AMC/IEM C - BASIC INSTRUMENT TRAINING DEVICES

AMC STD 4A.015
BITD Qualification – Application and Inspection
See JAR–STD 4A.015
See also IEM STD 4A.015

1 Letter of Application

A sample of letter of application is provided overleaf.

AMC STD 4A.015 (continued)

LETTER OF APPLICATION FOR JAA EVALUATION OF A BITD

(Date)………………………

PRINCIPAL INSPECTOR
(JAA NAA OFFICE)
(Address)…………………………………….
………………………………………………..
(City)………………………………………….
(Country)……………………………………..

Dear …………………………………………….

..................(Name of Applicant)...................... requests the evaluation of its ......(type)..... BITD for qualification. The ... (BITD manufacturer name)...... BITD 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 BITD and declare that it meets all applicable requirements of JAR-STD 4A (Basic Instrument Training Devices) except as noted below. Appropriate hardware and software configuration control procedures have been established and these are appended for your inspection and approval.

The BITD has been assessed by the following evaluation team:

.... (name)	Qualification/Title ....
.... (name)	Qualification/Title ....
.... (name)	Pilot's Licence Nr...............................

who attest(s) that it conforms to -------- (class of aeroplane) and that the simulated systems and subsystems function equivalently to those in that class of aeroplane. This pilot has also assessed the performance and the flying qualities of the BITD and finds that it represents the designated class of 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.

AMC STD 4A.015 (continued)

2 Composition of evaluation team for an initial evaluation

2.1 To gain a qualification, a BITD is evaluated in accordance with a structured routine conducted by a technical team. This team consists of an Inspector from a JAA National Aviation Authority and one from another JAA National Aviation Authority, including the manufacturer‘s Authority if applicable. The team consists of at least:

a. A Technical STD Inspector qualified in all aspects of STD hardware, software and computer modelling and

b. A Flight Inspector, who is qualified in flight crew training procedures and class rated on the class of aeroplane.

2.2 Additionally the following persons should be present:

a. Sufficient BITD support staff to assist with the running of tests and operations of the instructor‘s operating station.

2.3 For the recategorisation of an FNPT(G) or STD originally qualified under special category both members of the evaluation team may be from the same JAA National Aviation Authority.

IEM STD 4A.015
BITD Evaluations
See JAR-STD 4A.015
See also AMC STD 4A.015

1 General

1.1 During BITD evaluations it will be necessary for the Authority to conduct the objective and subjective tests described in JAR–STD 4A.030 and detailed in AMC STD 4A.030. There will be occasions when all tests cannot be completed – for example during recurrent evaluations on a convertible BITD – but arrangements should be made for all tests to be completed within a reasonable time.

1.2 Following an evaluation, a number of defects may be identified, generally these defects should be rectified and the Authority notified of such action within 30 days. In case of serious defects, affecting crew training or if any defect remains unattended without good reason for period greater than 30 days, the BITD qualification could be removed.

2 Initial Evaluations

2.1 Objective Testing

2.1.1 Objective testing is centred on 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 BITD 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 manual systems set up to run each test and whether or not special equipment is required. The Authority will not necessarily warn the BITD 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 normally the objective tests on a BITD are manually flown. Therefore sufficient time should be set aside for the examination and running of the QTG. A useful explanation of how the Validation Tests should be run is contained in the RAeS 'Aeroplane Flight Simulator Evaluation Handbook' (February 95 or as amended).

2.2 Subjective Testing

2.2.1 The Subjective Tests for the evaluation can be found in AMC STD 4A.030, paragraph 3, and a suggested Subjective Test profile is described in sub-paragraph 4.6 below.

2.2.2 Essentially half a working day is required for the Subjective Test routine, which effectively denies use of the BITD for any other purpose.

2.3 Conclusion
2.3.1 To ensure adequate coverage of Subjective and Objective Tests and to allow for cost effective rectification and retest before departure of the inspection team, one working day (i.e. 8 consecutive hours) should be dedicated to an initial evaluation of a BITD.

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

IEM STD 4A.015 (continued)

during the evaluation, including those, which may be cause for concern, giving adequate notification if special equipment is required.

