SECTION 1 - REQUIREMENTS

1   GENERAL

1.1   This Section contains the requirements for Basic Instrument Training Devices.

2   PRESENTATION

2.1   The requirements of JAR-STD 4A are presented in two columns on loose pages, each page being identified by the date of issue and/or the amendment number under which it is amended or reissued.

2.2   Subheadings are in italic typeface.

3.2   Explanatory notes not forming part of the requirements appear in smaller typeface.

2.4   New, amended and corrected text will be enclosed within heavy brackets until a subsequent 'Amendment' is issued.

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SUBPART A – APPLICABILITY

JAR–STD 4A.001 Applicability

JAR-STD 4A applies to those manufacturers and/or operators of Basic Instrument Training Devices (BITD) seeking qualification of Basic Instrument Training Devices. BITD users also shall gain approval to use the BITD as part of their approved training programmes despite the fact that the BITD has been previously qualified. Although this document provides guidance material for BITD users, precise details of such approvals are contained in JAR–FCL and other applicable documents.

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SUBPART B – GENERAL

JAR–STD 4A.005 Terminology
(See Appendix 1 to JAR-STD 4A.005)
(See AMC STD 4A.005)

Because of the technical complexity of Synthetic Training Device qualification, it is essential that standard terminology is used throughout. The following principal terms and abbreviations shall be used in order to comply with JAR–STD. Further terms and abbreviations are contained in Appendix 1 to JAR-STD 4A.005.

(a)   *Synthetic Training Device (STD).* A training device which is either a Flight Simulator (FS, a Flight Training Device (FTD), a Flight Navigation Procedure Trainer (FNPT) or a Basic Instrument Training Device (BITD).

(b)   *Flight Simulator (Simulator).* A full size replica of specific type or make, model and series aeroplane flight deck, including 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 (FNPT).* A training device which represents the flight deck/cockpit environment including the assemblage of equipment and computer programmes necessary to represent an aeroplane type or class in flight operations to the extent that the systems appear to function as in an aeroplane. It is in compliance with the minimum standards for a specific FNPT Level of Qualification.

(e)   *Basic Instrument Training Device (BITD).* A ground based training device which represents the student pilot's station of a class of aeroplanes. It may use screen based instrument panels and springloaded flight controls, providing a training platform for at least the procedural aspects of instrument flight.

(f)   *BITD User Approval.* The extent to which a qualified BITD may be used by persons, organisations or enterprises as approved by the Authority. It takes account of aeroplane to BITD differences and the operating and training ability of the organisation.

(g)   *BITD Manufacturer.* That organisation or enterprise being directly responsible to the Authority for requesting the initial BITD model qualification.

(h)   *BITD Model.* A defined hardware/software combination which has obtained a qualification. Each BITD will equate to a specific model and be a serial numbered unit.

(i)   *BITD Operator.* That person, organisation or enterprise directly responsible to the Authority for requesting and maintaining the recurrent qualification of a particular BITD.

(j)   *BITD User.* The person, organisation or enterprise requesting training credits through the use of a BITD.

(k)   *BITD Qualification.* The technical ability of a BITD as defined in the compliance document.

(l)   *Qualification Test Guide (QTG).* A document designed to demonstrate that the performance and handling qualities of a BITD agree within prescribed limits with agreed validation data and that all applicable regulatory requirements have been met. The QTG includes both the agreed validation data and BITD data used to support the validation.

Appendix 1 to JAR–STD 4A.005 Additional Terminology

In addition to the principal terms defined in JAR-STD 4A.005 itself, additional terms used in the context of JAR-STD 4A have the following meanings:

(a) *Automatic Testing*. BITD 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 BITD to follow a pre-defined target response.

(d) *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.

(e) *Convertible BITD*. A BITD in which hardware and software can be changed so that the BITD represents more than one model, usually of the same class of aeroplane. The same cockpit shell, computers and necessary peripheral equipment can thus be used in more than one simulation.

(f) *Critical Engine Parameter*. The engine parameter which is the most appropriate measure of propulsive force.

