approach Slope Indicator System
VGS	=	Visual Ground Segment
V _{mca}	=	Minimum Control Speed (Air)
V _{mcg}	=	Minimum Control Speed (Ground)
V _{mcl}	=	Minimum Control Speed (Landing)
V _r	=	Rotate Speed
V _s	=	Stall Speed or minimum speed in the stall
WAT	=	Weight, Altitude, Temperature

**AMC/IEM C – AEROPLANE FLIGHT TRAINING DEVICES****AMC STD 2A.015 FTD Qualification – Application and Inspection**
(See IEM STD 2A.015)**1 Letter of Application**

A sample of letter of application is provided overleaf.



LETTER OF APPLICATION FOR INITIAL EVALUATION OF A FLIGHT TRAINING DEVICE

(Date)
PRINCIPAL INSPECTOR

(Address)

(City)

(Country)

Dear ,

..... (Name of Applicant)..... requests the evaluation of its(type)..... Flight Training Device for Level(1 or 2) qualification. The(FTD Manufacturer Name) FTD with its (Visual System Manufacturer Name if applicable) Visual System is fully defined on page of the accompanying Qualification Test Guide (QTG) which was run on..... (date)..... at(place)..... We have completed tests of the FTD and declare that it meets all applicable requirements of the YCAR-STD 2A (Aeroplane FTD) except as noted below. Appropriate hardware and software configuration control procedures have been established and these are appended for your inspection and approval.

The FTD has been assessed by the following evaluation team:

(name)	Qualification
(name)	Qualification
(name)	Qualification
(name)	Pilot's Licence Nr.....
(name).....	Flight Engineer's Licence Nr (if applicable)

who attest(s) that it conforms to the aeroplane flight deck configuration of(Name of STD operator).....(type of aeroplane) aeroplane and that the simulated systems and subsystems function equivalently to those in that aeroplane. This pilot has also assessed the performance and the flying qualities of the FTD and finds that it represents the designated aeroplane.

(additional comments as required)

The following tests are outstanding:

It is expected that they will be completed and submitted 3 weeks prior to the evaluation date.

Sincerely,

Print Name
Position/Appointment held



2 Composition of Evaluation Team.

2.1 To gain a Qualification Level, an FTD is evaluated in accordance with a structured routine conducted by a technical team which is appointed by the Authority and consists of at least:

- a. A Technical FTD Inspector of the Authority, qualified in all aspects of flight simulation hardware, software and computer modelling.
- b. A Flight Inspector of the Authority who is qualified in flight crew training procedures and type rated on the aeroplane.

Exceptionally, where either a Technical FTD Inspector or a type rated Flight Inspector is not available, an Authority designee may be used.

For an FTD level 1, one suitably qualified Inspector may combine the functions in a. and b. above.

2.2 Additionally the following persons should be present:

- a. A type rated Training Captain typically from the STD operator or main STD users.
- b. Sufficient FTD support staff to assist with the running of tests and operation of the instructor's station.

**IEM STD 2A.015 FTD Evaluations****See YCAR–STD 2A.015****1 General**

- 1.1 During initial and recurrent FTD evaluations it will be necessary for the Authority to conduct the Objective and Subjective Tests described in YCAR–STD 2A.030 and YCAR–STD 2A.035, and detailed in AMC STD 2A.030. There will be occasions when all tests cannot be completed – for example during recurrent evaluations on a convertible FTD – but arrangements should be made for all tests to be completed within a reasonable time.
- 1.2 Following an evaluation, it is possible that a number of defects may be identified; generally these defects should be rectified and the Authority notified of such action within 30 days. Serious defects which affect crew training, testing and checking could result in an immediate downgrading of the Qualification Level, or if any defects remain unattended without good reason for period greater than 30 days, subsequent downgrading may occur.

2 Initial Evaluations**2.1 Objective Testing**

- 2.1.1 Objective Testing is centred around the QTG. Before testing can begin on an initial evaluation the acceptability of the Validation Tests contained in the QTG should be agreed with the Authority well in advance of the evaluation date to ensure that the FTD time especially devoted to the running of some of the tests by the Authority is not wasted. The acceptability of all tests depends upon their content, accuracy, completeness and recency of the results.
- 2.1.2 Much of the time allocated to Objective Tests depends upon the speed of the automatic and manual systems set up to run each test and whether or not special equipment is required. The Authority will not necessarily warn the STD operator of the sample validations tests which will be run on the day of the evaluation, unless special equipment is required. It should be remembered that the FTD cannot be used for Subjective Tests whilst part of the QTG is being run. Therefore sufficient time should be set aside for the examination and running of the QTG.

2.2 Subjective Testing

- 2.2.1 The Subjective Tests for the evaluation can be found in AMC STD 2A.030, and a suggested Subjective Test Profile is described in IEM STD 2A.015 para 4.6.
- 2.2.2 Essentially one working day is required for the Subjective Test routine, which effectively denies use of the FTD for any other purpose.

2.3 Conclusion

To ensure adequate coverage of Subjective and Objective Tests and to allow for cost effective rectification and re-test before departure of the inspection team, up to three consecutive days should be dedicated to an initial evaluation of an FTD.

3 Recurrent Evaluations**3.1 Objective Testing**

- 3.1.1 During recurrent evaluations, the Authority will wish to see evidence of the successful running of the QTG between evaluations. The Authority will select a number of tests to be run during the evaluation, including those which may be cause for concern.

Again adequate notification would be given when special equipment is required for the test.

- 3.1.2 Essentially the time taken to run the Objective Tests depends upon the need for special equipment and the test system, and the FTD Level 2 cannot be used for Subjective Tests or other functions whilst testing is in progress. For a modern FTD level 2 incorporating an automatic test system, four (4) hours

would normally be required. FTDs which rely upon Manual Testing may require a longer period of time.

3.2 Subjective Testing

3.2.1 Essentially the same Subjective Test routine should be flown as per the profile described in IEM STD 2A.015 para 4.6 with a selection of the Subjective Tests taken from AMC STD 2A.030.

3.2.2 Normally, the time taken for recurrent Subjective Testing is about four (4) hours, and the FTD cannot perform other functions during this time.

3.3 Conclusion

To ensure adequate coverage of Subjective and Objective Tests during a recurrent evaluation, a total of 8 hours should be allocated for an FTD Level 2. However, it should be remembered that any FTD deficiency which arises during the evaluation could necessitate the extension of the evaluation period.

4 Functions and Subjective Tests – Suggested Test Routine

4.1 During initial and recurrent evaluations of an FTD, the competent Authority will conduct a series of Functions and Subjective Tests which together with the Objective Tests complete the comparison of the FTD with the aeroplane.

