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# AIC

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## QUALIFICATION OF FLIGHT SIMULATION TRAINING DEVICE

### INTRODUCTION

1. This AIC is issued in the exercise of the powers conferred under Section 24o of the Civil Aviation Act 1969.
2. This document has been prepared to set forth the requirements for the approval of a Flight Simulation Training Device (FSTD) for aircraft pursuant to Regulation 45 of the Civil Aviation Regulation 1996 and ICAO Annex 1.
3. A FSTD is any one of the following three types of apparatus in which flight conditions are simulated on the ground:
  - (1) Full Flight Simulator (FFS);
  - (2) Flight Training Device (FTD); or
  - (3) Flight and Navigation Procedures Trainer (FNPT).
4. Training devices other than the above shall be considered on a case-by-case basis.
5. The meanings of the terms used in this AIC are contained in Appendix 1.
6. The minimum requirements for type and level of FSTD Qualifications for aeroplane are contained in Appendix 2.
7. The minimum requirements for FNPT aeroplane approved for Multi Crew Co-operation (MCC) training are contained in Appendix 3.
8. The minimum requirements for type and level of FSTD Qualifications for helicopters are contained in Appendix 4.
9. The minimum requirements for FNPT helicopter approved for MCC training are contained in Appendix 5.

### APPLICATION FOR FSTD QUALIFICATION

10. This AIC applies to any body of persons, corporate or unincorporate, seeking qualification of FSTD.

11. Any body of persons, corporate or unincorporate, requiring evaluation of a FSTD shall apply to the DCA giving 3 months notice. In exceptional cases this period may be reduced to one month at the discretion of the DCA.
12. A FSTD Qualification Certificate will be issued following satisfactory completion of an evaluation of the FSTD by the DCA.

#### **FSTD USER APPROVAL**

13. Any Operator, requesting training, checking and testing credits through the use of FSTD, as part of their approved training programmes, shall obtain, from the DCA, a FSTD User Approval. The applicant shall apply in writing, not less than 30 days prior to the intended use, detailing the:
  - (1) type of training to be undertaken;
  - (2) level to which qualification is sought;
  - (3) length of or total amount of training envisaged;
  - (4) level of qualification assigned by the supervising regulatory authority; and
  - (5) Qualification Test Guide (QTG) suitable for the qualification level.
14. The validity period of a FSTD User Approval shall be 12 months or any lesser period as determined by the DCA. The Approval is subjected to the continued qualification of the FSTD by the DCA or qualifying Authority.

#### **VALIDITY OF FSTD QUALIFICATION**

15. A FSTD Qualification shall be valid for 12 months unless otherwise specified by the DCA.
16. A FSTD Qualification revalidation can take place at any time within the 60 days prior to 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.
17. The DCA shall refuse, revoke, suspend or vary a FSTD Qualification, if the provisions of this AIC are not satisfied.
18. A FFS qualified before 1 March 2009 shall have the right to retain their FFS Qualification level. The original qualifying document will be referred for the recurrent evaluation. Any improvement or enhancement for the purpose of achieving a higher level of qualification will be based on the currently applicable requirement.

#### **REQUIREMENTS FOR FSTD OPERATORS**

19. A FSTD Operator shall demonstrate the capability to maintain the performance, functions and other characteristics specified for the FSTD Qualification level.
20. A FSTD Operator shall establish a Quality System that is acceptable to the DCA. The Quality System shall be described in relevant documentation.

21. A FSTD Operator shall designate a Quality Manager, acceptable to the DCA, to monitor compliance with, and the adequacy of, procedures required to ensure the maintenance of the FSTD Qualification level. Compliance monitoring shall include a feedback system to the Accountable Manager to ensure corrective action as necessary.
22. A FSTD Operator shall maintain a link between their organisation, the DCA and the relevant manufacturers to incorporate important modifications, especially those involving aircraft modifications that are essential for training and checking, including those involving the motion and visual systems.
23. When essential for training and checking, FSTD Operators shall update their FSTD. Modifications of the FSTD hardware and software that affect handling, performance and systems operation or any major modifications of the motion or visual system shall be evaluated to determine the impact on the original qualification criteria. FSTD Operators shall prepare amendments for any affected validation tests. The FSTD Operator shall test the FSTD to the new criteria.
24. The DCA shall be advised in advance of any major changes to determine if the tests carried out by the FSTD Operator are satisfactory. A special evaluation of the FSTD may be necessary prior to returning it to training, following the modification.
25. A FSTD Operator shall ensure that the FSTD are housed in a suitable environment that supports safe and reliable operation and complies with the national regulation for health and safety.
26. All FSTD occupants and maintenance personnel shall be briefed on FSTD safety to ensure that they are aware of all safety equipment and procedures of the FSTD in the event of emergencies.
27. FSTD shall have safety features such as emergency stops and emergency lighting and are checked at least annually and recorded by the FSTD Operator.
28. Where additional equipment has been added to the FSTD, even though not required for qualification, it will be assessed to ensure that it does not adversely affect the quality of training.

#### **REQUIREMENTS FOR FSTD QUALIFICATION**

29. Any FSTD submitted for initial evaluation or recurrent evaluation on or after 1 March 2009 will be evaluated against applicable FSTD Qualification criteria for the level applied.
30. A FSTD shall be assessed in those areas that are essential to completing the flight crewmember training and checking process as applicable.
31. The FSTD shall be subjected to:
  - (1) Validation tests; and
  - (2) Functions and Subjective tests.
32. The FSTD Operator shall submit a QTG in a form and manner that is acceptable to the DCA.

33. 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 DCA. After inclusion of the results of the tests witnessed by the DCA, the approved QTG becomes the Master QTG (MQTG), which is the basis for the FSTD qualification and subsequent recurrent evaluations.
34. FSTD Operators shall run the complete set of tests contained within the MQTG progressively between each annual evaluation by the DCA. Results shall be dated and retained in order to satisfy both the FSTD Operator and the DCA that FSTD standards are being maintained.
35. FSTD Operators are to establish a Configuration Control System to ensure the continued integrity of the hardware and software of the qualified FSTD.
36. The DCA may conduct a special evaluation when a FSTD appears not to be performing at its initial qualification level.