3.1.2 Essentially the time taken to run the objective tests depends upon the need for special equipment and the test system.

3.2 Subjective Testing

3.2.1 Essentially the same subjective test routine should be flown as per the profile described in sub-paragraph 4.6 below with a selection of the subjective tests taken from AMC STD 4A.030, paragraph 3.

3.3 Conclusion

3.3.1 To ensure adequate coverage of Subjective and Objective Tests during a recurrent evaluation, a total of 4 hours should be allocated. However, it should be remembered that any BITD deficiency, which arises during the evaluation could necessitate the extension of the evaluation period.

3.3.2 The recurrent evaluation may be conducted by one suitably qualified Flight Inspector only, in conjunction with the visit of any Registered Facility or inspection of any Flight Training Organisation, using the BITD.

4 Functions and Subjective Tests – Suggested Test Routine

4.1 During initial and recurrent evaluations of a BITD, the Authority will conduct a series of functions and subjective tests, which together with the objective tests complete the comparison of the BITD with the class of aeroplane.

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

4.3 The BITD 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 Instructor Operating Station (IOS) should not present an unnecessary distraction from observing the activities of the flight crew whilst providing adequate facilities for the tasks.

4.4 Section 1 of JAR-STD 4A prescribes the requirements and the AMCs in Section 2 the means of compliance for BITD qualification. However, it is important that both the Authority and the BITD Operator understand what to expect from the routine of BITD functions and subjective tests. It should be remembered that part of the subjective tests routine should involve an uninterrupted fly-out comparable with the duration of typical training sessions in addition to assessment of flight freeze and repositioning. A description of such a profile is to be found in 4.6 below. A useful explanation of Functions and Subjective Tests and an example of subjective test routine checklist are to be found in the RAeS Airplane Flight Simulator Evaluation Handbook (February 95 or as amended).

4.5 JAA Regulatory Authorities and BITD operators who are unfamiliar with the evaluation process are advised to contact a suitably experienced JAA Authority.

IEM STD 4A.015 (continued)

4.6 Typical Subjective Test Profile (2 hours - items and altitudes as applicable to BITDs)

- Instrument departure, rate of climb, climb performance
- Level-off at 4000 ft
- fail engine (if applicable)
- Engine out climb to 6000 ft (if applicable)
- Engine out cruise performance (if applicable), restart engine
- All engine cruise performance with different power settings
- Descent to 2000 ft
- All engine performance with different configurations, followed by
- ILS approach
- All engine go-around
- Non precision approach
- Go-around with engine failure (if applicable)
- Engine out ILS approach (if applicable)
- Go-around engine out (if applicable)
- Non precision approach engine out (if applicable), followed by
- Go-around
- Restart engine (if applicable)
- Climb to 4000 ft
- Manoeuvring:
    - Normal turns left and right
    - Steep turns left and right
    - Acceleration and deceleration within operational range
    - Approaching to stall in different configurations
    - Recovery from spiral dive
- Autoflight performance (if applicable)
- System malfunctions
- Approach

AMC STD 4A.025
Operator's Quality System
See JAR-STD 4A.025

1 Introduction

1.1 In order to show compliance with JAR-STD 4A.025, a BITD operator should establish his Quality System in accordance with the instructions and information contained in the following paragraphs.

2 Quality Policy

1.1 A BITD 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.

1.2 The Accountable Manager is someone who by virtue of his position has overall authority and responsibility (including financial) for managing the organisation.

1.3 The Quality Manager is responsible for the function of the quality system and requesting corrective actions.

3 Quality System

3.1 The Quality System should enable the BITD operator to monitor compliance with JAR-STD 4A, and any other standards specified by that BITD operator to ensure correct maintenance and performance of the device.

3.2 A Quality Manager oversees the day to day control of quality.

3.3 For a small operator the position of the Accountable Manager and the Quality Manager may be combined. However, in this event, independent personnel should conduct Quality Audits.