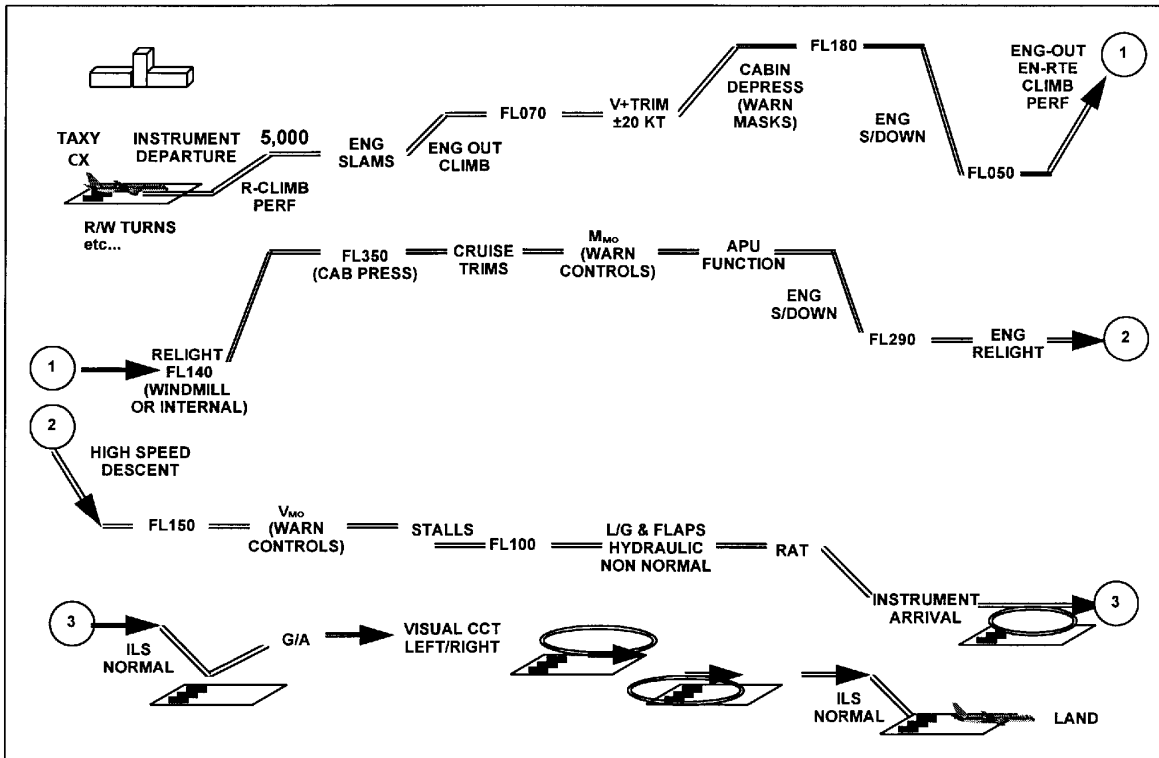
4.2 Whereas functions tests verify the acceptability of the simulated aeroplane systems and their integration, Subjective Tests verify the fitness of the FTD in relation to training, checking and testing tasks.

4.3 The FTD should provide adequate flexibility to permit the accomplishment of the desired/required tasks while maintaining an adequate perception by the flight crew that they are operating in a real aeroplane environment. Additionally, the operation of the Instructor Operating Station (IOS) should be simple enough to give the instructor spare capacity to observe the activities of the flight crew.

4.4 Section 1 of YCAR–STD 2A sets out the requirements, and the AMCs in Section 2 the means of compliance for FTD qualification. However, it is important that both the competent Authority and the STD operator understand what to expect from the routine of FTD Functions and Subjective Tests. It should be remembered that part of the Subjective Tests routine for an FTD Level 2 should involve an uninterrupted fly-out comparable with the duration of typical training sessions in addition to assessment of flight freeze and repositioning. An example of such a profile is to be found in para 4.6 below. (A useful explanation of Functions and Subjective Tests and an example of Subjective Test routine check-list may be found in the RAeS Airplane Flight Simulator Evaluation Handbook Volume II produced in support of the IQTG and the YCAR–STD document.)

4.5 Regulatory Authorities and STD operators who are unfamiliar with the evaluation process are advised to contact CAMA.

4.6 Typical Test Profile for an FTD level 2 (2 hours)



(*) NOTE:

- (1) Flight with AFCS
- (2) Manual handling qualities are purely generic and should not provide negative training.

**AMC STD 2A.025 Quality System****See YCAR–STD 2A.025****1 Introduction**

- 1.1 In order to show compliance with YCAR–STD 2A.025, an STD operator should establish his Quality System in accordance with the instructions and information contained in the following paragraphs.

2 General**2.1 Terminology**

- a. The terms used in the context of the requirement for an STD operator's Quality System have the following meanings:
- i. *Accountable Manager.* The person acceptable to the Authority who has corporate authority for ensuring that all necessary activities can be financed and carried out to the standard required by the Authority, and any additional requirements defined by the STD operator.
- ii. *Quality Assurance.* All those planned and systematic actions necessary to provide adequate confidence that specified performance, functions and characteristics satisfy given requirements.
- iii. *Quality Manager.* The manager, acceptable to the Authority, responsible for the management of the Quality System, monitoring function and requesting corrective actions.

2.2 Quality Policy

- 2.2.1 An STD operator should establish a formal written Quality Policy Statement that is a commitment by the Accountable Manager as to what the Quality System is intended to achieve. The Quality Policy should reflect the achievement and continued compliance with YCAR–STD 2A together with any additional standards specified by the STD operator.
- 2.2.2 The Accountable Manager is an essential part of the STD qualification holder's organisation. With regard to the above terminology, the term 'Accountable Manager' is intended to mean the Chief Executive/President/Managing Director/General Manager etc. of the STD operator's organisation, who by virtue of his position has overall responsibility (including financial) for managing the organisation .
- 2.2.3 The Accountable Manager will have overall responsibility for the STD qualification holder's Quality System including the frequency, format and structure of the internal management evaluation activities as prescribed in paragraph 4.9 below.

2.3 Purpose of the Quality System

- 2.3.1 The Quality System should enable the operator to monitor compliance with YCAR–STD 2A, and any other standards specified by that STD operator, or the Authority, to ensure correct maintenance and performance of the device.

2.4 Quality Manager

- 2.4.1 The primary role of the Quality Manager is to verify, by monitoring activity in the fields of STD qualification, that the standards required by the Authority, and any additional requirements defined by the STD operator, are being carried out under the supervision of the relevant Manager.
- 2.4.2 The Quality Manager should be responsible for ensuring that the Quality Assurance Programme is properly established, implemented and maintained.
- 2.4.3 The Quality Manager should:
- a. Have direct access to the Accountable Manager;
- b. Have access to all parts of the STD operator's and, as necessary, any sub-contractor's organisation.



2.4.4 The posts of the Accountable Manager and the Quality Manager may be combined by STD operators, whose structure and size may not justify the separation of those two posts. However, in this event, Quality Audits should be conducted by independent personnel.

3 Quality System

3.1 Introduction

3.1.1 The STD operator's Quality System should ensure compliance with STD Qualification requirements, standards and procedures.

3.1.2 The STD operator should specify the structure of the Quality System.

3.1.3 The Quality System should be structured according to the size and complexity of the organisation to be monitored.

3.2 Scope

3.2.1 As a minimum, the Quality System should address the following:

- a. The provisions of YCAR–STD 2A;
- b. The STD operator's additional standards and procedures;
- c. The STD operator's Quality Policy;
- d. The STD operator's organisational structure;
- e. Responsibility for the development, establishment and management of the Quality System;
- f. Documentation, including manuals, reports and records;
- g. Quality Procedures;
- h. Quality Assurance Programme;
- i. The required financial, material, and human resources;
- j. Training requirements.

3.2.2 The Quality System should include a feedback system to the Accountable Manager to ensure that corrective actions are both identified and promptly addressed. The feedback system should also specify who is required to rectify discrepancies and non-compliance in each particular case, and the procedure to be followed if corrective action is not completed within an appropriate timescale.

3.3 Relevant Documentation

3.3.1 Relevant documentation should include the following:

- a. Quality Policy;
- b. Terminology;
- c. Reference to specified STD technical standards;
- d. A description of the organisation;
- e. The allocation of duties and responsibilities;
- f. Qualification procedures to ensure regulatory compliance;
- g. The Quality Assurance Programme, reflecting:

- i. Schedule of the monitoring process;
- ii. Audit procedures;
- iii. Reporting procedures;
- iv. Follow-up and corrective action procedures;
- v. Recording system;
- h. Document control.

4 Quality Assurance Programme

4.1 Introduction

4.1.1 The Quality Assurance Programme should include all planned and systematic actions necessary to provide confidence that all maintenance is conducted and all performance is maintained in accordance with all applicable requirements, standards and procedures.