#### **CHANGES TO APPROVED FSTD**

37. The Operator of an approved FSTD shall inform the DCA of proposed major changes to the FSTD involving:
  - (1) aircraft modifications, which could affect FSTD Qualification.
  - (2) FSTD hardware and or software modifications that could affect the handling qualities, performances or system representations.
38. If an upgrade is proposed, the FSTD Operator shall seek the advice of the DCA 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 FSTD to continue to qualify even at the previous qualification level.
39. For a FSTD upgrade, an FSTD Operator shall run all validation tests for the requested qualification level. Results from previous evaluations shall not be used to validate FSTD performance for the upgrade. A special evaluation by DCA is required.
40. The DCA shall be advised before a FSTD is to be moved to a new location. Prior to returning the FSTD to service at the new location, the FSTD Operator shall perform at least one third of the validation tests and, functions and subjective tests to ensure that the FSTD performance meets its original qualification standard. A copy of the test documentation shall be retained together with the FSTD records for review by the DCA.
41. If a FSTD Operator plans to remove a FSTD from active status for prolonged periods, the DCA shall be notified and suitable controls established for the period during which the FSTD is inactive. The FSTD operator shall agree to a procedure with the DCA to ensure that the FSTD can be restored to active status at its original qualification level.

## **CHANGE OF FSTD OPERATOR**

42. In cases of a request for the change of the FSTD Operator:
- (1) the acquiring FSTD operator shall advise the DCA in advance in order to agree upon a plan of transfer of the FSTD;
  - (2) at the discretion of the DCA, the FSTD shall be subjected to an evaluation in accordance with its original qualification criteria; and
  - (3) provided that the FSTD performs to its original standard, its original qualification level shall be restored. Revised FSTD User Approval may also be required.

## **IMPLEMENTATION**

43. The charges for the approval and renewal of FSTD shall be in accordance to MCAR 1996 12<sup>th</sup> Schedule Part B paragraph 14.
44. All expenses associated with FSTD qualification test, involving DCA personnel, shall be borne by the FSTD Operator or User in accordance with MCAR 1996 12<sup>th</sup> Schedule.
45. This AIC supersedes AIC 3/2000 dated 1 March 2000 and will become effective 1 March 2009.

**DATO' AZHARUDDIN ABDUL RAHMAN**

**Director General**

**Department of Civil Aviation**

**Malaysia**

## ABBREVIATIONS AND INTERPRETATIONS

1. CT&M – Correct Trend and Magnitude
2. FFS - “Full Flight Simulator” means a full size replica of a specific type or make, model and series aircraft flight deck, including the assemblage of all equipment and computer programmes necessary to represent the aircraft in ground and flight operations, a visual system providing an out of the flight deck view, and a force cueing motion system.
3. FNPT - “Flight and Navigation Procedures Trainer” means a training device which represents the flight deck or cockpit environment including the assemblage of equipment and computer programmes necessary to represent an aircraft or class of aircraft in flight operations to the extent that the systems appear to function as in an aircraft.
4. Free Response – The response of the aircraft after the completion of a control input or disturbance.
5. FSTD User – “Flight Simulation Training Device User” means the persons, corporate or unincorporate, requesting training, checking and testing credits through the use of a FSTD.
6. FSTD User Approval – “Flight Simulation Training Device User Approval” means extent to which a FSTD of a specified qualification level may be used by body of persons, corporate or unincorporate, as approved by the DCA. It takes account of aircraft to FSTD differences and the operating and training ability of the organisation.
7. FSTD Operator – “Flight Simulation Training Device Operator” means body of persons, corporate or unincorporate, directly responsible to the DCA for requesting and maintaining the qualification of a particular FSTD.
8. FSTD User – “Flight Simulation Training Device User” means body of persons, corporate or unincorporate, requesting training, checking and testing credits through the use of an FSTD.
9. FSTD Qualification – “Flight Simulation Training Device Qualification” means the level of technical ability of a FSTD as defined in the compliance document.
10. FTD – “Flight Training Device” means a full size replica of a specific aircraft type’s instruments, equipment, panels and controls in an open flight deck area or an enclosed aircraft flight deck, including the assemblage of equipment and computer software programmes necessary to represent the aircraft 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.
11. “Functional test” mean a quantitative and/or qualitative assessment of the operation and performance of a FSTD which includes verification of correct operation of controls, instruments and systems of the simulated aircraft under normal and non-normal conditions.

12. Ground Effect – The change in aerodynamic characteristics due to modification of the airflow past the aircraft caused by the presence of the ground.
13. Irreversible Control System – A control system in which movement of the control surface will not back-drive the pilot’s control on the flight deck.
14. Latency – The additional time, beyond that of the basic perceivable response time of the aircraft due to the response time of the FSTD.
15. MCC – Multi-Crew Co-operation
16. MQTG – “Master Qualification Test Guide” means the DCA approved QTG which incorporates the results of test witnessed by DCA. It serves as the reference for future evaluations.
17. QTG – “Qualification Test Guide” means a document designed to demonstrate that the performance and handling qualities of an FSTD agree within prescribed limits with those of the aircraft and that all applicable regulatory requirements have been met. The QTG includes both the aircraft and FSTD data used to support the validation.
18. “Subjective Test” means a qualitative assessment based on established standards as interpreted by a suitably qualified person.
19. “Transport Delay” means the total FSTD system processing time required for an input from a pilot primary flight control until the motion system, visual system or instrument response. It is the overall time delay incurred from signal input until output response. It does not include the characteristic delay of the aircraft simulated.
20. “Validation Test” means a test by which FSTD parameters can be compared with the relevant validation data

### MINIMUM QUALIFICATION REQUIREMENTS FOR FLIGHT SIMULATION TRAINING DEVICE (AEROPLANE)

The table below describes the minimum requirements for aeroplane Full Flight Simulator (FFS), Flight Training Device (FTD) and Flight and Navigation Procedures Trainer (FNPT) to the related qualification levels. Additional requirements or amendments for FNPT MCC are contained in Appendix 3.

Certain requirements included in this section shall be supported with a statement of compliance (SOC) and, in some designated cases, an objective test. The SOC will describe how the requirement was met. The test results shall show that the requirement has been attained.

		FSTD AEROPLANE										
		FFS				FTD		FNPT				
LEVEL		A	B	C	D	1	2	I	II	MCC	COMPLIANCE	
1.	<b>GENERAL</b>											
1.1	A fully enclosed flight deck.	X	X	X	X							
1.2	A cockpit/flight deck sufficiently enclosed to exclude distraction, which will replicate that of the aeroplane or class of aeroplane simulated.						X	X	X	X		
1.3	<p>Flight deck, a full scale replica of the aeroplane simulated. Equipment for operation of the cockpit windows shall be included in the FSTD, but the actual windows need not be operable.</p> <p>The flight deck, for FSTD purposes, consists of all that space forward of a cross section of the fuselage at the most extreme aft setting of the pilots' seats. Additional required flight crewmember duty stations and those required bulkheads aft of the pilot seats are also considered part of the flight deck and shall replicate the aeroplane.</p>	X	X	X	X						<p>Flight deck observer seats are not considered to be additional flight crewmember duty stations and may be omitted. Bulkheads containing items such as switches, circuit breakers, supplementary radio panels, etc. to which the flight crew may require access during any event after pre-flight cockpit preparation is complete are considered essential and may not be omitted.</p> <p>Bulkheads containing only items such as landing gear pin storage compartments, fire axes or extinguishers, spare light bulbs, aircraft document pouches etc. are not considered essential and may be omitted. Such items, or reasonable facsimile, shall still be available in the FSTD but may be relocated to a suitable location as near as practical to the original position. Fire axes and any similar purpose instruments need only be represented in silhouette.</p>	