4 Quality Assurance Programme

4.1 A quality Assurance Programme together with a statement acknowledging completion of a periodic review by the Accountable Manager should include the following:

4.1.1 A maintenance facility which provides suitable BITD hardware and software test and maintenance capability.

4.1.2 A recording system in the form of a technical log in which defects, deferred defects and development work are listed, interpreted, actioned and reviewed within a specified time scale.

4.1.3 Planned routine maintenance of the BITD and periodic running of the QTG with adequate manning to cover BITD operating periods and routine maintenance work.

4.1.4 A planned audit schedule and a periodic review should be used to verify that corrective action was carried out and that it was effective. The auditor should have adequate knowledge of BITDs and should be acceptable to the Authority.

5 Quality System Training

5.1 The Quality Manager should receive appropriate Quality System training and brief other personnel on the procedures.

AMC STD 4A.030
BITDs qualified on or after 1 January 2003
See JAR-STD 4A.030
See also IEM STD 4A.030

NOTE: The structure and numbering of this AMC departs from JAA layout due to the complexity of the technical content and the need to retain harmonisation with FAA AC 120 series.

1 Introduction

1.1 Purpose.

This AMC establishes the standards, which define the performance and documentation requirements for the evaluation of BITDs, used for training of student pilots.

1.2 Background

1.2.1 The availability of advanced technology has permitted greater use of BITDs for training of student pilots. The complexity, costs and operating environment of modern aircraft also have encouraged broader use of advanced simulation. BITDs can provide more in-depth training than can be accomplished in aeroplanes and provide a safe and suitable learning environment, especially during the instrument rating.

1.2.2 The methods, procedures, and testing standards contained in this AMC are the result of the experience and expertise of Authorities, operators, aeroplane- and STD manufacturers.

1.3 BITD Qualification.

Appendix 1 of JAR-STD 4A.030 and paragraph 2 of this AMC describe the minimum requirements for qualifying BITDs.

1.4 Terminology and Abbreviations

Terminology and abbreviations of terms used in this AMC are contained in Appendix 1 of JAR-STD 4A.005 and AMC STD 4A.005.

1.5 Testing for BITD Qualification

1.5.1 The BITD should be assessed in those areas, which are essential to completing student pilot training process. This includes the BITD's longitudinal and lateral directional responses; performance in climb, cruise, descent, approach, cockpit, and instructor station functions checks.

1.5.2 The intent is to evaluate the BITD as objectively as possible. Pilot acceptance, however, is also an important consideration. Therefore, the BITD will be subjected to validation, functions and subjective tests listed in paragraph 2.3 and 3 of this AMC. Validation tests are used to compare objectively BITD and class of aeroplane data to ensure that they agree within specified tolerances. Functions and subjective tests provide a basis for evaluating BITD capability to perform over a typical training period and to verify correct operation of the BITD.

1.5.3 Aeroplane flight test data packages are usually not available; therefore most of the tolerances can only be of the nature of Correct Trend and Magnitude (CT&M) during an initial evaluation. The tolerances listed in this AMC are intended to ensure repeatability for recurrent evaluations.

AMC STD 4A.030 (continued)

1.5.4 For initial qualification testing of BITDs validation data will be used. They may be derived from a specific aeroplane within the class of aeroplane the BITD is representing or they may be based on information from several aeroplanes within the class. With the concurrence of the Authority, it may be in the form of a manufacturer's previously approved set of validation data for the applicable BITD. Once the set of data for a specific BITD has been accepted and approved by the Authority, it will become the validation data that will be used as reference for subsequent recurrent evaluations.

1.5.5 The substantiation of the set of data used to build the validation data should be in the form of an engineering report and must show that the proposed validation data are representative of the class of aeroplane modelled. This report may include flight test data, manufacturer's design data, information from the Aeroplane Flight Manual (AFM) and Maintenance Manuals, results and approved or commonly accepted simulations or predictive models, recognised theoretical results, information from the public domain, or other sources as deemed necessary by the BITD manufacturer to substantiate the proposed model.

1.5.6 During BITD 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 operator error. Following this, if the test problem persists, a BITD 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 a BITD. It contains test results, statements of compliance and other information for the evaluator to assess if the BITD meets the test criteria described in this AMC.