4.1.2 When establishing a Quality Assurance Programme, consideration should, at least, be given to the paragraphs 4.2 to 4.9 below.

4.2 Quality Inspection

4.2.1 The primary purpose of a quality inspection is to observe a particular event/action/document etc., in order to verify whether established procedures and requirements are followed during the accomplishment of that event and whether the required standard is achieved.

4.2.2 Typical subject areas for quality inspections are:

- a. Actual STD operation;
- b. Maintenance;
- c. Technical standards;
- d. STD safety features.

4.3 Audit

4.3.1 An audit is a systematic and independent comparison of the way in which an activity is being conducted against the way in which the published procedures say it should be conducted.

4.3.2 Audits should include at least the following quality procedures and processes:

- a. A statement explaining the scope of the audit;
- b. Planning and preparation;
- c. Gathering and recording evidence; and
- d. Analysis of the evidence.

4.3.3 Techniques which contribute to an effective audit are:

- a. Interviews or discussions with personnel;
- b. A review of published documents;
- c. The examination of an adequate sample of records;
- d. The witnessing of the activities which make up the operation; and



- e. The preservation of documents and the recording of observations.

4.4 Auditors

- 4.4.1 An STD operator should decide, depending on the complexity and size of the organisation, whether to make use of a dedicated audit team or a single auditor. In any event, the auditor or audit team should have relevant STD experience.

- 4.4.2 The responsibilities of the auditors should be clearly defined in the relevant documentation.

4.5 Auditor's Independence

- 4.5.1 Auditors should not have any day-to-day involvement in the area of activity which is to be audited. An STD operator may, in addition to using the services of full-time dedicated personnel belonging to a separate quality department, undertake the monitoring of specific areas or activities by the use of part-time auditors. Due to the technological complexity of flight simulators and other STDs, which requires auditors with very specialised knowledge and experience, an STD operator may undertake the audit function by the use of part-time personnel from within his own organisation or from an external source under the terms of an agreement acceptable to the Authority. In all cases the STD operator should develop suitable procedures to ensure that persons directly responsible for the activities to be audited are not selected as part of the auditing team. Where external auditors are used, it is essential that any external specialist is familiar with the type of device conducted by the STD operator.

- 4.5.2 The STD operator's Quality Assurance Programme should identify the persons within the company who have the experience, responsibility and authority to:

- a. Perform quality inspections and audits as part of ongoing Quality Assurance;
- b. Identify and record any concerns or findings, and the evidence necessary to substantiate such concerns or findings;
- c. Initiate or recommend solutions to concerns or findings through designated reporting channels;
- d. Verify the implementation of solutions within specific time scales;
- e. Report directly to the Quality Manager.

4.6 Audit Scope

- 4.6.1 STD operators are required to monitor compliance with the procedures they have designed to ensure specified performance and functions. In doing so they should as a minimum, and where appropriate, monitor:

- a. Organisation;
- b. Plans and objectives;
- c. Maintenance procedures;
- d. STD Qualification Level;
- e. Supervision;
- f. STD technical status;
- g. Manuals, Logs, and Records;
- h. Defect deferral;
- i. Personnel training;
- j. Aeroplane modification management;



4.7 Audit scheduling

- 4.7.1 A Quality Assurance Programme should include a defined audit schedule and a periodic review. The schedule should be flexible, and allow unscheduled audits when trends are identified. Follow-up audits should be scheduled when necessary to verify that corrective action was carried out and that it was effective.
- 4.7.2 An STD operator should establish a schedule of audits to be completed during a specified calendar period. All aspects of the operation should be reviewed within every period of 12 months in accordance with the programme unless an extension to the audit period is accepted as explained below. An operator may increase the frequency of audits at his discretion but should not decrease the frequency without the agreement of the Authority.
- 4.7.3 When an STD operator defines the audit schedule, significant changes to the management, organisation, or technologies should be considered as well as changes to the regulatory requirements.
- 4.7.4 For STD operators whose structure and size do not justify the completion of a complex system of audits it may be appropriate to develop a Quality Assurance Programme that employs a checklist. The checklist should have a supporting schedule that requires completion of all checklist items within a specified time scale, together with a statement acknowledging completion of a periodic review by top management.
- 4.7.5 Whatever arrangements are made, the STD operator retains the ultimate responsibility for the Quality System and especially the completion and follow up of corrective actions.

4.8 Monitoring and Corrective Action

- 4.8.1 The aim of monitoring within the Quality System is primarily to investigate and judge its effectiveness and thereby to ensure that defined policy, performance and function standards are continuously complied with. Monitoring activity is based upon quality inspections, audits, corrective action and follow-up. The STD operator should establish and publish a quality procedure to monitor regulatory compliance on a continuing basis. This monitoring activity should be aimed at eliminating the causes of unsatisfactory performance.
- 4.8.2 Any non-compliance identified as a result of monitoring should be communicated to the manager responsible for taking corrective action or, if appropriate, the Accountable Manager. Such non-compliance should be recorded, for the purpose of further investigation, in order to determine the cause and to enable the recommendation of appropriate corrective action.
- 4.8.3 The Quality Assurance Programme should include procedures to ensure that corrective actions are taken in response to findings. These quality procedures should monitor such actions to verify their effectiveness and that they have been completed. Organisational responsibility and accountability for the implementation of corrective actions resides with the department cited in the report identifying the finding. The Accountable Manager will have the ultimate responsibility for resourcing the corrective action and ensuring, through the Quality Manager, that the corrective action has re-established compliance with the standard required by the Authority, and any additional requirements defined by the STD operator.
- 4.8.4 Corrective action
- a. Subsequent to the quality inspection/audit, the STD operator should establish:
 - i. The seriousness of any findings and any need for immediate corrective action;
 - ii. Cause of the finding;
 - iii. What corrective actions are required to ensure that the non-compliance does not recur;
 - iv. A schedule for corrective action;
 - v. The identification of individuals or departments responsible for implementing corrective action;
 - vi. Allocation of resources by the Accountable Manager, where appropriate.



4.8.5 The Quality Manager should:

- a. Verify that corrective action is taken by the manager responsible in response to any finding of non-compliance;
- b. Verify that corrective action includes the elements outlined in paragraph 4.8.4 above;
- c. Monitor the implementation and completion of corrective action;
- d. Provide management with an independent assessment of corrective action, implementation and completion;
- e. Evaluate the effectiveness of corrective action through the follow-up process.

4.9 Management Evaluation

4.9.1 A management evaluation is a comprehensive, systematic, documented review of the Quality System and procedures by the management, and it should consider:

- a. The results of quality inspections, audits and any other indicators;
- b. The overall effectiveness of the management organisation in achieving stated objectives.

4.9.2 A management evaluation should identify and correct trends, and prevent, where possible, future non-conformities. Conclusions and recommendations made as a result of an evaluation should be submitted in writing to the responsible manager for action. The responsible manager should be an individual who has the authority to resolve issues and take action.

4.9.3 The Accountable Manager should decide upon the frequency, format, and structure of internal management evaluation activities.

4.10 Recording

4.10.1 Accurate, complete, and readily accessible records documenting the results of the Quality Assurance Programme should be maintained by the STD operator. Records are essential data to enable an STD operator to analyse and determine the root causes of non-conformity, so that areas of non-compliance can be identified and addressed.

4.10.2 The following records should be retained for a period of 5 years:

- a. Audit Schedules;
- b. Quality inspection and Audit reports;
- c. Responses to findings;
- d. Corrective action reports;
- e. Follow-up and closure reports; and
- f. Management Evaluation reports.

5 Quality Assurance responsibility for sub-contractors

5.1 Sub-contractors

5.1.1 STD operators may decide to sub-contract out certain activities to external agencies for the provision of services related to areas such as:

- a. Maintenance;
- b. Manual preparation.