1.4	Direction of movement of controls and switches identical to that in the aeroplane.	X	X	X	X						
1.5	A full size panel of replicated systems which will have actuation of controls and switches that replicate those of the aeroplane simulated.					X	X				The use of electronically displayed images with physical overlay incorporating operable switches, knobs, buttons replicating aeroplane instruments panels may be acceptable.
1.6	Cockpit/flight deck switches, instruments, equipment, panels, systems, primary and secondary flight controls sufficient for the training events to be accomplished shall be located in a spatially correct flight deck area and will operate as, and represent those in, that aeroplane or class of aeroplane.							X	X	X	For MCC qualification, see Appendix 3.
1.7	Crew members seats shall be provided with sufficient adjustment to allow the occupant to achieve the design eye reference position appropriate to the aeroplane or class of aeroplane and for the visual system to be installed to align with that eye position.					X		X	X		
1.8	Circuit breakers that affect procedures and/or result in observable cockpit indications properly located and functionally accurate.	X	X	X	X	X	X		X	X	
1.9	Flight dynamics model that accounts for various combinations of drag and thrust normally encountered in flight corresponding to actual flight conditions, including the effect of change in aeroplane attitude, sideslip, thrust, drag, altitude, temperature, gross weight, moments of inertia, centre of gravity location, and configuration.	X	X	X	X	X	X	X	X	X	For FTD Levels 1 and 2 aerodynamic modeling sufficient to permit accurate systems operation and indication is acceptable.  For FNPT, class specific modelling is acceptable.
1.10	All relevant instrument indications involved in the simulation of the applicable aeroplane shall automatically respond to control movement by a flight crewmember or induced disturbance to the simulated aeroplane; e.g., turbulence or wind shear.	X	X	X	X	X	X	X	X	X	For FNPT, instrument indications sufficient for the training events to be accomplished.
1.11	Lighting environment for panels and instruments shall be sufficient for the operation being conducted.					X	X	X	X	X	For FTD Level 2, lighting environment shall be as per aeroplane.
1.12	Communications, navigation, and caution and warning equipment corresponding to that installed in the applicant's aeroplane with operation within the tolerances prescribed for the applicable airborne equipment.	X	X	X	X	X	X				For FTD Level 1, applies where the appropriate systems are replicated.

1.13	Navigation equipment corresponding to that of the replicated aeroplane or class of aeroplanes, with operation within the tolerances prescribed for the actual airborne equipment. This shall include communication equipment (interphone) and air/ground communications system.							X	X	X	
1.14	Navigational data with the corresponding approach facilities. Navigation aids should be usable within range without restriction.	X	X	X	X	X	X	X	X	X	For FTD Level 1 applies where navigation equipment is replicated.  For all FFS and FTD Level 2 where used for area or airfield competence training or checking, navigation data should be updated within 28 days.  For FNPT complete navigational data for at least 5 different airports with corresponding precision and non-precision approach procedures including current updating within a period of 3 months.
1.15	In addition to the flight crewmember duty stations, three suitable seats for the instructor, delegated examiner and DCA inspector. The DCA will consider options to this standard based on unique cockpit configurations. These seats shall provide adequate vision to the pilot's panel and forward windows. Observer seats need not represent those found in the aeroplane but in the case of FSTD fitted with a motion system, the seats shall be adequately secured to the floor of the FSTD, fitted with positive restraint devices and be of sufficient integrity to safely restrain the occupant during any known or predicted motion system excursion.	X	X	X	X	X	X	X	X	X	For FTD and FNPT, suitable seating arrangements for the Instructor, Authorised Examiner or DCA Inspector should be provided.
1.16	FSTD systems shall simulate applicable aeroplane system operation, both on the ground and in flight. Systems shall be operative to the extent that all normal, abnormal and emergency operating procedures can be accomplished.	X	X	X	X	X	X		X	X	For FTD Level 1, applies where system is simulated. For FNPT systems shall be operative to the extent that it shall be possible to perform all normal, abnormal and emergency operations as may be appropriate to the aeroplane or class of aeroplanes being simulated and as required for the training.
1.17	Instructor controls shall enable the operator to control all required system variables and insert abnormal or emergency conditions into the aeroplane systems.	X	X	X	X	X	X	X	X	X	Where applicable and as required for training the following shall be available : (1) position and flight freeze; (2) a facility to enable the dynamic plotting of the flight path on approaches, commencing at the final approach fix, including the vertical profile; and (3) hard copy of map and approach plot.

1.18	Control forces and control travel shall correspond to that of the replicated aeroplane. Control forces shall react in the same manner as in the aeroplane under the same flight conditions.	X	X	X	X		X	X	X	X	<p>For FTD Level 2, control forces and control travel should correspond to that of the replicated aeroplane with CT&amp;M. It is not intended that the device should be flown manually other than for short periods when the autopilot is temporarily disengaged.</p> <p>For FNPT Level I, control forces and control travel shall broadly correspond to that of the replicated aeroplane or class of aeroplane. Control force changes due to an increase/decrease in aircraft speed are not necessary.</p> <p>In addition for FNPT Level II and MCC, control forces and control travels shall respond in the same manner under the same flight conditions as in the aeroplane or class of aeroplane being simulated.</p>
1.19	<p>Ground handling and aerodynamic programming shall include:</p> <p>(1) Ground Effect (eg. round-out, flare, and touchdown). This requires data on lift, drag, pitching moment, trim, and power ground effect.</p> <p>(2) Ground reaction - reaction of the aeroplane upon contact with the runway during landing to include strut deflections, tyre friction, side forces, and other appropriate data, such as weight and speed, necessary to identify the flight condition and configuration.</p> <p>(3) Ground handling characteristics (steering inputs to include crosswind, braking, thrust reversing, deceleration and turning radius)</p>	X	X	X	X				X	X	<p>SOC and tests required.</p> <p>For FFS Level A, generic ground handling to the extent that allows turns within the confines of the runway, adequate control on flare, touchdown and roll-out (including from a cross-wind landing) only is acceptable.</p> <p>For FNPT a generic ground handling model need only be provided to enable representative flare and touch down effects.</p>
1.20	<p>Wind shear models shall provide training in the specific skills required for recognition of wind shear phenomena and execution of recovery manoeuvres. Such models shall be representative of measured or accident derived winds, but may include simplifications which ensure repeatable encounters. For example, models may consist of independent variable winds in multiple simultaneous components. Wind models shall be available for the following critical phases of flight:</p> <p>(1) prior to take-off rotation;</p> <p>(2) at lift-off;</p> <p>(3) during initial climb; and</p> <p>(4) short final approach.</p>			X	X						Test required.
1.21	Instructor controls for environmental effects including wind speed and direction shall be provided.	X	X	X	X	X	X	X	X	X	For FTD, environment modeling sufficient to permit accurate systems operation and indication.

