TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(6) Crosswind Takeoff	±3 Kts Airspeed, ±1.5° Pitch, ±1.5° Angle of Attack, ±20 ft (6 m) Altitude, ±2° Bank and Sideslip Angle. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/Column Force; ±10% or ±5 lb (2.2 daN); Wheel Force; ±10% or ±3 lb (1.3daN); and Rudder Pedal Force; ±10% or ±5 lb (2.2 daN).	Ground/Takeoff and First Segment Climb.	X	X	X	X	Record takeoff profile from brake release to at least 200 ft (61 m) AGL. Requires test data, including information on wind profile (*i.e.*, wind speed and direction vs. altitude), for a crosswind component of at least 20 Kts., but not more than the maximum (or maximum demonstrated) crosswind for the airplane.	.....	Yes.
(7) Rejected Takeoff	±5% Time or ±1.5 sec; ±7.5% Distance or ±250 ft (±76 m.	Ground/Takeoff	X	X	X	X	Record time and distance from brake application to full stop. The airplane must be at or near the maximum takeoff gross weight. Use maximum braking effort, auto or manual.	Autobrakes will be used where applicable.	Yes.
(8) Dynamic Engine Failure After Takeoff.	±20% Body Rates	1st Segment Climb			X	X	Engine failure speed must be within ±3 Kts of airplane data. Record Hands Off from 5 secs. before to 5 secs. after engine failure or 30° Bank, whichever occurs first, and then Hands On until wings level recovery. Engine failure may be a snap deceleration to idle. (**CCA:** Test in Normal AND Non-normal control state).	For safety considerations, airplane flight test may be performed out of ground effect at a safe altitude, but with correct airplane configuration and airspeed.	
c. Climb									
(1) Normal Climb	±3 kts Airspeed, ±5% or ±100 FPM (0.5 m/Sec.) Climb Rate.	All Engines Operating..	X	X	X	X	Record results at nominal climb speed and at nominal altitude. Manufacturer's gross climb gradient may be used for flight test data. May be a Snapshot Test.	.....	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(2) One engine Inoperative Second Segment Climb.	±3 kts Airspeed, ±5% or ±100 FPM (0.5 m/Sec.) Climb Rate, but not less than the FAA-Approved Airplane Flight Manual (AFM) Rate of Climb.	Second Segment Climb with one engine inoperative.	X	X	X	X	Record results at airplane limiting conditions of weight, altitude, & temperature. Manufacturer's gross climb gradient may be used for flight test data. May be a Snapshot Test.	.....	Yes.
(3) One Engine Inoperative En route Climb.	±10% Time, ±10% Distance, ±10% Fuel Used.	En route Climb			X	X	Record results for at least a 5000 ft (1550 m) climb segment. Approved Performance Manual data may be used.		
(4) One Engine Inoperative Approach Climb (if Approved AFM requires specific performance in icing conditions).	±3 Kts Airspeed, ±5% or ±100 FPM (0.5 m/Sec.) Climb Rate, but not less than the Approved AFM Rate of Climb.	Approach Climb With One Engine Inoperative.	X	X	X	X	Record results at not less than 80% of the FAA-certificated maximum landing weight. Manufacturer's gross climb gradient may be used for flight test data. May be a Snapshot Test.	.....	Yes.
d. Cruise									
(1) Level Acceleration and Deceleration.	±5% Time	Cruise	X	X	X	X	Record results for a minimum of 50 Kts speed change.		
(2) Cruise Performance ..	±.05 EPR ±5% of N_1 and N_2, ±5% of Torque, ±5% of Fuel Flow.	Cruise			X	X	May be a Snapshot Test; however, a minimum of 2 consecutive snapshots with a spread of at least 5 minutes will be required.		
e. Ground Deceleeration									
(1) Deceleration Time and Distance, using manual application of wheel brakes and no reverse thrust.	±5% of Time. For distance up to 4000 ft (1220 m): ±200 ft (61 m) or ±10%, whichever is smaller. For distance greater than 4000 ft (1220 m): ±5% of distance.	Landing, Dry Runway.	X	X	X	X	Record time and distance for at least 80% of the segment from touch down to full stop. Data on brake system pressure and position of ground spoilers (including method of deployment, if used) must be provided. Engineering data may be used for the medium and light gross weight conditions.	Data is required for medium, light, and near maximum landing gross weights.	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(2) Deceleration Time and Distance, using reverse thrust and no wheel brakes.	±5% Time and the smaller of ±10% or ±200 ft (61 m) of Distance.	Landing, Dry Runway.	X	X	X	X	Record time and distance for at least 80% of the total demonstrated reverse thrust segment. Data on the position of ground spoilers, (including method of deployment, if used) must be provided. Engineering data may be used for the medium and light gross weight conditions.	Data is required for medium, light, and near maximum landing gross weights.	Yes.
(3) Deceleration Distance, using wheel brakes and no reverse thrust.	±10% of Distance or ±200 ft (61 m).	Landing, Wet Runway.	.....	.....	X	X	The FAA-approved AFM data or FAA accepted ground handling model calculations are permissible.		
(4) Deceleration Distance, using wheel brakes and no reverse thrust.	±10% of Distance or ±200 ft (61 m).	Landing, Icy Runway.	.....	.....	X	X	The FAA-approved AFM data or FAA accepted ground handling model calculations are permissible.		
f. Engines									
(1) Acceleration	±10% T_i, ±10% T_t	Approach or landing	X	X	X	X	Record engine power (N_1, N_2, EPR, Torque, etc.) from idle to go-around power for a rapid (slam) throttle movement.	.....	Yes
(2) Deceleration	±10% T_i, ±10% T_t	Ground/Takeoff					Record engine power (N_1, N_2, EPR, Torque, etc.) from Max T/O power to 90% decay of Max T/O power for a rapid (slam) throttle movement.	.....	Yes.
3. HANDLING QUALITIES									