5.1.2 The ultimate responsibility for the product or service provided by the sub-contractor always remains with the STD operator. A written agreement should exist between the STD operator and the sub-contractor clearly defining the services and quality to be provided. The sub-contractor's activities relevant to the agreement should be included in the STD operator's Quality Assurance Programme.

5.1.3 The STD operator should ensure that the sub-contractor has the necessary authorisation/approval when required, and commands the resources and competence to undertake the task. If the STD operator requires the sub-contractor to conduct activity which exceeds the sub-contractor's authorisation/approval, the STD operator is responsible for ensuring that the sub-contractor's Quality Assurance takes account of such additional requirements.

6 Quality System Training

6.1 General

6.1.1 An STD operator should establish effective, well planned and resourced quality related briefing for all personnel.

6.1.2 Those responsible for managing the Quality System should receive training covering:

- a. An introduction to the concept of the Quality System;
- b. Quality management;
- c. Concept of Quality Assurance;
- d. Quality manuals;
- e. Audit techniques;
- f. Reporting and recording; and
- g. The way in which the Quality System will function in the organisation.

6.1.3 Time should be provided to train every individual involved in quality management and for briefing the remainder of the employees. The allocation of time and resources should be sufficient for the scope of the training.

6.2 Sources of Training

6.2.1 Quality management courses are available from the various national or international Standards Institutions, and an STD operator should consider whether to offer such courses to those likely to be involved in the management of Quality Systems. STD operators with sufficient appropriately qualified staff should consider whether to carry out in-house training.

**AMC STD 2A.030 FTDs qualified on or after 1 January 2005****See YCAR STD 2A.030**

Note: AMC STD 2A.030 is an Acceptable Means of Compliance. The structure and numbering of this AMC departs from normal layout due to the complexity of the technical content and the need to retain harmonization with the ICAO Manual of Criteria for the Qualification of Flight Simulators (1995), FAA AC 120-40B, AC 120-40C (draft), AC 120-45A, YCAR-STD 1A and YCAR-STD 3A.

1 Introduction

1.1 Purpose. This AMC establishes the standards which define the performance and documentation requirements for the evaluation of aeroplane FTDs used for training, testing and checking of flight crew members. These test standards and methods of compliance were derived from extensive experience of competent Authorities and industry.

1.2 Background

1.2.1 The availability of advanced technology has permitted greater use of FTDs for training, testing and checking of flight crew members. The complexity, costs and operating environment of modern aeroplanes also have encouraged broader use of advanced simulation. FTDs can assist Flight Simulator training to provide more in-depth training than can be accomplished in aeroplanes and provide a safe and suitable learning environment.

1.2.2 The methods, procedures, and testing standards contained in this AMC are the result of the experience and expertise of Authorities, STD operators and manufacturers of aeroplanes and STDs (Flight Simulators, FTDs and FNPTs).

1.3 Levels of FTD Qualification. Parts 2, 3 and 4 of this AMC describe the minimum requirements for qualifying Level 1 and 2 aeroplane FTDs.

Note: Where an FTD Level 1 simulates an aeroplane system, it shall comply with the relevant subjective and objective tests relevant to that system.

1.4 Terminology. Terminology and abbreviations of terms as used in this AMC are contained in AMC STD 2A.005.

1.5 Testing for FTD Qualification

1.5.1 The FTD should be assessed in those areas which are essential to completing the flight crew member training, testing and checking process. This includes the FTD's specific operations, control checks, flight deck, flight engineer and instructor station functions checks, and certain additional requirements depending on the complexity or Qualification Level of the FTD. The motion system and visual system where fitted will be evaluated to ensure their proper operation.

1.5.2 The intent is to evaluate the FTD as objectively as possible. Pilot acceptance, however, is also an important consideration. Therefore, the FTD will be subjected to Validation, and Functions and Subjective Tests listed in Part 3 and 4 of this AMC. Validation Tests are used to compare objectively FTD performances and aeroplane data to ensure that they agree within specified tolerances. Functions and Subjective Tests provide a basis for evaluating FTD capability to perform over a typical training period and to verify correct operation of the FTD.

1.5.3 Tolerances listed for parameters in the Validation Tests (Part 3) of this AMC should not be confused with FTD design tolerances. Validation Test tolerances are the maximum acceptable for FTD qualification.

1.5.4 For initial qualification testing of FTDs the aeroplane manufacturer's approved Data is preferred. Data from other sources may be used, subject to the review and concurrence of the Authority.

1.5.5 In the case of new aeroplane programmes, the aeroplane manufacturer's Predicted Data partially validated may be used in the interim qualification of the FTD. However, the FTD should be re-evaluated following the release of the manufacturer's approved data. The schedule should be as agreed by the Authority, STD operator, STD manufacturer, and aeroplane manufacturer.



1.5.6 During STD evaluation, if a problem is encountered with a particular Validation Test, the test may be repeated to ascertain if the problem was caused by test equipment or STD operator error. Following this, if the test problem persists an STD operator should be prepared to offer alternative test results which relate to the test in question.

1.5.7 Validation Tests which do not meet the test criteria should be addressed to the satisfaction of the Authority.

1.6 Qualification Test Guide (QTG)

1.6.1 The QTG is the primary reference document used for evaluating an FTD. It contains test results, Statements of Compliance and other information for the evaluator to assess if the FTD meets the test criteria described in this AMC.

1.6.2 The STD operator should submit a QTG which includes:

- a. A title page with STD operator and approval Authority signature blocks.
- b. An STD information page (for each configuration in the case of convertible FTDs) providing:
 - i. STD operator's STD identification number.
 - ii. Aeroplane model and series being simulated.
 - iii. Aerodynamic data revision.
 - iv. Engine model and its data revision.
 - v. Avionic equipment system identification where the revision level affects the training and checking capability of the STD.
 - vi. STD model and manufacturer.
 - vii. Date of STD manufacture.
 - viii. STD computer identification.
 - ix. Visual system type and manufacturer (if fitted).
 - x. Motion system type and manufacturer (if fitted).
- c. Table of contents.
- d. Log of revisions and/or list of effective pages.
- e. Listing of all reference and source data.
- f. Glossary of terms and symbols used.
- g. Statements of Compliance (SOC) with certain requirements. SOC's should refer to sources of information and show compliance rationale to explain how the referenced material is used, applicable mathematical equations and parameter values, and conclusions reached.
- h. Recording procedures and required equipment for the Validation Tests.
- i. The following items for each Validation Test designated in Part 3 of this AMC:
 - i. Test Title. This should be short and definitive, based on the test title referred to in AMC STD 2A.030 para 3.
 - ii. Test objective. This should be a brief summary of what the test is intended to demonstrate.