1.22	Stopping and directional control force shall be representative for at least the following runway conditions based on aeroplane related data: dry, wet, icy, patchy wet, patchy icy and wet on rubber residue in touchdown zone.			X	X							SOC required. Objective tests required for dry, wet and icy runway conditions. Subjective check required for patchy wet, patchy icy and wet on rubber residue in touchdown zone.
1.23	Brake and tyre failure dynamics (including antiskid) and decreased brake efficiency due to brake temperatures shall be representative and based on aeroplane related data.			X	X							SOC required. Subjective test is required for decreasing braking efficiency due to brake temperature, if applicable.
1.24	A means for quickly and effectively conducting daily testing of FSTD programming and hardware shall be available.			X	X							SOC required.
1.25	Computer capacity, accuracy, resolution, and dynamic response shall be sufficient to fully support the overall fidelity, including its evaluation and testing.	X	X	X	X	X	X					SOC required.
1.26	Control feel dynamics shall replicate the aeroplane simulated.  Free response of the controls shall match that of the aeroplane within the tolerances specified. Initial and upgrade evaluations will include control free response (pitch, roll and yaw controller) measurements recorded at the controls. The measured responses shall correspond to those of the aeroplane in take-off, cruise, and landing configurations. For aeroplanes with irreversible control systems, measurements may be obtained on the ground if proper pitot static inputs are provided to represent conditions typical of those encountered in flight. Engineering validation or aeroplane manufacturer rationale will be submitted as justification to ground test or omit a configuration. For FSTD requiring static and dynamic tests at the controls, special test fixtures will not be required during initial evaluation if the FSTD operator's MQTG shows both test fixture results and alternate test method results such as computer data plots, which were obtained concurrently. Repetition of the alternate method during initial evaluation may then satisfy this requirement.			X	X							Test required

1.27	A transport delay test to demonstrate that the FSTD system response does not exceed 150 milliseconds. This test shall measure all the delay encountered by a step signal migrating from the pilot's control through the control loading electronics and interfacing through all the simulation software modules in the correct order, using a handshaking protocol, finally through the normal output interfaces to the motion system, to the visual system and instrument displays. Latency test is acceptable as an alternate method to show compliance.	X	X	X	X	X	X	X	X	X	Tests required.  For FFS Level A and B, and applicable systems for FTD and FNPT, the maximum permissible delay is 300 milliseconds
1.28	Latency Test. The visual system, flight deck instruments and initial motion system response shall respond to abrupt pitch, roll and yaw inputs from the pilot's position within 150 milliseconds of the time, but not before the time, when the aeroplane would respond under the same conditions. Transport delay test is acceptable as an alternate method to show compliance	X	X	X	X	X	X	X	X	X	Tests required.  For FFS Level A and B, and applicable systems for FTD and FNPT, the maximum permissible delay is 300 milliseconds.
1.29	Aerodynamic modelling shall be provided. This shall include, for aeroplanes issued an original type certificate after June 1980, low altitude level flight ground effect, Mach effect at high altitude, normal and reverse dynamic thrust effect on control surfaces, aeroelastic representations, and representations of non-linearities due to sideslip based on aeroplane flight test data provided by the manufacturer.			X	X						SOC required. Mach effect, aeroelastic representations, and non-linearities due to sideslip are normally included in the FSTD aerodynamic model. The SOC shall address each of these items.  Separate tests for thrust effects and a SOC are required.
1.30	Modelling that includes the effects of airframe and engine icing.			X	X				X	X	SOC required. It shall describe the effects that provide training in the specific skills required for recognition of icing phenomena and execution of recovery.
1.31	Aerodynamic and ground reaction modelling for the effects of reverse thrust on directional control shall be provided.		X	X	X						SOC required
1.32	Realistic aeroplane mass properties, including mass, centre of gravity and moments of inertia as a function of payload and fuel loading shall be implemented.	X	X	X	X						SOC required at initial evaluation. SOC shall include a range of tabulated target values to enable a demonstration of the mass properties model to be conducted from the instructor's station.
1.33	Self-testing for FSTD hardware and programming to determine compliance with the FSTD performance tests shall be provided. Evidence of testing shall include FSTD number, date, time, conditions, tolerances, and the appropriate dependent variables portrayed in comparison with the aeroplane standard.			X	X						SOC and test required.
1.34	Timely and permanent update of hardware and programming subsequent to aeroplane modification sufficient for the qualification level sought.	X	X	X	X	X	X				

1.35	Daily pre-flight documentation either in the daily log or in a location easily accessible for review is required	X	X	X	X	X	X	X	X	X	
2	<b>MOTION SYSTEM</b>										
2.1	Motion cues as perceived by the pilot shall be representative of the aeroplane.	X	X	X	X						For FSTD where motion systems are not specifically required, but have been added, they will be assessed to ensure that they do not adversely affect the qualification of the FSTD.
2.2	Motion system shall provide sufficient cueing, which may be of a generic nature to accomplish the required tasks.	X									SOC and test required.
2.3	Motion system shall have a minimum of 3 degrees of freedom.		X								SOC and test required.
2.4	Motion system shall produce cues at least equivalent to those of a six-degrees-of-freedom synergistic platform motion system.			X	X						SOC and test required.
2.5	A means of recording the motion response time as required.	X	X	X	X						
2.6	Motion effects programming shall include:  (1) Effects of runway rumble oleo deflections, groundspeed, uneven runway, centerline lights and taxiway characteristics. (2) Buffets on the ground due to spoiler/speedbrake extension and thrust reversal. (3) Bumps associated with the landing gear. (4) Buffet during extension and retraction of landing gear. (5) Buffet in the air due to flap and spoiler/speedbrake extension. (6) Approach to stall buffet. (7) Touchdown cues for main and nose gear. (8) Nose wheel scuffing. (9) Thrust effect with brakes set. (10) Mach and manoeuvre buffet. (11) Tyre failure dynamics. (12) Engine malfunction and engine damage. (13) Tail and pod strike.	X	X	X	X						For FFS Level A, effects may be of a generic nature sufficient to accomplish the required tasks.
2.7	Motion vibrations: Tests with recorded results that allow the comparison of relative amplitudes versus frequency are required.  Characteristic motion vibrations that result from operation of the aeroplane in so far as vibration marks an event or aeroplane state that can be sensed at the flight deck shall be present. The FSTD shall be programmed and instrumented in such a manner that the characteristic vibration modes can be measured and compared with aeroplane data.				X						SOC and test required.