(g) *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.

(h) *Damping (over-damped)*. 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.

(i) *Damping (under-damped)*. 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.

(j) *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.

(k) *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.

(l) *BITD Data*. The various types of data used to design, manufacture, test and maintain the BITD.

(m) *BITD Evaluation*. A detailed appraisal of a BITD by the Authority to ascertain whether or not the standard required for a Qualification is met.

(n) *Flight Test Data*. Actual aeroplane data obtained by the aeroplane manufacturer (or other supplier of acceptable data) during an aeroplane flight test programme.

(o) *Free Response*. The response of the aeroplane after completion of a control input or disturbance.

(p) *Frozen/Locked*. A state where a variable is held constant with time.

(q) *Functions Test*. A quantitative assessment of the operation and performance of a BITD by a suitably qualified evaluator. The test can include verification of correct operation of controls, instruments, and systems of the simulated aeroplane under normal and 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.

(r) *Hands-off Manoeuvre*. A test manoeuvre conducted or completed without pilot control inputs.

(s) *Hands-on Manoeuvre*. A test manoeuvre conducted or completed with pilot control inputs as required.

(t) *Integrated Testing*. Testing of the BITD 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.

Appendix 1 to JAR-STD 4A.005 (continued)

(u)   *Latency*. The additional time, beyond that of the basic perceivable response time of the aeroplane due to the response time of the BITD.

(v)   *Manual Testing*. BITD testing wherein the pilot conducts the test without computer inputs except for initial setup.   All modules of the simulation should be active.

(w)   *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.

(x)   *Objective Test (Objective Testing)*.   A quantitative assessment based on comparison with data.

(y)   *Power Lever Angle*.   The angle of the pilot's primary engine control lever(s) in the cockpit.   This may also be referred to as PLA, Throttle, Power Lever and Propeller Lever.

(z)   *Predicted Data*.   Data derived from sources other than type specific aeroplane flight tests.

(aa) *Proof-of-Match (POM)*.   A document which shows agreement within defined tolerances between model responses and flight test cases at identical test and atmospheric conditions.

(bb) *Protection Functions*.   Systems functions designed to protect an aeroplane from exceeding its flight and manoeuvre limitations.

(cc) *Pulse Input*.   An abrupt input to a control followed by an immediate return to the initial position.

(dd) *Reversible Control System*.   A control system in which movement of the control surface will backdrive the pilot's control in the cockpit.

(ee) *Snapshot*. A presentation of one or more variables at a given instant of time.

(ff)   *Statement of Compliance (SOC)*.   A declaration that specific requirements have been met.

(gg) *Step Input*.   An abrupt input held at a constant value.

(hh) Subjective Test (Subjective Testing).   A qualitative assessment based on established standards as interpreted by a suitably qualified person.

(ii)   Time History.   A presentation of the change of a variable with respect to time.

(jj)   Transport Delay. The total BITD system processing time between an input signal from a pilot primary flight control and the instrument

Appendix 1 to JAR-STD 4A.005 (continued)

response. It is the overall time delay incurred from signal input until output response. It does not include the characteristic delay of the aeroplane simulated.

(kk) *Validation Data*. Data used to prove that the BITD performance corresponds to that class of aeroplane.

(ll)   *Validation Test*. A test by which BITD parameters can be compared with the relevant Validation Data.

JAR–STD 4A.010 Implementation

JAR-STD 4A will be implemented on 1 January 2003 when national arrangements, procedures and Qualification Certificates shall fully comply with JAR-STD 4A criteria.

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SUBPART C – BASIC INSTRUMENT TRAINING DEVICES

JAR–STD 4A.015 Application for   BITD Qualification
(See AMC STD 4A.015)
(See IEM STD 4A.015)

(a)   The BITD manufacturer of a new BITD model which requires evaluation shall apply to the Authority giving 3 months notice. In exceptional cases this period may be reduced to one month at the discretion of the Authority.