1.6.2 The manufacturer should submit a QTG, which includes:

a. A title page with manufacturer/operator and approving Authority signature blocks.

b. A BITD information page (for each configuration in the case of convertible BITDs) providing:

   i. BITD model and serial number.
   ii. Class of aeroplane being simulated.
   iii. Aerodynamic and engine model data revision.
   iv. Avionics equipment system identification.
   v. BITD manufacturer.
   vi. Date of BITD manufacture.
   vii. BITD computer identification.

c. Table of contents.

d. Log of revisions and/or list of effective pages.

e. Listing of all references and source data.

f. Glossary of terms and symbols used.

4A.030 (continued)

g. Statements of Compliance (SOC) are required to comply with the BITD standards according Appendix 1 to JAR-STD 4.A.030, table 1. SOC's should refer to sources of AMC STD 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 par. 2.3 of this AMC:

- i. Test Title. This should be short and definitive, based on the test title referred to in par. 2.3 in this AMC.
- 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, using reference to flight deck instrumentation and without reference to other parts of the QTG or other documents.
- vii. Evaluation criteria. Specify the main parameter(s) under scrutiny during the test.
- viii. Expected result(s), including tolerances and, if necessary, a further definition of the point at which the information was extracted from the validation data.
- ix. Test Result. Dated BITD validation test results obtained by the manufacturer from the BITD. Tests run on a computer, which is independent of the BITD, are not acceptable.
- x. Source Data. Copy of the validation data, clearly marked with the document, page number, issuing Authority, the test number and title.
- xi. Comparison of Results. An acceptable means of easily comparing BITD test results with the validation data. The preferred method is overplotting.

j. A Statement of Compliance (SOC) covering the functions and subjective tests designated in paragraph 3 below.

1.7 Configuration control.

1.7.1 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 BITD Qualification

1.8.1 The request for evaluation should reference the QTG and also include a statement that the manufacturer has thoroughly tested the BITD and that it meets the criteria described in this document except as noted in the Application Form. The manufacturer should further certify that all the QTG checks, for the requested Qualification, have been achieved and that the BITD is representative of the class of aeroplane.

1.8.2 A copy of the manufacturer'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.

AMC STD 4A.030 (continued)

1.9 BITD 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 BITDs continue to maintain their initially qualified performance, functions and other characteristics.

1.9.2 The BITD Operator should run the complete QTG – which includes validation, functions & subjective tests – between each 3 yearly evaluation by the Authority. The QTG should be run progressively on an annual cycle. Results shall be dated and retained in order to satisfy both the Operator as well as the Authority that the BITD standards are being maintained.

NOTE: It is not intended that the complete QTG be run just prior to the 3 yearly recurrent evaluation.

2 BITD Validation Tests

2.1 Discussion.

2.1.1 BITD performance and system operation shall be objectively evaluated by comparing the results of tests conducted in the BITD with the relevant validation data. To facilitate the validation of the BITD, a line printer, or other appropriate recording device acceptable to the Authority should be used to record each validation test result. These recordings should then be compared with the relevant validation data.

2.1.2 Some tests in this paragraph are not necessarily based upon validation data with specific tolerances. However, these tests are included here for completeness, and the required criteria should be fulfilled instead of meeting a specific tolerance.

2.1.3 The QTG provided by the manufacturer shall describe clearly and distinctly how the BITD will be set up and operated for each test. It is not the intent, nor is it acceptable, to test each BITD subsystem independently. Overall Integrated Testing of the BITD should be accomplished to assure that the total BITD system meets the prescribed standards. A test procedure with explicit and detailed steps for completion of each test shall therefore be provided.

2.1.4 The tests and tolerances contained in this paragraph should be included in the manufacturer's QTG. Submittals for Approval of data other than flight test should include an explanation of validity with respect to available flight test information.

2.1.5 The table of validation tests of this AMC generally indicates the test results required. Unless noted otherwise, BITD tests should represent aeroplane performance and handling qualities at operating weights and centres of gravity (CG) typical of normal operation.

2.2 Test requirements

2.2.1 The flight tests required for qualification are listed in the table of validation tests. Computer generated BITD test results should be provided for each test. The results should be produced on a line printer or other appropriate recording device acceptable to the Authority. Time histories are highly recommended as indicated in the table of validation tests.