3	<b>VISUAL SYSTEM</b>											
3.1	The visual system shall meet all the standards enumerated as applicable to the level of qualification requested by the applicant.	X	X	X	X					X	X	For FTD and FNPT Level I, when visual systems have been added by the FSTD Operator even though not attracting specific credits, they will be assessed to ensure that they do not adversely affect the qualification of the FSTD.  For FTD 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 FFS Level A.
3.2	Continuous minimum collimated visual field-of-view of 45 degrees horizontal and 30 degrees vertical field of view simultaneously for each pilot.	X	X									SOC is acceptable in place of this test.
3.3	Continuous, cross-cockpit, minimum collimated visual field of view providing each pilot with 180 degrees horizontal and 40 degrees vertical field of view. Application of tolerances require the field of view to be not less than a total of 176 measured degrees horizontal field of view (including not less than $\pm 88$ measured degrees either side of the centre of the design eye point) and not less than a total of 36 measured degrees vertical field of view from the pilot's and co-pilot's eye points.			X	X							Consideration shall be given to optimising the vertical field of view for the respective aeroplane cut-off angle.  SOC is acceptable in place of this test.
3.4	A visual system (night/dusk or day) capable of providing a field-of-view of a minimum of 45 degrees horizontally and 30 degrees vertically, unless restricted by the type of aeroplane, simultaneously for each pilot, including adjustable cloud base and visibility.									X	X	The visual system need not be collimated but shall be capable of meeting the standards laid down in the validation and functions and subjective test.  SOC is acceptable in place of this test.
3.5	A means of recording the visual response time for visual systems.	X	X	X	X					X	X	
3.6	System Geometry. The system fitted shall be free from optical discontinuities and artifacts that create non-realistic cues	X	X	X	X					X	X	Test required. A SOC is acceptable in place of this test.
3.7	Visual textural cues to assess sink rate and depth perception during take-off and landing shall be provided.	X	X	X	X							For FFS Level A, visual cueing shall be sufficient to support changes in approach path by using runway perspective.
3.8	Horizon and attitude shall correlate to the simulated attitude indicator.	X	X	X	X							SOC required.
3.9	Occulting - A minimum of ten levels shall be available.	X	X	X	X							SOC required. Occulting shall be demonstrated.

3.10	Surface resolution shall occupy a visual angle of not greater than 2 arc minutes in the visual display used on a scene from the pilot's eye-point.			X	X							Test and SOC required containing calculations confirming resolution.
3.11	Surface contrast ratio shall be demonstrated by a raster drawn test pattern showing a contrast ratio of not less than 5:1.			X	X							Test and SOC required.
3.12	Highlight brightness shall be demonstrated using a raster drawn test pattern. The highlight brightness shall not be less than 20 cd/m2 (6ft-lamberts).			X	X							SOC and test required. Use of calligraphic lights to enhance raster brightness is acceptable.
3.13	Light point size - not greater than 5 arc minutes.			X	X							SOC and test required. This is equivalent to a light point resolution of 2.5 arc minutes.
3.14	Light point contrast ratio - not less than 10:1.	X	X									SOC and test required.
3.15	Light point contrast ratio - not less than 25:1.			X	X							SOC and test required.
3.16	Daylight, twilight and night visual capability as applicable for level of qualification sought.	X	X	X	X							SOC required for system capability. System objective and scene content tests are required.
3.17	The visual system shall be capable of meeting, as a minimum, the system brightness and contrast ratio criteria as applicable for level of qualification sought.	X	X	X	X							
3.18	Total scene content shall be comparable in detail to that produced by 10000 visible textured surfaces and (in day) 6000 visible lights, and sufficient system capacity to display 16 simultaneously moving objects.			X	X							
3.19	The system, when used in training, shall provide in daylight, full colour presentations and sufficient surfaces with appropriate textural cue to conduct a visual approach, landing and airport movement (taxi). Surface shading effects shall be consistent with simulated (static) sun position.			X	X							
3.20	The system, when used in training, shall provide at twilight, as a minimum, full colour presentations of reduced ambient intensity, sufficient surfaces with appropriate textural cues that include self-illuminated objects such as road networks, ramp lighting and airport signage, to conduct a visual approach, landing and airport movement (taxi). Scenes shall include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by representative ownship lighting (e.g. landing lights). If provided, directional horizon lighting shall have correct orientation and be consistent with surface shading effects.			X	X							

3.21	The system, when used in training, shall provide at night, as a minimum, all features applicable to the twilight scene, as defined above, with the exception of the need to portray reduced ambient intensity that removes ground cues that are not self-illuminating or illuminated by ownship lights (e.g. landing lights).	X	X	X	X						
4	<b>SOUND SYSTEM</b>										
4.1	Significant flight deck sounds which result from pilot actions corresponding to those of the aeroplane or class of aeroplane.	X	X	X	X		X	X	X	X	For FNPT Level I, engine sounds only need be available
4.2	Sound of precipitation, rain removal equipment and other significant aeroplane noises perceptible to the pilot during normal and abnormal operations and the sound of a crash when the FSTD is landed in excess of limitations.			X	X						SOC required.
4.3	Comparable amplitude and frequency of flight deck noises, including engine and airframe sounds. The sounds shall be coordinated with the required weather.				X						Test required
4.4	The volume control shall have an indication of sound level setting which meets all qualification requirements.	X	X	X	X						

### FNPT (AEROPLANE) MCC REQUIREMENTS

For FNPT (Aeroplane) to be used for Multi-Crew Co-operation (MCC) training, the general technical requirements are expressed in the MCC column of Appendix 2. In the table below are the additional requirements or amendments.

1.	Turbo-jet or turbo-prop engines.
2.	Performance reserves, in case of an engine failure, to be in accordance with Type Certificate category for large aeroplanes (refer Airworthiness Notice No 81 issue 1). These may be simulated by a reduction in the aeroplane gross mass.
3.	Retractable landing gear.
4.	Pressurisation system.
5.	De-icing systems.
6.	Fire detection / suppression system.
7.	Dual controls.
8.	Autopilot with automatic approach mode.
9.	2 VHF transceivers including oxygen masks intercom system.
10.	2 VHF NAV receivers (VOR, ILS, DME).
11.	1 ADF receiver.
12.	1 Marker receiver.
13.	1 Transponder.
14.	The following indicators shall be located in the same positions on the instrument panels of both pilots: (1) Airspeed; (2) Flight attitude with flight director; (3) Altimeter; (4) Flight director with ILS (HSI); (5) Vertical speed; (6) ADF; (7) VOR; (8) Marker indication (as appropriate); and (9) Stop watch (as appropriate).