- iii. Demonstration procedure. This is a brief description of how the objective is to be met.
 - iv. References. These are the aeroplane data source documents including both the document number and the page/condition number.
 - v. Initial conditions. A full and comprehensive list of the test initial conditions is required.
 - vi. Manual test procedures. Procedures should be sufficient to enable the test to be flown by a qualified pilot (or qualified inspector for FTD 1), using reference to flight deck instrumentation and without reference to other parts of the QTG or Flight Test Data.
 - vii. Automatic test procedures (if applicable).
 - viii. Evaluation criteria. Specify the main parameter(s) under scrutiny during the test.
 - ix. Expected result(s). The aeroplane result, including tolerances and, if necessary, a further definition of the point at which the information was extracted from the source data.
 - x. Test result. Dated STD Validation Test results obtained by the STD operator. Tests run on a computer which is independent of the STD are not acceptable.
 - xi. Source data. Copy of the aeroplane source data, clearly marked with the document, page number, issuing authority, and the test number and title as specified in a. above. Computer generated displays of Flight Test Data overplotted with STD Data are insufficient on their own for this requirement.
 - xii. Comparison of results. An acceptable means of easily comparing STD test results with the Validation Flight Test Data. The preferred method is overplotting.
 - j. A Statement of Compliance (SOC) covering the Functions and Subjective Tests designated in Paragraph 3.5 below.
- 1.7 Configuration control. A configuration control system should be established and maintained to ensure the continued integrity of the hardware and software as originally qualified.
- 1.8 Procedures for initial FTD Qualification
- 1.8.1 The request for evaluation should reference the QTG and also include a statement that the STD operator has thoroughly tested the FTD and that it meets the criteria described in this document except as noted in the application form. The STD operator should further certify that all the QTG checks, for the requested Qualification Level, have been achieved and that the FTD is representative of the respective aeroplane.
- 1.8.2 A copy of the STD operator's QTG, marked with test results, should accompany the request. Any QTG deficiencies raised by the Authority should be addressed prior to the start of the on-site evaluation.
- 1.8.3 The STD operator may elect to accomplish the QTG Validation Tests while the FTD is at the manufacturer's facility. Tests at the manufacturer's facility should be accomplished at the latest practical time prior to disassembly and shipment. The STD operator should then validate FTD performance at the final location by repeating at least one third of the Validation Tests in the QTG and submitting those tests to the Authority. After review of these tests, the Authority will schedule an initial evaluation. The QTG should be clearly annotated to indicate when and where each test was accomplished.
- 1.9 FTD recurrent qualification basis
- 1.9.1 Following satisfactory completion of the initial evaluation and qualification tests, a periodic check system should be established to ensure that FTDs continue to maintain their initially qualified performance, functions and other characteristics.
- 1.9.2 The STD operator should run the complete QTG (QTG) – which includes Validation, Functions and Subjective Tests (see para. 3.5 below) – between each annual evaluation by the Authority. The QTG should be run progressively, dated and retained in order to satisfy both the FTD operator as well as the Authority that the FTD standards are being maintained.
- NOTE: It is not intended that the complete QTG is run just prior to the annual evaluation.

2 FTD standards

2.1 General

The test should show that the requirement has been attained. In the following tabular listing of FTD standards, required Statements of Compliance (SOC) are indicated in the comments column.

FTD STANDARDS	FTD Level		COMMENTS
	1	2	
a. An enclosed flight deck which will have actuation of controls and switches that replicate those of the aeroplane simulated. A full size panel of replicated system(s) which will have actuation of controls and switches that replicate those of the aeroplane simulated.	✓	✓	The use of electronically displayed images with physical overlay incorporating operable switches, knobs, buttons replicating aeroplane instruments panels may be acceptable.
b. Lighting environment for panels and instruments shall be sufficient for the operation being conducted. Lighting environment shall be as per aeroplane.	✓	✓	
c. Circuit breakers shall function accurately when involved in operating procedures or malfunctions requiring or involving flight crew response. Circuit breakers that affect procedures and/or result in observable flight deck indications should be properly located and functionally accurate.	✓	✓	
d. Effect of aerodynamic changes for various combinations of drag and thrust normally encountered in flight corresponding to actual flight conditions, including the effect of change in aeroplane attitude, angle of attack, thrust, drag, altitude, temperature, gross weight, centre of gravity location, and configuration.		✓	See para. n. below.
e. Digital or analogue computing sufficient to conduct complete operation of the device including its evaluation and testing.	✓	✓	SOC
f. All relevant instrument indications involved in the simulation of the applicable aeroplane automatically respond to control input.	✓	✓	
g. Navigational data with the corresponding approach facilities. All navigation aids should be usable within range without restriction.	✓	✓	Applies to FTD 1 only where navigation equipment is replicated. Where FTD 2 is used for area or airfield competence training or checking, navigation data should be updated within 28 days.
h. Crew member seats should afford the capability for the occupants to be able to achieve the design eye reference position for the replicated aeroplane.		✓	



FTD STANDARDS	FTD Level		COMMENTS
	1	2	
i. In addition to the flight crew member stations, suitable seating arrangements for the Instructor/Examiner and Authority's Inspector. These seats shall provide adequate view of crew members' panel(s).	✓	✓	
j. It should be possible to perform normal, abnormal and emergency conditions, as may be appropriate. Once activated proper system operation shall result from system management by the flight crew and not require input from instructor controls.	✓	✓	
k. Instructor's controls to enable the STD operator to control all required system variables and insert abnormal or emergency conditions into the aeroplane systems.	✓	✓	Freeze facilities are recommended for FTD Level 2.
l. Control forces and control travel should correspond to that of the replicated aeroplane with CT&M.		✓	It is not intended that the device should be flown manually other than for short periods when the autopilot is temporarily disengaged.
m. Significant flight deck sounds (including engines) corresponding to those of the aeroplane, which result from pilot actions.		✓	
n. Aerodynamic and environment modelling sufficient to permit accurate systems operation and indication.	✓	✓	
o. Timely permanent update of FTD hardware and programming consistent with aeroplane modifications.	✓	✓	SOC
p. A Qualification Test Guide shall be submitted by the STD operator in a form and manner which is acceptable to the competent Authority.	✓	✓	
q. Visual system (if installed).	✓	✓	<p>1. If the visual system is to be used for the training of manoeuvring by visual reference (such as route and airfield competence) then the visual system should at least comply with that required for level A Flight Simulator.</p> <p>2. When other visual systems have been added by the STD operator even though not attracting specific credits, they will be assessed to ensure that they do not adversely affect the qualification of the STD.</p> <p>Also see Appendix 1 to YCAR-STD 2A.030 (Credits).</p>

3 FTD Validation Tests

3.1 Discussion

- 3.1.1 FTD performance and system operation shall be objectively evaluated by comparing the results of tests conducted in the FTD with aeroplane manufacturer's approved data unless specifically noted otherwise. To facilitate the validation of the FTD, a multi-channel recorder, line printer, or other appropriate recording device acceptable to the Authority is preferred to record each Validation Test result. These recordings should then be compared with the approved source data.



- 3.1.2 Certain visual, sound and motion tests in this AMC are not necessarily based upon validation data with specific tolerances. However, these tests are included here for completeness, and the required criteria shall be fulfilled instead of meeting a specific tolerance.
- 3.1.3 The QTG provided by the STD operator shall describe clearly and distinctly how the FTD will be set up and operated for each test. Use of a driver programme designed to automatically accomplish the tests is encouraged. It is not the intent, nor is it acceptable, to test each FTD subsystem independently. Overall Integrated Testing of the FTD shall be accomplished to assure that the total FTD system meets the prescribed standards. A test procedure with explicit and detailed steps for completion of each test shall also be provided.
- 3.1.4 The tests and tolerances contained in this AMC shall be included in the STD operator's QTG. An STD operator may, after making reasonable attempts to obtain aeroplane manufacturer approved data, indicate in the QTG where such data are unavailable or unsuitable for a specific test. In advance of submitting the QTG the alternative data should be submitted to the Authority for approval.
- 3.1.5 Although FTDs are not designed for the purpose of training and testing of flight handling skills, it will be necessary, particularly for FTD Level 2 to include tests which ensure stability and repeatability of the generic flight package. These tests are also indicated in the tables.