2.2.2 Validation data, which exhibit rapid variations of the measured parameters, may require engineering judgement when making assessments of BITD validity. Such judgement 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 BITD to validation data throughout a time history, an explanation shall be provided.

AMC STD 4A.030 (continued)

2.2.2.1 Parameters, tolerances, and flight conditions. The table of validation tests in paragraph 2.3 below describes the parameters, tolerances, and flight conditions for BITD 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, it should be disregarded. BITD results shall be labelled using the tolerances and units specified.

2.2.2.2 Flight condition verification. When comparing the parameters listed to those of the reference aeroplane, sufficient data shall also be provided to verify the correct flight condition. For example, to show the control force is within ± 2.2 daN (5 pounds) or ± 20% in a flap change force test, data to show correct airspeed, power, aeroplane configuration, altitude, and other appropriate datum identification parameters should also be given. If validating short period dynamics, normal acceleration shall be used, but airspeed, altitude, control input, aeroplane configuration and other appropriate data shall also be given. All airspeed values should be clearly annotated as to indicated, calibrated, etc., and like values used for comparison.

2.2.2.3 Where the tolerances have been replaced by 'Correct Trend and Magnitude' (CT&M), the BITD shall be tested and assessed as representative of the class of aeroplane to the satisfaction of the Authority. To facilitate future evaluations, sufficient parameters should be recorded to establish a reference and to ensure repeatability.

AMC STD 4A.030 (continued)

2.3 Table of validation tests

Most of the tests within the QTG have numerical tolerances and "Correct Trend and Magnitude" (CT&M). Where CT&M is used as tolerance for initial qualification, it is strongly recommended that an automatic recording system be used to footprint the baseline results during initial evaluation (column I in the table below). The numerical tolerances shall avoid the effects of possible divergent subjective opinions during recurrent evaluations (see column R in the table below).

Numerical tolerances for initial evaluations shall be used for all tests where numerical data out of an Aeroplane Flight Manual from a reference aeroplane are available.

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. An incorrect effect would be unacceptable (e.g. if the Validation Data show positive spiral stability, it would not be acceptable to exhibit neutral or even negative spiral stability).

Test		Tolerance	Flight Condition	Comments	I	R
1.	**PERFORMANCE**					
a. (1)	**Climb** Normal climb all engines operating	+/- 3 kt IAS +/- 5% or +/- 100 fpm ROC	Climb	Gear up, take-off flaps	✔	✔
(2)	One engine inoperative second segment climb	+/- 3 Kt IAS +/- 5% or +/- 100 fpm ROC	Climb	Gear up, take-off flaps Multi engine aeroplane only	✔ CT&M	✔ ✔
b.	**In flight**					
(1)	Stall warning	+/- 3 Kt IAS +/- 2° bank	Climb and approach	Gear up, take-off flaps and normal approach configuration	✔	✔
c.	**Engines**					
(1)	Acceleration	+/- 10% time or +/- 1 sec	Approach or landing	Time from power lever idle position up to 90% of go-around power following slam opening of the power lever	CT&M	✔
(2)	Deceleration	+/- 10% time or +/- 1 sec	Ground / take-off	Time from power lever max take-off power to idle over a power decay of 90% after abrupt reduction of power lever to idle.	CT&M	✔
2.	**HANDLING QUALITIES**					
a. (1)	**Static control checks** Column position vs. force	+/- 2.2 daN (5 lb) or +/- 10% force	Cruise or approach	Control forces and travel shall broadly correspond to that of the replicated class of aeroplane	CT&M	✔

AMC STD 4A.030 (continued)

Test		Tolerance	Flight Condition	Comments	I	R
(2)	Wheel position vs. force	+/- 1.3 daN (3 lb) or +/- 10% force	Cruise or approach	Control forces and travel shall broadly correspond to that of the replicated class of	CT&	✔