### MINIMUM QUALIFICATION REQUIREMENTS FOR FLIGHT SIMULATION TRAINING DEVICE (HELICOPTER)

The table below describes the minimum requirements for helicopter Full Flight Simulator (FFS), Flight Training Device (FTD) and Flight and Navigation Procedures Trainer (FNPT) to the related qualification levels. Additional requirements or amendments for FNPT MCC are contained in Appendix 5.

Certain requirements included in this section shall be supported with a statement of compliance (SOC) and, in some designated cases, an objective test. The SOC will describe how the requirement was met. The test results shall show that the requirement has been attained.

LEVEL		FSTD HELICOPTER											COMPLIANCE	
		FFS				FTD			FNPT					
		A	B	C	D	1	2	3	I	II	III	MCC		
1.	<b>GENERAL</b>													
1.1	A flight deck that is a full-scale replica of the helicopter simulated. Additional required crewmember duty stations and those required bulkheads aft of the pilot seats are also considered part of the cockpit and shall replicate the helicopter.	X	X	X	X		X	X						
1.2	A flight deck that replicates the helicopter.					X			X	X	X	X		
1.3	The flight deck, including the instructor's station is fully enclosed.	X	X	X	X									
1.4	A flight deck, including the instructor's station that is sufficiently closed off to exclude distractions.					X	X	X	X	X	X	X		
1.5	Full size panels with functional controls, switches, instruments and primary and secondary flight controls, which shall be operating in the correct direction and with the correct range of movement.	X	X	X	X	X	X	X						For FTD Level 1 as appropriate for the replicated system. The use of electronically displayed images with physical overlay incorporating operable switches, knobs and buttons may be acceptable. This option is not acceptable for analogue instruments in FFS.
1.6	Functional controls, switches, instruments and primary and secondary flight controls sufficient for the training events to be accomplished, shall be located in a spatially correct area of the flight deck								X	X	X	X		The use of electronically displayed images with physical overlay incorporating operable switches, knobs and buttons is acceptable
1.7	Lighting for panels and instruments shall be as per the helicopter.	X	X	X	X		X	X						

1.8	Lighting for panels and instruments shall be sufficient for the training events.					X			X	X	X	X	
1.9	Flight deck ambient lighting environment shall be dynamically consistent with the visual display and sufficient for the training event.			X	X								
1.10	The ambient lighting should provide an even level of illumination which is not distracting to the pilot.	X	X				X	X		X	X	X	
1.11	Relevant flight deck circuit breakers shall be located as per the helicopter and shall function accurately when involved in operating procedures or malfunctions requiring or involving flight crew response.	X	X	X	X	X	X	X		X	X	X	
1.12	Effect of aerodynamic changes for various combinations of airspeed and power normally encountered in flight, including the effect of change in helicopter attitude, aerodynamic and propulsive forces and moments, altitude, temperature, mass, centre of gravity location and configuration.	X	X	X	X		X	X	X	X	X	X	Effects of centre of gravity, mass and configuration changes are not required for FNPT Level I.
1.13	Aerodynamic and environment modelling shall be sufficient to permit accurate systems operation and indication.					X							
1.14	Aerodynamic modelling which includes ground effect, effects of airframe and rotor icing (if applicable), aerodynamic interference effects between the rotor wake and fuselage, influence of the rotor on control and stabilization systems, and representations of nonlinearities due to sideslip, vortex ring and retreating blade stall.			X	X		X	X		X	X	X	
1.15	Validation flight test data shall be used as the basis for flight and performance and systems characteristics.		X	X	X			X					
1.16	Representative/generic aerodynamic data tailored to the helicopter with fidelity sufficient to meet the objective tests and sufficient to permit accurate system operation and indication.	X				X	X		X	X	X	X	Aerodynamic data need not be necessarily based on flight test data.
1.17	All relevant flight deck instrument indications automatically respond to control movement by a crewmember, helicopter performance, or external simulated environmental effects upon the helicopter.	X	X	X	X	X	X	X	X	X	X	X	
1.18	All relevant communications, navigation, caution and warning equipment shall correspond to that installed in the helicopter. All simulated navigation aids within range shall be usable without restriction. Navigational data shall be capable of being updated.	X	X	X	X	X	X	X					For FTD Level 1 applies where the appropriate systems are replicated.

1.19	Navigation equipment corresponding to that of a helicopter, with operation within the tolerances typically applied to the airborne equipment. This shall include communication equipment (interphone and air/ground communications systems).								X	X	X	X	
1.20	Navigational data with the corresponding approach facilities. Navigation aids should be usable within range without restriction	X	X	X	X	X	X	X	X	X	X	X	For FFS and FTD the navigation database should be updated within 28 days. For FNPT complete navigational data for at least 5 different airports with corresponding precision and non-precision approach procedures including current updating within a period of 3 months.
1.21	In addition to the flight crewmember stations, at least two suitable seats for the instructor and an additional observer shall be provided permitting adequate vision to the crewmembers' panel and forward windows. Observer seats need not represent those found in the helicopter but shall be adequately secured to the floor of the flight simulator, fitted with positive restraint devices and be of sufficient integrity to safely restrain the occupant during any known or predicted motion system excursion	X	X	X	X								The DCA will consider options to this standard based on unique cockpit configurations.  Any additional seats installed shall be equipped with similar safety provisions
1.22	Crewmember seats shall afford the capability for the occupants to be able to achieve the design eye reference position. In addition to the flight crewmember stations, at least two suitable seats for the instructor and an additional observer shall be provided permitting adequate vision to the crewmembers' panel and forward windows.					X	X	X	X	X	X	X	The instructor's and observer's seats need not represent those found in the helicopter.
1.23	FFS systems shall simulate the applicable helicopter system operation, both on the ground and in flight. Systems shall be operative to the extent that normal, abnormal, and emergency operating procedures appropriate to the simulator application can be accomplished. Once activated, proper system operation shall result from system management by the flight crew and not require input from instructor controls.	X	X	X	X								
1.24	FTD systems represented shall be fully operative to the extent that normal, abnormal and emergency operating procedures can be accomplished. Once activated, proper system operation shall result from system management by the flight crew and not require input from instructor controls.					X	X	X					