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
For simulators requiring Static or Dynamic tests at the controls (i.e., column, wheel, rudder pedal), special test fixtures will not be required during initial or upgrade evaluations if the sponsor's QTG/MQTG shows both test fixture results *and* the results of an alternative approach, such as computer plots produced concurrently, that show satisfactory agreement. Repeat of the alternative method during the initial or upgrade evaluation would then satisfy this test requirement. For initial and upgrade evaluations, the control dynamic characteristics must be measured at and recorded directly from the cockpit controls, and must be accomplished in takeoff, cruise, and landing flight conditions and configurations. Contact the NSPM for clarification of any issue regarding airplanes with reversible controls.									
a. Static Control Checks									
(1) Column Position vs. Force and Surface Position Calibration.	Breakout: ±2 lb (0.9 daN). Force: ±10% or ±5 lb (2.2 daN) and ±2° Elevator.	Ground	X	X	X	X	Record results for an uninterrupted control sweep to the stops. **CCA:** Position vs. force not required if cockpit controller is installed in the simulator.		Yes.
(2) Wheel Position vs. Force and Surface Position Calibration.	Breakout: ±2 lb (0.9 daN). Force: ±10% or ±3 lb (1.3 daN) and ±1° Aileron, ±3° Spoiler Angle.	Ground	X	X	X	X	Record results for an uninterrupted control sweep to the stops. **CCA:** Position vs. force not required if cockpit controller is installed in the simulator.		Yes.
(3) Rudder Pedal Position vs. Force and Surface Position Calibration.	Breakout: ±5 lb (2.2 daN). Force ±10% or ±5 lb (2.2 daN) and ±2° Rudder Angle.	Ground	X	X	X	X	Record results for an uninterrupted control sweep to the stops.		Yes.
(4) Nosewheel Steering Force & Position.	Breakout: ±2 lb (0.9 daN). Force: ±10% or ±3 lb (1.3 daN) and ±2° Nosewheel Angle.	Ground	X	X	X	X	Record results of an uninterrupted control sweep to the stops.		Yes.
(5) Rudder Pedal Steering Calibration.	±2° Nosewheel Angle, ±0.5° Deadband.	Ground	X	X	X	X	Record results of an uninterrupted control sweep to the stops.		Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(6) Pitch Trim Calibration (Indicator vs. Computed) and Rate.	±0.5° of Computed Trim Angle, ±10% Trim Rate.	Ground and Go Around.	X	X	X	X	Trim rate must be checked using the pilot primary trim control (ground) and using the autopilot or pilot primary trim control in flight at go-around flight conditions.	.....	Yes.
(7) Alignment of Power Lever Angle vs. Selected Engine Parameter (*e.g.*, EPR, N_1, Torque, etc.).	±5° of Power Lever Angle	Ground	X	X	X	X	Requires recording for all engines. No simulator throttle position may be more than 5° (in either direction) from the airplane throttle position. Also, no simulator throttle position may differ from any other simulator throttle position by more than 5°. Where power levers do not have angular travel, a tolerance of ± 0.8 in (2 cm) applies. In the case of propeller powered airplanes, if a propeller lever is present, it must also be checked. May be a series of shapshot test results.	.....	Yes.
(8) Brake Pedal Position vs. Force and Brake System Pressure.	±5 lb (2.2 daN) or 10% Force, ±150 psi (1.0 MPa) or ±10% Brake System Pressure.	Ground	X	X	X	X	Hydraulic system pressure must be related to pedal position through a ground static test.	.....	Yes.
b. Dynamic Control Checks									
(1) Pitch Control	±10% of time for first zero crossing and ±10 (n+1)% of period thereafter, ±10% amplitude of first overshoot, ±20% of amplitude of 2nd and subsequent overshoots greater than 5% of initial displacement (A_d), ±1 overshoot.	Takeoff, Cruise, and Landing.			X	X	Data must show normal control displacement in both directions. Tolerances apply against the absolute values of each period (considered independently). Normal control displacement for this test is 25% to 50% of full throw. **CCA:** Test not required if cockpit controller is installed in the simulator.	''n'' is the sequential period of a full cycle of oscillation. Refer to paragraph 3 of this attachment for more information.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(2) Roll Control	±10% of time for first zero crossing, and ±10 (n±1)% of period thereafter, ±10% amplitude of first overshoot, ±20% of amplitude of 2nd and subsequent overshoots greater than 5% of initial displacement (A_d), ±1 overshoot.	Takeoff, Cruise, and Landing.			X	X	Data must show normal control displacement in both directions. Tolerances apply against the absolute values of each period (considered independently). Normal control displacement for this test is 25% to 50% of full throw. **CCA:** Test not required if cockpit controller is installed in the simulator.	''n'' is the sequential period of a full cycle of oscillation. Refer to paragraph 3 of this attachment for more information.	