(b)   A BITD Qualification Certificate will be issued for the BITD model to the manufacturer following satisfactory completion of an evaluation by the Authority. This qualification is valid for all serial numbers of this model without further technical evaluation.

JAR–STD 4A.020 Validity of BITD Qualification

(a)   A BITD qualification of each serial mumber is valid for 36 months from the commencement of operation, unless reduced by the Authority. It is the operator's responsibility to apply for the revalidation of the qualification.

(b)   A BITD 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 36 months period of validity shall continue from the expiry date of the previous qualification document.

(c)   The Authority may refuse, revoke, suspend or vary a BITD qualification, if the provisions of JAR-STD 4A are not satisfied.

(d)   As a BITD only broadly replicates a class of aeroplanes, and not a specific type of aeroplane, an interim qualification will not be issued.

JAR–STD 4A.025 Rules governing BITD Operators
(See AMC STD 4A.025)

The operator of a BITD shall demonstrate his capability to maintain the performance, functions and other characteristics specified for the BITD qualification as follows:

(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 of the BITD. 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 and Modifications*. The BITD operator shall maintain a link between his own organisation, the Authority and the BITD manufacturer.   to   incorporate   important modifications,

(1)   Where applicable and essential for training, BITD operators shall update their BITDs (for example in the light of data revisions). Modifications of the BITD hardware and software which affect flight characteristics and performance, shall be evaluated to determine the impact on the original qualification criteria. If necessary, BITD operators shall provide amendments for any affected validation tests.

(2)   The Authority shall be advised in advance of any major changes to determine if the tests carried out by the BITD operator are satisfactory. A special evaluation of the BITD may be necessary prior to returning it to training following the modification.

(3)   The BITD operator providing the information on the intended modification shall also provide a justification that this information is adequate either from the BITD operator's own resources, or through an arrangement with the BITD manufacturer.

(c)   *Installations*. Ensure that the BITD is housed in suitable premises which support safe and reliable operation.

(1)   BITD occupants and maintenance personnel shall be briefed on safety to ensure that they are aware of all safety equipment and arrangement in the BITD in case of emergency.

(d)   *Additional Equipment*. Where additional equipment has been added by the BITD Operator to a BITD even though not required for qualification,

JAR-STD 4A.025(d) (continued)

it will be assessed to ensure that it does not adversely affect the quality of training. Therefore any subsequent modification, removal or unserviceability could affect the qualification of the device.

JAR–STD 4A.030 Requirements for BITDs qualified on or after 1 January 2003
(See AMC STD 4A.030)
(See IEM STD 4A.030)

(a)   Any BITD submitted for initial evaluation on or after 1 January 2003, shall be evaluated against JAR-STD 4A criteria.

(b)   A BITD shall be assessed in those areas which are essential to completing the student pilot training process according Appendices 1 and 2 to JAR-STD 4A.030.

(c)   The BITD shall be subjected to:

(1)   Validation tests as found in the Qualification Test Guide (QTG) as expressed in AMC STD 4A.030, para 2.3.

(2)   Functions & Subjective tests as expressed in AMC STD 4A.030, para 3.

(d)   Data which is used to ensure the fidelity of a BITD shall be of a standard that satisfies the Authority before the BITD can be qualified.

(e)   The BITD manufacturer shall submit a QTG acceptable to the Authority.

(f)   Upon completion of the initial evaluation, and when all the discrepancies in the QTG have been addressed to the satisfaction of the Authority, the QTG is approved. 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 BITD model qualification and subsequent recurrent BITD individual serial number evaluation.

(g)   The BITD operator shall:

(1)   Run the complete QTG progressively on an annual cycle. Results shall be dated and retained at least until the next requalification in order to satisfy both the BITD operator as well as the Authority that BITD standards are being maintained; and

(2)   Establish a Configuration Control System to ensure the continued integrity of the hardware and software qualified.

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Appendix 1 to JAR–STD 4A.030
Technical Requirements

(a)　This Appendix describes the minimum technical requirements for qualifying a BITD.