1.25	The systems should be operative to the extent that it should be possible to perform normal, abnormal, and emergency operations appropriate to a helicopter as required for training. Once activated, proper systems operations should result from the system management by the crewmember and not require any further input from the instructor's controls.								X	X	X	X	
1.26	The instructor shall be able to control system variables and insert abnormal or emergency conditions into the helicopter systems.  Independent freeze and reset facilities shall be provided.	X	X	X	X	X	X	X	X	X	X	X	FNPT I applicable only to enable the instructor to carry out selective failure of basic flight instruments and navigation equipment. For FNPT Level I: Ability to set the FNPT to minimum IMC speed or above.
1.27	Control forces and control travel which correspond to that of the replicated helicopter. Control forces shall react in the same manner as in the helicopter under the same flight conditions.	X	X	X	X								For Level A only static control force characteristics need to be tested.
1.28	Control forces and control travel shall be representative of the replicated helicopter under the same flight conditions as in the helicopter.					X	X	X					For FTD level 1, as appropriate for the system training required.
1.29	Control forces and control travel shall broadly correspond to that of a helicopter.								X				Only static control force characteristics need to be tested.
1.30	Control forces and control travels shall respond in the same manner under the same flight conditions as in a helicopter.									X	X	X	Only static control force characteristics need to be tested.
1.31	Cockpit control dynamics, which replicate the helicopter simulated. Free response of the controls shall match that of the helicopter within the given tolerance. Initial and upgrade evaluation will include control free response (cyclic, collective, and pedal) measurements recorded at the controls. The measured responses shall correspond to those of the helicopter in ground operations, hover, climb, cruise, and auto-rotation.		X	X	X		X	X					For helicopters with irreversible control systems, measurements may be obtained on the ground. Engineering validation or helicopter manufacturer rationale will be submitted as justification for ground test or to omit a configuration. For FFS requiring static and dynamic tests at the controls, special test fixtures will not be required during the initial evaluations if the FSTD operator's QTG shows both test fixture results and alternate test method results, such as computer data plots, which were obtained concurrently. Use of the alternate method during initial evaluation may then satisfy this test requirement. FTD Level 2 data can be representative/generic and need not necessarily be based on flight test data.



1.41	Cockpit control dynamics, which replicate the helicopter simulated. Free response of the controls shall match that of the helicopter within the given tolerance. Initial and upgrade evaluation will include control free response (cyclic, collective, and pedal) measurements recorded at the controls. The measured responses shall correspond to those of the helicopter in ground operations, hover, climb, cruise, and auto-rotation.		X	X	X		X	X		X	X	X	<p>For helicopters with irreversible control systems, measurements may be obtained on the ground. Engineering validation or helicopter manufacturer rationale will be submitted as justification for ground test or to omit a configuration.</p> <p>For FFS requiring static and dynamic tests at the controls, special test fixtures will not be required during the initial evaluations if the FSTD Operator's QTG shows both test fixture results and alternate test method results, such as computer data plots, which were obtained concurrently. Use of the alternate method during initial evaluation may then satisfy this test requirement. FTD Level 2 aerodynamic data can be representative/generic and need not necessarily be based on flight test data.</p>
1.42	<p>Transport Delay Test. Transport delay is the time between control input and the individual hardware (systems) responses.</p> <p>As an alternative, a Latency test may be used to demonstrate that the flight simulator system does not exceed the permissible delay.</p>	X	X	X	X	X	X	X	X	X	X	X	<p>For FTD Level 1, only instrument response is required within a maximum permissible delay of 200 milliseconds.</p> <p>For FFS Level A and B and FTD Level 2 the maximum permissible delay is 150 milliseconds.</p>
1.43	<p>Latency test. Relative response of the visual system, cockpit instruments and initial motion system response shall be coupled closely to provide integrated sensory cues. These systems shall respond to abrupt pitch, roll, and yaw inputs at the pilot's position within the permissible delay, but not before the time, when the helicopter would respond under the same conditions. Visual scene changes from steady state disturbance shall occur within the system dynamic response limit but not before the resultant motion onset. Transport delay test is acceptable as an alternate method to show compliance.</p>	X	X	X	X	X	X						<p>For FFS Level C and D and FTD Level 3 the maximum permissible delay is 100 milliseconds.</p> <p>For FTD Level 1 and FNPT Level I, only instrument response is required within a maximum permissible delay of 200 milliseconds.</p> <p>For Level 'A' &amp; 'B' FFS, Level 2 FTD and FNPT Level II and III the maximum permissible delay is 150 milliseconds.</p> <p>For Level 'C' &amp; 'D' FFS and Level 3 FTD the maximum permissible delay is 100 milliseconds.</p>

1.44	A means for quickly and effectively testing FSTD programming and hardware. This may include an automated system, which could be used for conducting at least a portion of the tests in the QTG.	X	X				X				X	X	Recommended for FTD Level 1, FNPT Level I and II. Automatic flagging of "out-of-tolerance" tests results is encouraged
1.45	Self-testing for FSTD hardware and programming to determine compliance with the FSTD performance tests. Evidence of testing shall include FSTD number, date, time, conditions, tolerances, and the appropriate dependent variables portrayed in comparison with the helicopter standard.			X	X			X					
1.46	A system allowing for timely continuous updating of FSTD hardware and programming consistent with helicopter modifications.	X	X	X	X	X	X	X					
1.47	The FSTD Operator shall submit a QTG in a form and manner acceptable to the DCA. A recording system shall be provided that will enable the FSTD performance to be compared with QTG criteria.	X	X	X	X	X	X	X	X	X	X	X	
1.48	FSTD computer capacity, accuracy, resolution and dynamic response sufficient for the Qualification Level sought.	X	X	X	X	X	X	X	X	X	X	X	
1.49	Daily preflight documentation, either in the daily log or in a location easily accessible for review.	X	X	X	X	X	X	X	X	X	X	X	
2	<b>MOTION SYSTEM</b>												
2.1	Motion cues as perceived by the pilot shall be representative of the helicopter, e.g. touchdown cues should be a function of the simulated rate of descent.	X	X	X	X								Motion tests to demonstrate that each axes onset cues are properly phased with pilot input and helicopter response.
2.2	A motion system having a minimum of 3 degrees of freedom (pitch, roll, heave) to accomplish the required task.	X											The instructor's and observer's seats need not represent those found in the helicopter.
2.3	A motion system having 6 degrees of freedom synergistic platform motion system.		X	X	X								For FFS level B, a reduced motion performance envelope is acceptable.
2.4	A means of recording the motion response time as required.	X	X	X	X								See 1.42 and 1.43.