(3) Yaw Control	±10% of time for first zero crossing, and ±10 (n±1)% of period thereafter, ±10% amplitude of first overshoot, ±20% of amplitude of 2nd and subsequent overshoots greater than 5% of initial displacement (A_d), ±1 overshoot.	Takeoff, Cruise, and Landing.			X	X	Data must show normal control displacement in both directions. Tolerances apply against the absolute values of each period (considered independently). Normal control displacement for this test is 25% to 50% of full throw.	''n'' is the sequential period of a full cycle of oscillation. Refer to paragraph 3 of this attachment for more information.	
(4) Small Control Inputs	±20% Body Rates	Cruise and Approach.			X	X	This test is applicable in all three axes. Small control inputs are 5% of total travel.		
c. Longitudinal			.....	.....					
(1) Power Change Dynamics.	±3 Kts Airspeed, ±100 ft (30 m) Altitude, ±20% or ±1.5° Pitch.	Approach	X	X	X	X	Wing flaps must remain in the approach position. Record the uncontrolled free response from 5 seconds before the power change is initiated to 15 seconds after the power change is completed. (**CCA:** Test in Normal and Non-normal control state.).	.....	Yes.
(2) Flap/Slat Change Dynamics.	±3 Kts Airspeed, ±100 ft (30 m) Altitude, ±20% or ±1.5° Pitch.	Takeoff, and Approach.	X	X	X	X	Record the uncontrolled free response from 5 seconds before the configuration change is initiated to 15 seconds after the configuration change is completed. (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(3) Spoiler/Speedbrake Change Dynamics.	±3 Kts Airspeed, ±100 ft (30 m) Altitude, ±20% or ±1.5° Pitch.	Cruise	X	X	X	X	Record the uncontrolled free response from 5 seconds before the configuration change is initiated to 15 seconds after the configuration change is completed. (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.
(4) Gear Change Dynamics.	±3 Kts Airspeed, ±100 ft (30 m) Altitude, ±20% or ±1.5° Pitch.	Takeoff, Second Segment Climb, and Approach.	X	X	X	X	Record the time history of uncontrolled free response for a time increment from 5 seconds before the configuration change is initiated to 15 seconds after the configuration change is completed. (**CAA:** Test in Normal and Non-normal control state).	.....	Yes.
(5) Alternate Landing Gear and Alternate Flap/Slat Operating Times.	±1 second or ±10% of Time	Takeoff and Approach.	X	X	X	X	Record all data throughout full range. Record extension and retraction for alternate flap operation. Record extension only for alternate gear operation. Tabular data from production airplanes are acceptable.	Intermediate increment times are not required.	Yes.
(6) Longitudinal Trim	±1° Pitch Control (Stab and Elev.), ±1° Pitch Angle, ±5% Net Trust or Equivalent.	Cruise, Approach, and Landing.	X	X	X	X	May be Snapshot Tests. (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.
(7) Longitudinal Maneuvering Stability (Stick Force/g).	±5 lb (±2.2 daN) or ±10% Column Force or Equivalent Surface Position.	Cruise, Approach, and Landing.	X	X	X	X	Record results for approximately 20° and 30° of bank for approach and landing configurations. Record results for approximately 20°, 30°, and 45° of bank for the cruise configuration. May be a series of shapshot test results. (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(8) Longitudinal Static Stability.	±5 lb (±2.2 daN) or ±10% Column Force or Equivalent Surface Position.	Approach	X	X	X	X	Record results for at least 2 speeds above and 2 speeds below trim speed. May be a series of shapshot test results. (**CCA:** Test in Normal or Non-normal control state).	.....	Yes.
(9) Stick Shaker, Airframe Buffet, Stall Speeds.	±3 Kts Airspeed, ±2° Bank for speeds higher than stick shaker or initial buffet, Airplanes with reversible flight control systems, ±10% or ±5 lb (2.2 daN)) Stick/Column force.	Second Segment Climb, and Approach or Landing.	X	X	X	X	Record the stall warning signal and buffet on-set, if applicable. The signal must occur in the proper relation to buffet/stall. Airplanes exhibiting a sudden pitch attitude change or ''g break'' must demonstrate this characteristic. (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.
(10) Phugoid Dynamics ..	±10% of Period, ±10% of Time to ½ or Double Amplitude or ±.02 of Damping Ratio.	Cruise	X	X	X	X	The test must include whichever is less of the following: Three full cycles (six overshoots after the input is completed), or The number of cycles sufficient to determine time to ½ or double amplitude. (**CCA:** Test in Non-normal control state).	.....	Yes.
(11) Short Period Dynamics.	±1.5° Pitch or ±2°/sec. Pitch Rate, ±0.10g Acceleration.	Cruise		X	X	X	(**CCA:** Test in Normal and Non-normal control state).	.....	Yes.
d. Lateral Directional									
(1) Minimum Control Speed, Air (V_{mca}), per Applicable Airworthiness Standard or Low Speed Engine Inoperative Handling Characteristics in Air.	±3 Kts Airspeed	Takeoff or Landing (Whichever is most critical in the airplane).	X	X	X	X	(**CCA:** Test in Normal or Non-normal control state).	Low Speed Engine Inoperative Handling may be governed by a performance or control limit that prevents demonstration of V_{mca} in the conventional manner.	Yes.
(2) Roll Response (Rate)	±10% Roll Rate or ± 2°/sec. Additionally, for those simulators of airplanes with reversible flight control systems: wheel force ±10% or ±3lb (1.3 daN).	Cruise, and Approach or Landing.	X	X	X	X	Record results for normal wheel deflection (about 30%).		