(b)　Specific requirements for the use of the BITD will be determined by the Authority. Specialised training courses require an adequate standard of simulation which will be evaluated by the Authority. (See JAR-FCL 1).

(c)　Maximum credits are granted according to JAR-FCL 1.

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Appendix 1 to JAR-STD 4A.030 (continued)

Table 1 Minimum technical requirements for qualifying JAA BITD

Minimum Technical Requirements
1. A student pilot's station which represents a class of aeroplane sufficiently enclosed to exclude distraction.
2. The switches and all the controls shall be of a representative size and shape, and shall operate as and represent those as in the simulated class of aeroplane.
3. Instruments, equipment, panels, systems, primary and secondary flight controls sufficient for the training events to be accomplished shall be located in a position similar to that in the simulated class of aeroplane.
4. Lighting environment for panels and instruments sufficient for the operation being conducted.
5. In addition to the pilot's seat, suitable viewing arrangements for the instructor shall be provided allowing an adequate view over the pilot's panels.
6. The performance shall be representative of the simulated class of aeroplane.
7. Effects of aerodynamic changes for various combinations of drag, thrust and control settings encountered in flight, including the effect of change in aeroplane attitude and sideslip shall be representative of the simulated class of aeroplane.
8. Navigation equipment for flights under IFR with representative tolerances. This shall include communication equipment.
9. Control forces and travel shall broadly correspond to that of the simulated class of aeroplane.
10. Complete navigation data base for at least 3 airports with corresponding precision and non-precision approach procedures including regular updates. All navigational aids shall be usable, if within range, without restrictions and instructor intervention.
11. Engine sound shall be available.
12. Control and effects of atmospheric conditions, including at least: - Wind direction and speed - Barometric pressure
13. Map and approach profiles flown shall be available.
14. Provision for position freeze, flight freeze and repositioning (geographical position, heading, speed and altitude).
15. Instructor controls to set and reset malfunctions relating to: - flight instruments\ - navigation aids - flight controls - engine out operations (for multi engine aeroplanes only)
16. Stall recognition device corresponding to that of the simulated class of aeroplane.
17. A Qualification Test Guide (QTG) which shall be submitted in a form and manner acceptable to the Authority and which conforms to AMC STD 4A.030 (para1.6).

Appendix 2 to JAR-STD 4A.030
Table 1 - BITD Standards

Table 1 below shows how the requirements, listed in Table 1 of Appendix 1 to JAR-STD 4A.030, shall be fulfilled.

	BITD STANDARDS	COMMENTS
a.	Time from pilot's control input to recognisable system response (transport delay) on the attitude indicator shall be 300 ms or less. This standard shall be certified by the manufacturer in the QTG submitted for Qualification.	SOC required.
b.	The basic flight instruments shall be displayed and arranged in the usual "T-layout". The following instruments shall be displayed so as to be representative for the simulated class of aeroplane:	Covers also screen-based instrument panel. Instruments shall be displayed very nearly full-size as in the simulated class of aeroplane.
	1. An attitude indicator with at least 5° and 10° pitch markings, and bank angle markings for 10°, 20°, 30° and 60°.	
	2. Adjustable altimeter(s) with 20 ft markings.	
	3. An airspeed indicator with at least 5 kts markings within a representative speed range and colour coding.	Controls to adjust the instruments, e.g. QNH, course or heading bugs shall be located spatially correct at the respective instrument.
	4. An HSI or heading indicator with incremental markings each of at least 5°, displayed on a 360° circle. The heading figures shall be radially aligned.	
	5. A vertical speed indicator with 100 fpm markings up to 1 000 fpm and 500 fpm thereafter within a representative range.	
	6. A turn and bank indicator with incremental markings for a rate of 3° per second turn for left and right turns. The 3° per second rate index shall be inside of the maximum deflection of the indicator.	
	7. A slip indicator representative of the simulated class of aeroplane, where a coordinated flight condition is indicated with the ball in centre position.	A triangle slip indicator is acceptable if applicable for the simulated class of aeroplane.
	8. A magnetic compass with incremental markings each 10°.	
	9. Engine instruments as applicable to the simulated class of aeroplane, with markings for normal ranges, minimum and maximum limits.	
	10. A suction gauge or instrument pressure gauge, as applicable, with a display as applicable for the simulated class of aeroplane.	
	11. A flap position indicator which displays the current flap setting. This indicator shall be representative of the simulated class of aeroplane.	
	12. A pitch trim indicator with a display that shows zero trim and appropriate indices of aeroplane nose down and nose up trim.	
	13. A stop watch or digital timer which allows the readout of seconds and minutes.	