3.2 Test requirements

- 3.2.1 The ground and flight tests required for qualification are listed in the Table of Validation Tests. Computer generated FTD test results are preferred for each test. The results should be produced preferably on a multi-channel recorder, line printer, or other appropriate recording device acceptable to the Authority. Time histories are required where indicated in the Table of Validation Tests.
- 3.2.2 Approved data which exhibit rapid variations of the measured parameters may require engineering judgment when making assessments of FTD validity. Such judgment shall not be limited to a single parameter. All relevant parameters related to a given manoeuvre or flight condition shall be provided to allow overall interpretation. When it is difficult or impossible to match FTD to approved data throughout a time history, differences should be justified by providing a comparison of other related variables for the condition being assessed.
- 3.2.2.1 Parameters, tolerances, and flight conditions. The table of Validation Tests of AMC STD 2A.030 para 3 describes the parameters, tolerances, and flight conditions for FTD validation. When two tolerance values are given for a parameter, the less restrictive may be used unless indicated otherwise. If a flight condition or operating condition is shown which does not apply to the Qualification Level sought, it should be disregarded. FTD results shall be labelled using the tolerances and units given.
- 3.2.2.2 Flight condition verification. When comparing the parameters listed to those of the aeroplane, sufficient data shall also be provided to verify the correct flight condition. All values should be clearly annotated as to indicated, calibrated, etc., and like values used for comparison.
- 3.2.2.3 Where the tolerances have been replaced by 'Correct Trend and Magnitude' (CT&M), the FTD shall be tested and assessed as representative of the aeroplane to the satisfaction of the Authority. To facilitate future evaluations, sufficient parameters should be recorded to establish a reference.

3.3 FTD technical specification

It is essential that a structured process is followed for the initial acceptance and recurrent validation of FTDs. To gain and maintain a Qualification Level, the following process should be followed:

- a. A design specification is presented to the Authority. The specification should contain a statement of the source data and the target performance of the device in the relevant stages of flight.
- b. A proposed QTG should accompany the design specification document.
- c. When the device is constructed an acceptance test comprising of Objective, Functional and Subjective Tests should be completed. If Subjective Testing discloses unacceptable flight characteristics, then data package and QTG may be amended to improve handling and performance characteristics.

Following the subjective tuning described in c. above, and a further acceptance test completed by the Authority, the QTG criteria should be frozen to provide criteria against which the device will be assessed (using stated tolerances) to ensure repeatability during recurrent qualification tests.



3.4 Table of Validation Tests

The tolerances listed below are intended for the evaluation of FTD for initial qualification, except where CT&M is indicated. In all cases the tests are intended for use in recurrent evaluations at least to ensure repeatability.

A number of tests within the QTG have had their requirements reduced to 'Correct Trend and Magnitude' (CT&M) for initial evaluations thereby avoiding the need for specific Flight Test Data. Where CT&M is used it is strongly recommended that an automatic recording system be used to 'footprint' the baseline results thereby avoiding the effects of possible divergent subjective opinions on recurrent evaluation.

However, the use of CT&M is not to be taken as an indication that certain areas of simulation can be ignored. It is imperative that the specific characteristics are present, and incorrect effects would be unacceptable.

It should also be noted that where the FTD is intended for checking and testing, the FTD is required to comply with the same criteria as for the Flight Simulator. Where manual handling characteristics are tested, they are for the purpose of validating the model and do not imply that pilot handling, training and checking are permitted.

Note: Although Level 1 and 2 FTDs are not listed separately against each Test in the table, the test and associated criteria apply to both levels of FTDs. However it is accepted that tests and associated tolerances will only apply to a Level 1 FTD if that system or flight condition is simulated.

Tests	Tolerances	Flight Conditions	Comments	Evaluation	
				Initial	Recurr.
1. PERFORMANCE					
a.	Intentionally left blank				
b. TAKE-OFF					
(1) Ground Acceleration Time	$\pm 5\%$ Time or ± 1 sec	Ground/Take-off	Acceleration time should be recorded for a minimum of 80% of the total time from brake release to V_r .	C T & M	✓
(2) One Engine Inoperative second Segment Climb	± 3 Kts Airspeed $\pm 5\%$ or ± 0.5 m/s (100 ft/min) Rate of Climb	2nd Segment Climb	Manufacturers' gross climb gradient may be used for Flight Test Data and Rate of Climb cannot be less than Approved Flight Manual values. Test at WAT (Weight, Altitude, or Temperature) limiting condition. May be a Snapshot test.	C T & M	✓
(3) One Engine Inoperative En route Climb	$\pm 10\%$ Time $\pm 10\%$ Distance $\pm 10\%$ Fuel Used	En route Climb	Approved Performance Manual data may be used. Test for at least a 1 550 M (5 000 ft) segment.	C T & M	✓



Tests	Tolerances	Flight Conditions	Comments	Evaluation	
				Initial	Recurr.
d. CRUISE (1) Cruise Performance	± 0.05 EPR ± 5% of N1 and N2 ± 5% Torque ± 5% Fuel Flow	Cruise	May be a minimum of two consecutive Snapshots with a spread of at least 5 minutes.	✓	✓
f. ENGINES (1) Acceleration	± 10% T _i ± 10% T _t	Approach or Landing	T _i = Total time from initial throttle movement until a ± 10% response of a Critical Engine Parameter. T _t = Total time from T _i to 90% of Go Around Power. Critical Engine Parameter should be a measure of power (N1, N2, EPR, etc). Plot from Flight Idle to Go Around power for a rapid throttle movement. CT&M acceptable for piston engines.	✓	✓
2. HANDLING QUALITIES a. STATIC CONTROL CHECKS					
Note: Column, wheel, and pedal position vs. force or time should be measured at the control. An alternative method would be to instrument the FTD in an equivalent manner to the flight test aeroplane. The force and position data from this instrumentation can be directly recorded and matched to the approved data. Such a permanent installation could be used without any time for installation of external devices.					
(1) Column Position vs. Force and Surface Position Calibration	± 0.9 daN (2 lbs) Breakout. ± 2.2 daN (5 lbs) or ± 10% Force. ± 2 degs Elevator Angle	Ground	Uninterrupted Control Sweep to stops. CCA: Position vs. force not applicable if aeroplane flight deck controller is used.	C T & M	✓
(2) Wheel Position vs. Force and Surface Position Calibration	± 0.9 daN (2 lbs) Breakout. ± 1.3 daN (3 lbs) or ± 10% Force. ± 1 deg Aileron Angle ± 3 degs Spoiler Angle	Ground	Uninterrupted Control Sweep to stops. CCA: Position vs. force not applicable if aeroplane flight deck controller is used.	C T & M	✓
(3) Pedal Position vs. Force and Surface Position Calibration	± 2.2 daN (5 lbs) Breakout. ± 2.2 daN (5 lbs) or ± 10% Force. ± 2 degs Rudder Angle	Ground	Uninterrupted Control Sweep to stops.	C T & M	✓



Tests	Tolerances	Flight Conditions	Comments	Evaluation	
				Initial	Recurr.
(6) Pitch Trim Calibration Indicator vs. Computed	± 0.5 degs of Computer Trim Angle. $\pm 10\%$ Trim Rate (deg/sec)	Ground and Go Around	Trim rate to be checked at pilot primary induced trim rate (ground) and autopilot or pilot primary trim rate in flight at Go Around flight conditions.	✓	✓
(7) Alignment of Power Lever Angle vs. Selected Engine Parameter (EPR, N1, Torque)	± 5 degs of Power Lever Angle	Ground	Simultaneous recording for all engines. The 5 deg tolerance applies against approved data and between engines. May be a Snapshot test.	✓	✓
Note: In the case of propeller powered aeroplanes, if an additional lever, usually referred to as the propeller lever, is present, it should also be checked. Where these levers do not have angular travel a tolerance of ± 2 cm (± 0.8 inches) applies.					
b. Intentionally left blank					



Tests	Tolerances	Flight Conditions	Comments	Evaluation	
				Initial	Recurr.
c. LONGITUDINAL (1) Power Change Dynamics	± 3 Kts Airspeed ± 30 m (100 ft) Altitude. ± 1.5 degs or ± 20% Pitch	Approach to Go Around	Time History of uncontrolled Free Response for a time increment equal to at least 5 secs before initiation of the power change to completion of the power change + 15 secs. CCA: Test in Normal AND Non-normal Control state.	C T & M	✓
(2) Flap Change Dynamics	± 3 Kts Airspeed ± 30 m (100 ft) Altitude. ± 1.5 degs or ± 20% Pitch	2nd to 3rd Segment Climb and Approach to Landing	Time History of uncontrolled Free Response for a time increment equal to at least 5 secs before initiation of the reconfiguration change to completion of the reconfiguration change + 15 secs. (3rd segment climb corresponds to initial flap retraction after T/O) CCA: Test in Normal AND Non-normal Control state.	C T & M	✓
(3) Spoiler/Speedbrake Change Dynamics	± 3 Kts Airspeed ± 30 m (100 ft) Altitude. ± 1.5 degs or 20% Pitch	Cruise	Time History of uncontrolled Free Response for a time increment equal to at least 5 secs before initiation of the reconfiguration change to completion of the reconfiguration change + 15 secs. Results required for both extension and retraction. CCA: Test in Normal AND Non-normal Control state.	C T & M	✓
Tests	Tolerances	Flight Conditions	Comments	Evaluation	
				Initial	Recurr.