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(3) Roll Response to Cockpit Roll Controller Step Input.	±10% or ±2°/sec. roll rate	Approach or Landing.	X	X	X	X	Record from initiation of roll through 15 seconds after control is returned to neutral and released. After the roll rate is established, the controller is returned to neutral and the remaining response is to be ''hands-off.'' (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.
(4) Spiral Stability	±2° Bank or ±10% in 20 seconds. Bank must be in the proper direction.	Cruise	X	X	X	X	Record results for both directions. Airplane data averaged from multiple tests may be used. (**CCA:** Test in Non-normal control state).	.....	Yes.
(5) Engine Inoperative Trim.	±1° Rudder angle or ±1° Tab angle or equivalent pedal, ±2° Sideslip angle.	Second Segment Climb, and Approach or Landing.	X	X	X	X	May be Snapshot Tests.	.....	Yes.
(6) Rudder Response	±2°/sec. or ±10% Yaw Rate	Approach or Landing.	X	X	X	X	Record results for stability augmentation system ON and OFF. A rudder step input of 20%–30% rudder pedal throw is used. (**CCA:** Test in Normal and Non-normal control state).	.....	Yes.
(7) Dutch Roll, (Yaw Damper OFF).	±0.5 sec. or ±10% of period, ±10% of time to ½ or double amplitude or ±.02 of damping ratio, ±20% or ±1 sec. of time difference between peaks of bank and sideslip.	Cruise, and Approach or Landing.	X	X	X	X	Record results for at least 6 cycles with stability augmentation OFF. (**CCA:** Test in Non-normal control state).	.....	Yes.
(8) Steady State Sideslip	For given rudder position ±2° Bank, ±1° Sideslip, ±10% or ±2° Aileron, ±10% or ±5° Spoiler or equivalent wheel position or force. Additionally, for those simulators of airplanes with reversible flight control systems: Wheel force, ±10% or ±3 lb (1.3 daN), and Rudder pedal force, ±10% or ±5 lb (2.2 daN).	Approach or Landing.	X	X	X	X	Propeller driven airplanes must test in each direction. May be a series of shapshot test results using at least two rudder positions.	.....	Yes.
e. Landings									