Test		Tolerance	Flight Condition	Comments	I	R
				aeroplane	M	
(3)	Pedal position vs. force	+/- 2.2 daN (5 lb) or +/- 10% force	Cruise or approach	Control forces and travel shall broadly correspond to that of the replicated class of aeroplane	C T & M	✔
(4)	Pitch trim calibration	+/- 1° of trim angle	Ground	Only applicable if appropriate trim settings are available, e.g. data from the AFM.	C T & M	✔
(5)	Alignment of power lever angle vs. selected engine parameter	+/- 5% or +/- 2 cm (0.8") of power lever angle	Ground	In case of adjustable propeller powered aeroplane, this test is also applicable for the propeller lever.	✔	✔
b.	**Dynamic Control Checks**			not applicable		
c. (1)	**Longitudinal** Power change force or power change dynamics	 +/- 2.2 daN (5 lb) or +/- 10% force +/- 3 Kt IAS +/- 100 ft altitude +/- 1.5° or +/- 20% pitch	 Cruise or approach Cruise or approach	 Time history of uncontrolled free response recom-mended for a time increment of 5 sec before and 15 sec after any control input.	 C T & M C T & M	 ✔ ✔
(2)	Flap change force or flap change dynamics	+/- 2.2 daN (5 lb) or +/- 20% force +/- 3 Kt IAS +/- 100 ft altitude +/- 1.5° or +/- 20% pitch	Climb and approach Climb and approach	Time history of uncontrolled free response recom-mended for a time increment of 5 sec before and 15 sec after any control input.	C T & M C T & M	✔ ✔
(3)	Gear change force or gear change dynamics	+/- 2.2 daN (5 LB) or +/- 20% force +/- 3 Kt IAS +/- 100 ft altitude +/- 2° or +/- 20% pitch	Take-off and approach Climb and approach	Time history of uncontrolled free response recom-mended for a time increment of 5 sec before and 15 sec after any control input.	C T & M C T & M	✔ ✔

AMC STD 4A.030 (continued)

Test		Tolerance	Flight Condition	Comments	I	R
(4)	Gear and flap operating times	+/- 3 sec or +/- 10% 0f time	Take-off and approach		C T & M	✔
(5)	Longitudinal trim	+/- 2° pitch trim +/- 2° pitch +/- 5% power	Cruise and approach	May be a series of snapshot tests.	C T & M	✔
(6)	Longitudinal manoeuvring stability (stick force / g)	+/- 2.2 daN (5 lb) or +/- 10% force	Cruise and approach	Test at approx. 20° bank for approach and 30 to 45° bank for cruise configuration.	C T & M	✔
(7)	Longitudinal static stability	+/- 2.2 daN (5 lb) or +/- 10% force	Approach		C T & M	✔
(8)	Phugoid dynamics	10% period with representative damping	Cruise	Test should include at least 3 full cycles. Time history recommended.	C T & M	✔
d.	**Lateral directional**					
(1)	Minimum control speed air (V_{mca})		Take-off	It is important that there exists a realistic relationship between V_{mca} and V_s for all configurations and in particular the most critical full-power engine-out take-off configuration. Multi engine aeroplane only.	C T & M	C T & M
(2)	Roll response (rate)	+/- 10% or +/- 2°/sec roll rate	Cruise and approach	Test with normal wheel deflection (about 30% of maximum wheel). Time history of uncontrolled free response recommended for a time increment of 5 sec before and 15 sec after any control input.	C T & M	✔
(3)	Spiral stability	Correct trend and +/- 2° or +/- 10% bank in 20 sec	Cruise	Time history of uncontrolled free response recommended for a time increment of 5 sec before and 20 sec after any control input. Test for both directions required.	C T & M	✔

AMC STD 4A.030 (continued)

Test		Tolerance	Flight Condition	Comments	I	R
(4)	Rudder response	+/- 2°/sec or +/- 10% yaw rate or heading change	Approach	Test with a step input of approx. 25% of full rudder travel. Time history of uncontrolled free response recommended for a time increment of 5 sec before and 15 sec after any control input.	C T & M	✔
(5)	Steady heading sideslip	For a given rudder position: +/-2° bank +/- 1° sideslip. +/- 10% or +/- 5° wheel position	Approach	May be a series of snapshot tests using at least two rudder positions in both directions.	C T & M	✔
3.	**TRANSPORT DELAY**					
a	**Transport delay**					
(1)	Instrument response time	300 ms or less		One test for each axis	✔	✔
4.	**SOUND SYSTEM**					
a	**Aeroplane system sound**					
(1)	Engine and propeller sound			On a multi engine BITD propeller synchronisation should be possible by means of audio awareness	C T & M	C T & M