Appendix 2 to JAR-STD 4A.030 (continued)

	BITD STANDARDS	COMMENTS
c.	A communication and navigation panel shall be displayed in a manner that the frequency in use is shown. The NAV equipment shall include ADF, VOR, DME and ILS indicators with the following incremental markings: 1. one-half dot or less for course and glide slope indications on the VOR and ILS display. 2. 5° or less of bearing deviation for ADF and RMI, as applicable. All NAV radios shall be equipped with an aural identification feature. A marker beacon receiver shall also be installed with an optical and aural identification.	Controls to select the frequencies and other functions may be located on a central COM/NAV panel or on a separate ergonomically located panel.
d.	All instrument displays shall be visible during all flight operation. The instrument system shall be designed to ensure jumping and stepping is not a distraction and to display all changes within the range of the replicated instruments that are equal or greater than the values stated below: 1. Attitude ½° pitch and 1° bank 2. Turn and bank of ¼ standard rate turn 3. IAS 1 kts 4. VSI 20 fpm 5. Altitude 3 ft 6. Heading on HSI ½° 7. Course and Heading on OBS and/or RMI 1° 8. ILS ¼° 9. RPM 25 10. MP ½ inch	
e.	The update rate of all displays shall provide an image of the instruments that: 1. does not appear out of focus. 2. does not appear to "jump" or "step" to a distracting degree during operation. 3. does not appear with distracting jagged lines or edges.	Only applicable for screen-based instrument panels. SOC required to proof the resolution.

JAR–STD 4A.035 Requirements for STDs approved or qualified before 1 January 2003

(a)   FNPT(G)s and STDs under special category may be recategorised as BITDs. The STD operator shall apply for the evaluation. Following satisfactory completion of the evaluation the STD operator will be issued a Qualification Certificate.

(b)   Recategorized BITD's will be qualified in accordance with JAR-STD 4A.030.

JAR–STD 4A.040 Changes to qualified BITDs

(a)   *Requirement to notify major changes to a BITD*. The Operator of a qualified BITD shall inform the Authority of proposed major changes such as:

(1)   BITD hardware and/or software modifications which could affect the handling qualities, performances or system representations.

(2)   Relocation of the BITD; and

(3)   Any deactivation of the BITD.

Note: The Authority may complete a special evaluation following major changes or when a BITD appears not to be performing to its initial qualification.

(b)   *Upgrade of a BITD*. If an upgrade to an FNPT I is planned, the procedures according JAR-STD 3A apply.

(c)   *Relocation of a BITD*

(1)   In instances where a BITD is moved to a new location, the Authority shall be advised. At the discretion of the Authority, the BITD shall be subject to an evaluation in accordance with its original JAA qualification criteria.

(d)   *Deactivation of a currently qualified BITD*

(1)   In the event a BITD operator plans to remove a BITD from active status for prolonged periods, the Authority shall be notified.

(2)   The BITD operator shall agree a procedure with the Authority to ensure that the BITD can be restored to active status to its original Qualification Level.

JAR–STD 4A.045 intentionally blank

JAR–STD 4A.050 Transferability of BITD Qualification

(a)   When there is a change of BITD operator, the new operator shall advise the Authority in advance in order to agree upon a plan of transfer of the BITD.

(b)   At the discretion of the Authority, the BITD shall be subject to an evaluation in accordance with its original JAA qualification criteria.

(c)   Provided that the BITD performs to its original standard, its original qualification shall be restored.

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