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(1) Normal Landing	±3 Kts Airspeed, ±1.5° Pitch, ±1.5° Angle of Attack, ±10% or ±10 ft (3 m) Altitude. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/Column Force ±10% or ±5 lbs (±2.2 daN).	Landing		X	X	X	Record results from a minimum of 200 ft (61 m) AGL to nose-wheel touchdown. Results with medium, light, and near maximum landing weights must be shown. (**CCA:** Test in Normal and Non-normal control state).	Derotation may be shown as a separate segment from the time of MLG touch down.	Yes.
(2) Minimum/No Flap Landing.	±3 Kts Airspeed, ±1.5° Pitch, ±1.5° Angle of Attack, ±10% or ±10 ft (3 m) Altitude. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/Column Force, ±10% or ±5 lbs 9/2.2 daN).	Minimum Certified Landing Flap Configuration.			X	X	Record results from a minimum of 200 ft (61 m) AGL to nosewheel touchdown with airplane at near Maximum Landing Weight.	Derotation may be shown as a separate segment from the time of MLG touch down.	
(3) Crosswind Landing ...	±3 Kts Airspeed, ±1.5° Pitch, ±1.5° Angle of Attack, ±10% or ±10 ft (3 m) Altitude, ±2° Bank Angle, ±2° Sideslip Angle. Additionally, for those simulators of airplanes with reversible flight control systems: Wheel force, ±10% or ±3 lb (1.3 daN) and Rudder pedal force, ±10% or ±5 lb (2.2 daN).	Landing		X	X	X	Record results from a minimum of 200 ft (61 m) AGL, through nosewheel touch down, to 50% of V_{REF} speed. Use maximum demonstrated crosswind if available. If not available use 20 kts.	.....	Yes.
(4) One Engine Inoperative Landing (Not required for Single-engine airplanes.).	±3 Kts Airspeed, ±1.5° Pitch, ±1.5° Angle of Attack, ±10% Altitude or ±10 ft (3 m), ±2° Bank Angle, ±2° Sideslip Angle.	Landing		X	X	X	Record results from a minimum of 200 ft (61 m) AGL, through nosewheel touch down, to 50% of V_{REF} speed.	.....	Yes.
(5) Autoland (if applicable).	±5 ft (1.5 m) Flare Height, ±0.5 sec T_f, ±140 ft/min (.7 m/sec) Rate of Descent at Touch-down, ±10 ft (3 m) Lateral Deviation from Maximum demonstrated crosswind (autoland) deviation.	Landing			X	X	Record Lateral Deviation and continue to Autopilot disconnect.	This test is not a substitute for the Ground Effects test requirement.	