(4) Gear Change Dynamics	± 3 Kts Airspeed ± 30 m (100 ft) Altitude. ± 1.5 degs or 20% Pitch	1st to 2nd Segment Climb and Approach to Landing	Time History of uncontrolled Free Response for a time increment equal to at least 5 secs before initiation of the reconfiguration change to completion of the reconfiguration change + 15 secs. CCA: Test in Normal AND Non-normal Control state.	C T & M	✓
(5) Gear and Flap/Slat Operating Times	± 1 sec or ± 10% of Time	Take-off and Approach (Air Loaded)	Normal & Alternate flaps – Data for extend and retract. Normal gear – Data for extend and retract. Alternate gear – Data for extend only. All data for full range (intermediate increment times not required). Tabular data from production aeroplanes are acceptable.	✓	✓
(6) Longitudinal Trim	± 1 deg Pitch Control (Elevator & Stabilizer) ± 1 deg Pitch ± 5% Net Thrust or Equivalent	Cruise, Approach and Landing	May be a series of Snapshot tests. CCA: Test in Normal AND Non-normal Control state.	C T & M	✓
(9) Stick Shaker, Stall warning Speeds	± 3 Kts Airspeed ± 2 degs Bank for speeds greater than Stick Shaker	2nd Segment Climb and Approach or Landing	Stall warning signal should be recorded and should occur in the proper relation to stall. CCA: Test in Normal AND Non-normal Control state.	✓	✓
Tests	Tolerances	Flight Conditions	Comments	Evaluation	
				Initial	Recurr.
d. LATERAL DIRECTIONAL					



(1) Minimum Control Speed, Air (V_{mca} or V_{mcl}) – Low Speed Engine Inoperative Handling Characteristics in the Air.	± 3 Kts Airspeed	Climb, Approach or Landing (whichever is most critical in the aeroplane)	Demonstrated lateral directional control is available at least until published V_{MCA} , V_{MCL} CCA: Test in Normal OR Non-normal Control state.	C T & M	✓
(2) Roll Response (Rate)	$\pm 10\%$ or ± 2 degs/sec Roll Rate	Cruise and Approach or Landing	Test with normal wheel deflection (about 30% of maximum wheel)	C T & M	✓
(4) Spiral Stability	Correct Trend and ± 2 degs or $\pm 10\%$ Bank in 20 seconds	Cruise	Approved data averaged from multiple tests may be used. Test for both directions. CCA: Test in Non-normal Control state.	C T & M	✓
(5) Engine Inoperative Trim	± 1 deg Rudder Angle or ± 1 deg Tab Angle or Equivalent Pedal. ± 2 degs Sideslip.	2nd Segment Climb and Approach or Landing	May be Snapshot tests	C T & M	✓
e.	Intentionally left blank				
f.	Intentionally left blank				
g.	Intentionally left blank				
h.	Intentionally left blank				
Tests	Tolerances	Flight Conditions	Comments	Evaluation	
				Initial	Recurr.



i.	FLIGHT MANOEUVRE ENVELOPE PROTECTION FUNCTIONS AND					
(1)	Overspeed	± 5 Kts Airspeed	Cruise	CCA: Time History results are required of simulator and response to control inputs during entry into protection envelope limits. Approved data should be provided for both Normal AND Non-normal Control states.	✓	✓
(2)	Minimum Speed	± 3 Kts Airspeed	Take-off, Cruise, and Approach or Landing	CCA: See e (1) above.	✓	✓
(3)	Load Factor	$\pm 0.1g$ Normal Acceleration	Take-off, Cruise	CCA: See e (1) above.	✓	✓
(4)	Pitch Angle	± 1.5 degs Pitch	Cruise, Go Around	CCA: See e (1) above.	✓	✓
(5)	Bank Angle	± 2 degs or $\pm 10\%$ Bank	Approach	CCA: See e (1) above.	✓	✓
(6)	Angle of Attack	± 1.5 degs AOA	Second Segment and Approach or Landing	CCA: See e (1) above.	✓	✓
Note: The requirements of the above paragraph are only applicable to Computer Controlled Aeroplanes.						
3.	Intentionally left blank					
4.	FLIGHT INSTRUMENTS DECK RESPONSE					
a.	Instrument Systems response to an abrupt pilot controller input, compared with aeroplane response for a similar input.	$- 300$ milliseconds or less.	Take-off, Cruise, and Approach or Landing	One test is required in each axis (Pitch, Roll, Yaw) for each of the 3 conditions compared with approved data for a similar input.	✓	✓
	—or— Transport Delay	$- 300$ milliseconds or less.	Pitch, Roll and Yaw	One test is required in each axis. (Total 3 tests.)	✓	✓

3.5 Functions and manoeuvres

It is accepted that tests will only apply to FTD Level 1 if that system and flight condition is simulated.

It is intended that the tests listed below should be conducted in automatic flight. Where automatic flight is not possible and pilot manual handling is required, the FTD shall be at least controllable to permit the conduct of the flight.



TABLE OF FUNCTIONS AND SUBJECTIVE TESTS	
a. PREPARATION FOR FLIGHT	(1) Preflight. Accomplish a functions check of all switches, indicators, systems, and equipment at all crew members' and instructor's stations and determine that the flight deck design and functions are identical to that of the aeroplane within the scope of simulation.
b. SURFACE OPERATIONS (PRE-TAKEOFF)	(1) Engine Start. (a) Normal start. (b) Alternate start procedures. (c) Abnormal starts and shutdowns (hot start, hung start, tail pipe fire, etc.).
c. TAKEOFF	(1) Normal (a) Aeroplane/engine parameter relationships. (b) Acceleration characteristics. (c) Nosewheel and rudder steering.
d. CLIMB	(1) Normal. (2) One or more engines inoperative. (3) Other.
e. CRUISE	(1) Performance characteristics (speed vs. power). (2) High altitude handling. (3) High Mach number performance. (4) High IAS handling.
f. MANOEUVRES	(1) Approach to stalls and stall warning (takeoff, cruise, approach, and landing configuration). (2) Flight envelope protection (high angle of attack, bank limit, overspeed, etc). (3) Turns with/without speedbrake deployed. (4) In-flight engine shutdown and restart (assisted and windmill). (5) Manoeuvring with one or more engines inoperative. (6) Specific flight characteristics (e.g. Direct Lift Control). (7) Flight control system failures, reconfiguration modes and manual reversion. (8) Other.
g. DESCENT	(1) Normal. (2) Maximum rate (clean and with speedbrake, etc). (3) Flight control system failures, reconfiguration modes and manual reversion. (4) Other.
h. INSTRUMENT APPROACHES	Only those instrument approach tests relevant to the simulated aeroplane type should be selected from the following list. (1) Precision. (a) CAT I. 1 Manual approach with/without flight director. * 2 Autopilot/autothrottle coupled approach. 3 Manual approach to DH and G/A all engines. * 4 Manual one engine out approach to DH and G/A * 5 Autopilot/autothrottle coupled approach, one engine out to DH and G/A 6 Approach with minimum/standby electrical power.*



TABLE OF FUNCTIONS AND SUBJECTIVE TESTS

- (c) CAT III.
 - 1 Autopilot/autothrottle coupled approach to land and rollout.
 - 2 Autopilot/autothrottle coupled approach to DH and G/A.
 - 3 Autopilot/autothrottle coupled approach to land and rollout with one engine out.
 - 4 Autopilot/autothrottle coupled approach to DH and G/A with one engine out.
- (2) Non-precision.
 - (a) NDB.
 - (b) VOR, VOR/DME, VOR/TAC.
 - (c) RNAV.
 - (d) LLZ, LLZ/BC.