AMC STD 4A.030 (continued)

3 Functions and Manoeuvres

Functions Tests will be run in a logical flight sequence at the same time as performance and handling assessments. This also permits real time BITD running for around 2 hours, without repositioning or flight or position freeze, thereby permitting proof of reliability.

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS	Comments
1. PREPARATION FOR FLIGHT **a. Pre-flight** Accomplish a functions check of all switches, indicators, systems and equipment at student pilots' and instructors' stations and determine that the design and functions represent those of the simulated class of aeroplane.	
2. SURFACE OPERATION (pre-take-off) **a. Engine Start** (i) Normal start **b. Taxi**	 Not applicable
3. TAKE-OFF **a. Normal** **b. Abnormal / Emergency**	 Sufficient to commence the airborne exercises. Not applicable
4. CLIMB **a. Normal** (i) Landing gear and flap operation (ii) Constant speed climb (iii) Climbing turns **b. One engine inoperative** (i) Yaw moment (ii) Climb performance	 multi engine aeroplane only
5. CRUISE **a. Performance characteristics** (i) Straight level flight (ii) Change of airspeed	 Speed vs. power / configuration and attitude

AMC STD 4A.030 (continued)

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS		Comments
6.	**MANOEUVRES**	
a.	**Approach to stall**	
(i)	Stall warning in climb, cruise, approach and landing configuration	Horn or light
	Turns	
b.	Normal turns with 20° to 30° of bank	
(i)	Standard rate turns	
(ii)	Spiral dive recovery	
(iii)		multi engine aeroplane only
	Manoeuvring with one engine inoperative	
c.	Standard rate turns	
(i)	Performance	
(ii)	Power changes	
(iii)		
7.	**DESCENT**	
a.	**Normal**	
(i)	With constant speed and rate	
(ii)	Descending turns	
8.	**INSTRUMENT APPROACHES**	One approach shall be flown with one engine inoperative if applicable.
a.	**Precision approaches**	NAV equipment failure shall be demonstrated
b.	**Non precision approaches**	
(i)	NDB / VOR	
9.	**MISSED APPROACHES**	
a.	**All engines**	
b.	**One engine inoperative**	multi engine aeroplane only
10.	**ANY FLIGHT PHASE**	
a.	**Aeroplane systems operation**	
(i)	Communications	
(ii)	Electrical	
(iii)	Engine, fuel and oil	
(iv)	Other systems	As applicable
b.	**Radio Navigation Procedures**	
(i)	VOR intercept and tracking	Also cone of silence
(ii)	NDB intercept and tracking	Dip if programmed
(iii)	Holding procedures	
(iv)	Checking the DME	
(vi)	Checking beam-width of VOR and LOC	
c.	**Effect of wind**	

IEM STD 4A.030
Guidance on Design and Qualification
See JAR–STD 4A.030
See also AMC STD 4A.030

1 Background

1.1 Traditionally training devices used by the ab-initio pilot schools have been relatively simple instrument flight-only aids. These devices were loosely based on the particular school's aeroplane. The performance would be approximately correct in a small number of standard configurations, however the handling characteristics could range from rudimentary to loosely representative. The instrumentation and avionics fit varied between basic and very close to the target aeroplane. The approval to use such devices as part of a training course was based on a regular subjective evaluation of the equipment and its operator by an Authority inspector.

1.2 JAR-STD 3A introduces two new devices, where the FNPT I device is essentially a replacement for the traditional instrument flight ground training device taking advantage of recent technologies and having a more objective design basis.

1.3 JAR-STD 4A sets the requirements and guidelines for the lower level of STDs by introducing BITDs. It should clearly be understood that a BITD never can replace an FNPT I. The main purpose of a BITD is to replace an old instrument training device which cannot be longer approved either due to poor fidelity or system reliability.