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(6) Go Around	±3 Kts Airspeed, ±1.5° Pitch, ±1.5° Angle of Attack.	Go Around			X	X	Additionally, a Go Around with an engine inoperative is required. This test must be conducted at near maximum landing weight and with the critical engine inoperative. (Not required for single-engine airplanes.) A normal, all-engines-operating, Go Around with the autopilot engaged must also be demonstrated (if applicable) at medium landing weight. (**CCA:** Test in Normal and Non-normal control state).		
(7) Directional Control (Rudder Effectiveness) with symmetric reverse thrust.	±2 deg/sec yaw rate	On Ground		X	X	X	Record results from a speed approximating touchdown speed to the minimum thrust reverser operation speed. Airplane manufacturer's engineering simulator data may be considered as an alternative. Yaw control is applied in both directions until reaching minimum thrust reverser operation speed.		
(8) Directional Control (Rudder Effectiveness) with asymmetric reverse thrust.	±5 knots	On Ground		X	X	X	Maintain heading with yaw control. Record results from a speed approximating touchdown speed to a speed at which control of yaw cannot be maintained. The tolerance applies to this lower speed. Airplane manufacturer's engineering simulator data may be considered as an alternative.		
f. Ground Effect									
Demonstrate Longitudinal Ground Effect.	±1° Elevator or Stabilizer Angle, and ±5% Net Thrust or Equivalent, and ±1° Angle of Attack, and ±10% Height/Altitude or ±5 ft (1.5 m), and ±3 Knots Airspeed, and ±1° Pitch Attitude.	Landing		X	X	X	The Ground Effect model must be validated by the test selected and a rationale must be provided for selecting the particular test.	The test selected for validation is at the option of the sponsor. See paragraph 6, Ground Effect, in this attachment for additional information.	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
g. Brake Fade									
Demonstrate Decreased Braking Efficiency Due to Brake Temperature.	None	Takeoff or Landing			X	X	An SOC is required. The demonstration must show decreased braking efficiency due to brake temperature. Substantiating data must be provided.		
h. Windshear									
Demonstrate Windshear Models.	See Attachment 6	Takeoff and Landing			X	X	Requires windshear models that provide training in the specific skills needed to recognize windshear phenomena and to execute recovery procedures. See Attachment 6 for tests, tolerances, and procedures.	See Attachment 6 for information related to Level A and B simulators.	
i. Envelope Protection Functions									
The requirements of tests i. (1) through (6), of this attachment are applicable to computer controlled airplanes only. Time history results are required for simulator response to control inputs during entry into envelope protection limits. Flight test data must be provided for both normal and non-normal control states.									
(1) Overspeed	±5 Kts Airspeed	Cruise			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(2) Minimum Speed	±3 Kts Airspeed	Takeoff, Cruise, and Approach or Landing.			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(3) Load Factor	±0.1g Normal Acceleration	Takeoff and Cruise			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(4) Pitch Angle	±1.5° Pitch	Cruise, and Go Around.			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(5) Bank Angle	±2° or ±10% Bank	Approach			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
(6) Angle of Attack	±1.5° AOA	Second Segment Climb, and Approach or Landing.			X	X	(**CCA:** Test in Normal and Non-normal control state.).		
3. Motion System									
a. Minimum Excursion									
1) Pitch	At least ±40°	N/A	X	X			An SOC is required for 3.a.(1) through (6). (Applicable to Initial evaluations only.) The ''*'' in the Simulator Level column applies if this DOF is used..		
(2) Roll	At least ±40°	N/A	X	X					
(3) Yaw	At least ±45°	N/A	*	*					
(4) Heave	At least 40 inches total movement.	N/A	*	X					
		N/A	X	X					
(5) Sway	At least 45 inches total movement.	N/A	*	*					
(6) Surge	At least 50 inches total movement.								
(7) Pitch	At least ±50°	N/A			X	X	An SOC is required for 3.a.(7) through (12). (Applicable to Initial evaluations only.).		
(8) Roll	At least ±50°	N/A			X	X			
(9) Yaw	At least ±50°	N/A			X	X			
(10) Heave	At least 68 inches total movement.	N/A			X	X			