Note: If Standard Operating Procedures are to use autopilot for non precision approaches then these should be evaluated.

i. Intentionally left blank.

j. **MISSED APPROACH**

- (1) All engines.
- (2) One or more engine(s) out.
- (3) With flight control system failures, reconfiguration modes and manual reversion.

k. **SURFACE OPERATIONS (POST LANDING)**

- (1) Landing roll and taxi.
 - (a) Spoiler operation.
 - (b) Reverse thrust operation.
 - (c) Directional control and ground handling.
 - (d) Brake operation.
 - (e) Other.

l. **ANY FLIGHT PHASE**

- (1) Aeroplane and powerplant systems operation.
 - (a) Air conditioning and pressurisation.
 - (b) De-icing/anti-icing.
 - (c) Auxiliary powerplant.
 - (d) Communications.
 - (e) Electrical.
 - (f) Fire and smoke detection and suppression.
 - (g) Flight controls (primary and secondary).
 - (h) Fuel and oil, hydraulic and pneumatic.
 - (i) Landing gear.
 - (j) Oxygen.
 - (k) Powerplant.
 - (l) Airborne radar.
 - (m) Autopilot and flight director.
 - (n) Collision avoidance systems (GPWS, ACAS, etc.).
 - (o) Flight control computers.
 - (p) Flight display systems.
 - (q) Flight management computers.
 - (r) Head-up Guidance.
- (2) Airborne procedures.
 - (a) Holding.
 - (b) Air hazard avoidance (traffic, weather, etc.).
 - (c) Windshear.

*See introductory information for subparagraph 3.5 above

**TABLE OF FUNCTIONS AND SUBJECTIVE TESTS**

(4) Other.

m. Intentionally left blank

n. **SOUND**
Significant aeroplane noise such as engine, flaps, gear, spoiler extension/retraction, thrust reverser to a comparable level of that found in the aeroplane.

**AMC STD 2A.035 FTDs approved or qualified before 1 January 2005****See YCAR–STD 2A.035**

- 1 Introduction
 - 1.1 Under previous national rules, FTDs may have gained credits in accordance with primary reference documents which state appropriate technical criteria.
 - 1.2 Others may not have been monitored to the same extent, but may have documents or statements from the national Authority giving broad or specific permission for them to be used for certain training, testing and checking manoeuvres.
 - 1.3 In any case, it is intended that FTDs should continue to maintain their Qualification Level and/or approval granted prior to adoption of YCAR–STD 2A in accordance with previous national criteria.
- 2 Re-categorisation.
 - 2.1 Some of these FTDs may be of a standard which permits them to be recategorised as if they were FTDs presented for initial qualification on or after 1 January 2005.
- 3 Original national qualification
 - 3.1 FTDs that are not recategorised may continue to enjoy credits for an agreed list of training, testing and checking manoeuvres, provided they maintain their performance in accordance with any Validation, Functions and Subjective Tests which have been previously established or a list of tests selected from AMC STD 2A.030 by agreement with the Authority. Again the tests should relate to the list of manoeuvres permitted under the original national qualification/approval document.

The award of credits to an FTD user shall be at the discretion of the Authority. Current STD users may retain the credits granted under their previous national criteria.

**AMC STD 2A.045 New Aeroplane FTD Qualification****See YCAR–STD 2A.045****See also IEM STD 2A.045**

- a. During the introduction of new aeroplane programmes, it is not always possible to obtain all the necessary approved data and certified aeroplane avionics in time to satisfy the requirements for normal FTD qualification. The Authority may accept a measure of engineering and predicted data as well as preliminary avionics for a limited period to enable crew training to begin without delay.
- b. STD operators seeking interim qualification should contact the Authority at the earliest opportunity.



ITEM STD 2A.045 New Aeroplane FTD Qualification – Additional Information

- 1 In the case of new or derivative aeroplanes there will not usually be available aeroplane manufacturer's approved final data for performance, handling qualities, systems, or avionics until well after the aeroplane enters service. It is, of course, necessary in most cases to begin flight crew training and certification several months prior to the first entry of the aeroplane into service in order to have qualified crew members in sufficient numbers at the time of the beginning of service with the new aeroplane. Consequently, it will usually be preferable to use aeroplane manufacturer provided preliminary data (performance, systems, avionics) for interim qualification of FTDs.
- 2 In recognition of the sequence of events that should occur and the time required for final data to become available, the Authority may accept certain partially validated preliminary aeroplane and systems data, and early release ('red label') avionics in order to permit the necessary programme schedule for training, certification and service introduction.
- 3 STD operators seeking qualification based on preliminary data should, however, consult the Authority as soon as it is known that special arrangements will be necessary or as soon as it is clear that the preliminary data will need to be used for FTD qualification. The aeroplane and STD manufacturer's should also be made aware of the needs and be agreed party to the data plan and FTD qualification plan. The plan should include periodic meetings to keep the interested parties informed of project status.
- 4 The precise procedure followed to gain Authority acceptance of preliminary data will vary from case to case and between aeroplane manufacturers. Each aeroplane manufacturer's new aeroplane development and test programme is designed to suit the needs of the particular project and may not contain the same events or sequence of events as another manufacturer's programme or even the same manufacturer's programme for a different aeroplane. Hence, there cannot be a prescribed invariable procedure for acceptance of preliminary data, but instead a statement of needs with the final sequence of events, data sources, and validation procedures agreed by the STD operator, the aeroplane manufacturer, the FTD manufacturer, and the Authority.
- 5 There should be assurance that the preliminary data is the STD manufacturer's best representation of the aeroplane and reasonable certainty that final data will not deviate to a large degree from these preliminary, but refined, estimates. Data derived from these predictive or preliminary techniques should be validated by available sources including, at least, a manufacturer's engineering report explaining the predictive method used and illustrating past success of the method on similar projects. For example, the manufacturer could show the application of the method to an earlier aeroplane model or predict the characteristics of an earlier model and compare the results to final data for that model.
- 6 The use of preliminary data is not indefinite. The aeroplane manufacturer's final data should be available within six (6) months after aeroplane first 'service entry' or as agreed by the Authority, the STD operator and the aeroplane manufacturer, but usually not later than one (1) year. In applying for an interim qualification, using preliminary data, the STD operator and the Authority should agree the update programme. This will normally specify that the final data update will be installed in the FTD within a period of six (6) months following the final data release unless special conditions exist and a different schedule agreed. The FTD performance and handling validation would then be based on data derived from flight test. Initial aeroplane systems data should be updated after engineering tests. Final aeroplane systems data should also be used for FTD programming and validation.
7. FTD avionics should stay essentially in step with aeroplane avionics (hardware and software) updates. The permitted time lapse between aeroplane and FTD updates is not a fixed time but should be minimal. It may depend on the magnitude of the update and whether the QTG and pilot training and certification is affected. Permitted differences in aeroplane and FTD avionics versions and the resulting effects on FTD qualification should be agreed between the STD operator and the Authority. Consultation with the STD manufacturer is desirable throughout the agreement of the qualification process.

NOTE: The Proof of Match should meet the relevant AMC STD 2A.030 tolerances.