2 Design Standards

2.1 Unlike flight simulators, a BITD is intended to be representative of a class of aeroplane. The configuration chosen should broadly represent the aeroplane likely to be used as part of the overall training package. It would be in the interest of all parties to engage in early discussions with the Authority to broadly agree a suitable configuration, known as the 'designated aeroplane configuration'.

2.2 The student pilot station should be broadly representative of the designated aeroplane configuration and should be sufficiently enclosed to exclude any distractions.

2.3 The main instrument panel in a BITD may be displayed on a CRT. Touch screen or mouse and keyboard operation by the student pilot would not be acceptable for any instrument or system.

3 Validation Data

3.1 The data used to model the aerodynamics and engine(s) should be soundly based on the designated aeroplane configuration. It is not acceptable if the models merely represent a few key configurations.

3.2 Recognising the cost and complexity of flight simulation models, it should be possible to generate a generic class typical model. Such models should be continuous and vary sensibly throughout the required training flight envelope. A basic principal for any modelling is the integrity of the mathematical equations and models used to represent the flying qualities and performance of the class of aeroplane simulated. Data to tune the generic model to represent a more specific aeroplane can be obtained from many sources without recourse to expensive flight test:

a. Aeroplane design date
b. Flight and Maintenance Manuals
c. Observations on ground and during flight

IEM STD 4A.030 (continued)

Data obtained on ground or in flight can be measured and recorded using a range of simple means such as:

a. Video
b. Pencil and paper
c. Stopwatch
d. New technologies like GPS etc.

Any such data gathering should take place at representative masses and centres of gravity. Development of such a data package including justification and the rationale for the design and intended performance, the measurement methods and recorded parameters should be carefully documented and available for inspection by the Authority as part of the qualification process.

4 Limitations

A force cueing system may be springloaded. But it should be remembered that it is vitally important that negative characteristics would not be acceptable.

5 Testing and Evaluation

To ensure that any device meets its design criteria initially and periodically throughout its life a system of objective and subjective testing will be used. The subjective testing may be similar to that in use in the recent past. The objective testing methodology is drawn from that used currently on higher level training devices.

The validation tests specified in AMC STD 4A.030, par. 2.3 can be flown by a suitably skilled person and the results recorded manually. However a print out of the parameters of interest is highly recommended, thereby increasing the repeatability of the achieved results.

The tolerances specified are designated to ensure that the device meets its original target criteria year after year. It is therefore important that such target data is carefully derived and values are agreed with the appropriate inspecting Authority in advance of any formal qualification process. For initial qualification, it is highly desirable that the device should meet its design criteria within the listed tolerances, however the tolerances contained in this document are specifically intended to be used to ensure repeatability during the life of the device and in particular at each recurrent Authority evaluation.

Most of the tests within the QTG had their tolerances reduced to Correct Trend and Magnitude (CT&M). The use of CT&M is not to be taken as an indication that certain areas of simulation can be ignored. For such tests, the performance of the device should be approximate and representative of the simulated class of aeroplane and should under no circumstances exhibit negative characteristics. In all these cases it is strongly recommended to print out the baseline results during initial evaluation thereby avoiding the effects of possible divergent subjective opinions during recurrent evaluations.

The subjective tests listed under AMC STD 4A.030, par. 3, functions and manoeuvres should be flown out by a suitably qualified and experienced pilot. Subjective testing will review not only the interaction of all the systems applicable but the integration of the BITD within a training syllabus, including:

a. Training environment
b. Freezes and repositions
c. Navaid environment

IEM STD 4A.030 (continued)

In parallel with this objective and subjective testing process it is envisaged that suitable maintenance arrangements as part of a Quality System shall be in place. Such arrangements will cover routine maintenance, the provision of satisfactory spares holdings and personnel.

6 Additional Information

Unlike other STDs the manufacturer of a BITD has the responsibility for the initial evaluation of a new BITD model. Because all serial numbers of such a model are automatically qualified, the user approval at the operator's site becomes more important before the course approval is granted.

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