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(11) Sway	At least 90 inches total movement.	N/A			X	X			
(12) Surge	At least 68 inches total movement.	N/A			X	X			
b. Minimum Acceleration									
(1) Pitch	At least 80°/sec²	N/A	X	X			An SOC is required for 3.b.(1) through (6). (Applicable to Initial evaluations only.) The ''*'' in the Simulator Level column applies if this DOF is used.		
(2) Roll	At least 80°/sec²	N/A	X	X					
(3) Yaw	At least 80°/sec²	N/A	*	*					
(4) Heave	At least 0.6g in each direction	N/A	*	X					
(5) Sway	At least 0.6g in each direction	N/A	X	X			An SOC is required for 3.b.(7) through (12). (Applicable to Initial evaluations only.).		
(6) Surge	At least 0.6g in each direction	N/A	*	*					
(7) Pitch	At least 100°/sec²	N/A			X	X			
(8) Roll	At least 100°/sec²	N/A			X	X			
(9) Yaw	At least 100°/sec²	N/A			X	X			
(10) Heave	At least 0.8g in each direction	N/A			X	X			
(11) Sway	At least 0.6g in each direction	N/A			X	X			
(12) Surge	At least 0.6g in each direction	N/A			X	X			
c. Minimum Velocity									
(1) Pitch	At least 20°/sec	N/A	X	X			An SOC is required for 3.c.(1) through (6). (Applicable to Initial evaluations only.) The ''*'' in the Simulator Level column applies if this DOF is used.		
(2) Roll	At least 20°/sec	N/A	X	X					
(3) Yaw	At least 20°/sec	N/A	*	*					
(4) Heave	At least 20 in/sec	N/A	*	X					
(5) Sway	At least 20 in/sec	N/A	X	X					
(6) Surge	At least 20 in/sec	N/A	*	*					
(7) Pitch	At least 20°	N/A			X	X	An SOC is required for 3.c.(7) through (12). (Applicable to Initial evaluations only.).		
(8) Roll	At least 20°	N/A			X	X			
(9) Yaw	At least 20°	N/A			X	X			
(10) Heave	At least 24/in sec	N/A			X	X			
(11) Sway(12) Surge	At least 28/in sec	N/A			X	X			
	At least 28/in sec	N/A			X	X			
d. Frequency Response									
Phase lag	Not to exceed 45° at 4 Hz	N/A	X	X	X	X	A demonstration is required and must be made part of the MQTG. Iinject an acceleration command into the kinematic transformation equations and measuring the acceleration output of the motion platform. The response bandwidth must be determined in each applicable translational degree of freedom.		
e. Motion Cue									