3.5	"Continuous," cross-cockpit, minimum visual field of view providing each pilot with 150 degrees horizontal and 60 degrees vertical.							X			X		A minimum of 75 degrees horizontal field of view on either side of the zero degree azimuth line relative to the helicopter fuselage is required. This will allow an offset per side of the horizontal field of view if required for the training.  Where training tasks require extended fields of view beyond the 150 degrees x 60 degrees, then such extended fields of view should be provided.	
3.6	"Continuous" cross cockpit, minimum visual field of view providing each pilot with 180 degrees horizontal and 60 degrees vertical.				X								A minimum of 75 degrees horizontal field of view on either side of the zero degree azimuth line relative to the helicopter fuselage is required. This will allow an offset per side of the horizontal field of view if required for the training.  Where training tasks require extended fields of view beyond the 180 degrees x 60 degrees, then such extended fields of view shall be provided.	
3.7	A means of recording the visual response time for the visual system shall be provided.	X	X	X	X			X	X		X	X	X	
3.8	Visual cues to assess rate of change of height, translational displacements and rates, during takeoff and landing.	X	X										For Level 'A', Visual cueing sufficient to support changes in approach path by using Final Approach and Take Off (AFTO) perspective.	
3.9	Visual cues to assess rate of change of height, height AGL, translational displacements and rates, during takeoff, low altitude/low airspeed manoeuvring, hover, and landing.			X	X			X	X		X	X	X	
3.10	Test procedures to quickly confirm visual system colour, RVR, focus, intensity, level horizon, and attitude as compared with the specified parameters.	X	X	X	X			X	X		X	X	X	SOC and test required.
3.11	A minimum of 10 levels of occulting. This capability should be demonstrated by a visual model through each channel.			X	X			X	X		X	X	X	SOC and test required.
3.12	Surface resolution shall be demonstrated by a test pattern of objects shown to occupy a visual angle of not greater than 3 arc minutes in the visual display used on a scene from the pilot's eye point.			X	X			X	X		X	X	X	SOC and test required.

3.13	Light point size shall not be greater than 6 arc minutes.			X	X								This is equivalent to a light point resolution of 3 arc minutes.
3.14	Light point size shall not be greater than 8 arc minutes.		X				X	X		X	X	X	This is equivalent to a light point resolution of 4 arc minutes.
3.15	Daylight, dusk, and night visual scenes with sufficient scene content to recognise aerodromes, heliports, terrain, and major landmarks around the Final Approach and Take-off (FATO) area and to successfully accomplish low airspeed/low altitude manoeuvres to include lift-off, hover, translational lift, landing and touchdown.			X	X		X	X		X	X	X	
3.16	A visual database sufficient to support the requirements, including (i) Specific areas within the database needing higher resolution to support landings, take-offs and ground cushion exercises and training away from a heliport. Including elevated helipad, helidecks and confined areas. (ii) Where applicable, for cross-country flights sufficient scene details to allow for ground to map navigation over a sector length equal to 30 minutes at an average cruise speed. (iii) Where applicable, for offshore airborne radar approaches (ARA), harmonized visual/radar representations of installations. (iv) Where applicable, for training in the use of Night Vision Goggles (NVG), a visual display with the ability to represent various scenes with the required levels of ambient light/colour.		X	X	X		X	X		X	X	X	Generic database is acceptable only for FTD and FNPT.
3.17	Daylight, twilight (dusk/dawn) and night visual capability for system brightness and contrast ratio criteria as applicable for level of qualification sought.			X	X		X	X		X	X	X	The ambient lighting should provide an even level of illumination, which is not distracting to the pilot.
3.18	Night and Dusk scene.	X	X										The ambient lighting should provide an even level of illumination, which is not distracting to the pilot.
3.19	The visual system should be capable of producing full colour presentations. The texture shall be used to enhance visual cue perception for illuminated landing surfaces.			X	X		X	X		X	X	X	
3.20	The visual system should be capable of producing, as a minimum a scene content comparable in detail with that produced by 6000 polygons for daylight and 1000 visible light points for night and dusk scenes for the entire visual system.						X	X		X	X	X	SOC and test required.
3.21	The visual system should be capable of producing, as a minimum a scene content comparable in detail with that produced by 4000 polygons for daylight and 5000 visible light points for night and dusk scenes for the entire visual system.			X									SOC and test required. Freedom of apparent quantization and other distracting visual effects are also applicable for FFS levels A and B.

3.22	The visual system should be capable of producing, as a minimum a scene content comparable in detail with that produced by 6000 polygons for daylight and 7000 visible light points for night and dusk scenes for the entire visual system.				X									SOC and test required. Freedom of apparent quantization and other distracting visual effects are also applicable for FFS levels A and B.
3.23	Surface contrast ratio demonstration model of not less than 5:1.			X	X									
3.24	Surface contrast ratio demonstration model of not less than 8:1.						X	X			X	X	X	
3.25	Lightpoint contrast ratio of not less than 25:1.			X	X		X	X						
3.26	Highlight Brightness. The minimum light measured at the pilot's eye position should be 14 cd/m <sup>2</sup> (4 ft-Lamberts).			X										
3.27	Highlight Brightness. The minimum light measured at the pilot's eye position should be 17 cd/m <sup>2</sup> (5 ft-Lamberts).						X	X			X	X	X	
3.28	Highlight Brightness. The minimum light measured at the pilot's eye position should be 20 cd/m <sup>2</sup> (6 ft-Lamberts).				X									
4	<b>SOUND SYSTEM</b>													
4.1	Significant flight deck sounds, and those, which result from pilot actions corresponding to those of the helicopter shall be provided.	X	X	X	X	X	X	X			X	X	X	SOC required for FFS. For FTD level 1 as appropriate for the system training required.
4.2	Sounds due to engines, transmission and rotors should be available.								X					
4.3	Sound of precipitation, windshield wipers, the sound resulting from a blade strike and a crash condition when operating the helicopter in excess of limitations.			X	X		X	X						Crash sounds may be generic.  SOC or demonstration of representative sounds required.
4.4	Realistic amplitude and frequency of cockpit acoustic environment.				X									Objective steady-state tests required.
4.5	The volume control shall have an indication of sound level setting which meets all qualification requirements.	X	X	X	X									

### FNPT(HELICOPTER) MCC REQUIREMENTS

For FNPT (Helicopter) to be used for Multi-Crew Co-operation (MCC) training, the general technical requirements are expressed in the MCC column of Appendix 4. In the table below are the additional requirements or amendments.

1.	Multi engine and multi pilot helicopter.
2.	Performance reserves, in case of an engine failure, to be in accordance with Type Certificate category for large rotorcraft (refer Airworthiness Notice No 81 issue 1).
3.	Anti icing or de-icing systems.
4.	Fire detection / suppression system.
5.	Dual controls.
6.	Autopilot with upper modes.
7.	2 VHF transceivers.
8.	2 VHF NAV receivers (VOR, ILS, DME).
9.	1 ADF receiver.
10.	1 Marker receiver.
11.	1 Transponder.
12.	Weather radar.
13.	<p>The following indicators shall be located in the same positions on the instrument panels of:</p> <ul style="list-style-type: none"> <li>(1) Airspeed;</li> <li>(2) Flight attitude;</li> <li>(3) Altimeter and radio altimeter;</li> <li>(4) HSI;</li> <li>(5) Vertical speed;</li> <li>(6) ADF;</li> <li>(7) VOR, ILS, DME;</li> <li>(8) Marker indication; and</li> <li>(9) Stop watch.</li> </ul>