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
Repeatability	.....	N/A	X	X	X	X	A demonstration is required and must be made part of the MQTG. The assessment procedures must be designed to ensure that the motion system continues to perform as originally qualified. An example demonstration is described in paragraph 7, Motion Cue Repeatability.		
4. Sound System [Reserved]									

Begin Information

5. Control Dynamics

a. The characteristics of an airplane flight control system have a major effect on the handling qualities. A significant consideration in pilot acceptability of an airplane is the ''feel'' provided through the cockpit controls. Considerable effort is expended on airplane feel system design in order to deliver a system with which pilots will be comfortable and consider the airplane desirable to fly. In order for a simulator to be representative, it too must present the pilot with the proper feel; that of the respective airplane. Aircraft control feel dynamics shall duplicate the airplane simulated. This shall be determined by comparing a recording of the control feel dynamics of the simulator to airplane measurements in the takeoff, cruise, and landing configuration.

b. Recordings such as free response to an impulse or step function are classically used to estimate the dynamic properties of electromechanical systems. In any case, it is only possible to estimate the dynamic properties as a result of only being able to estimate true inputs and responses. Therefore, it is imperative that the best possible data be collected since close matching of the simulator control loading system to the airplane systems is essential. The required control feel dynamic tests are described in this attachment. This is usually accomplished by measuring the free response of the controls using a step or pulse input to excite the system.

c. For airplanes with irreversible control systems, measurements may be obtained on the ground if proper pitot-static inputs are provided to represent airspeeds typical of those encountered in flight. Likewise, it may be shown that for some airplanes, takeoff, cruise, and landing configurations have like effects. Thus, one may suffice for another. If either or both considerations apply, engineering validation or airplane manufacturer rationale must be submitted as justification for ground tests or for eliminating a configuration.

(1) *Control Dynamics Evaluations.* The dynamic properties of control systems are often stated in terms of frequency, damping, and a number of other classical measurements which can be found in texts on control systems. In order to establish a consistent means of validating test results for simulator control loading, criteria are needed that will clearly define the interpretation of the measurements and the tolerances to be applied. Criteria are needed for both the underdamped system and the overdamped system, including the critically damped case. In the case of an underdamped system with very light damping, the system may be quantified in terms of frequency and damping. In critically damped or overdamped systems, the frequency and damping is not readily measured from a response time history. Therefore, some other measurement must be used.

(2) *For Levels C and D Simulators.* Tests to verify that control feel dynamics represent the airplane show that the dynamic damping cycles (free response of the control) match that of the airplane within the specified tolerances. An acceptable method of evaluating the response and the tolerance to be applied are described below for the underdamped and critically damped cases.

d. Tolerances. (1) *Underdamped Response.* (a) Two measurements are required for the period, the time to first zero crossing (in case a rate limit is present) and the subsequent frequency of oscillation. It is necessary to measure cycles on an individual basis in case there are nonuniform periods in the response. Each period will be independently compared to the respective period of the airplane control system and, consequently, will enjoy the full tolerance specified for that period.

(b) The damping tolerance will be applied to overshoots on an individual basis. Care must be taken when applying the tolerance to small overshoots since the significance of such overshoots becomes questionable. Only those overshoots larger than 5 percent of the total initial displacement will be considered significant. The residual band, labeled $T(A_d)$ on Figure 1 is ±5 percent of the initial displacement amplitude A_d from the steady state value of the oscillation. Oscillations within the residual band are considered insignificant. When comparing simulator data to airplane data, the process would begin by overlaying or aligning the simulator and airplane steady state values and then comparing amplitudes of oscillation peaks, the time of the first zero crossing, and individual periods of oscillation. To be satisfactory, the simulator would show the same number of significant overshoots to within one when compared against the airplane data. This procedure for evaluating the response is illustrated in Figure 1 of this attachment.

(2) *Critically Damped and Overdamped Response.* Due to the nature of critically damped responses (no overshoots), the time to reach 90 percent of the steady state (neutral point) value would be the same as the airplane within ±10 percent. The simulator response must be critically damped also. Figure 2 illustrates the procedure.

(3)(a) The following summarizes the tolerances, T, for an illustration of the referenced measurements. (See Figures 1 and 2 of this attachment):

$T(P_0)$ ±10% of P_0
$T(P_1)$ ±20% of P_1
T(A) ±10% of A_1, ±20% of Subsequent Peaks
$T(A_d)$ ±5% of A_d = Residual Band
Overshoots ±1

(b) In the event the number of cycles completed outside of the residual band, and thereby significant, exceeds the number depicted in figure 1 of this attachment, the following tolerances (T) will apply:

$T(P_n)$ ±10(n+1)% of P_n, where ''n'' is the next in sequence.

e. Alternative Method for Control Dynamics. (1) An alternative means for dealing with control dynamics applies to airplanes with hydraulically powered flight

controls and artificial feel systems. Instead of free response measurements, the system would be validated by measurements of control force and rate of movement.

(2) For each axis of pitch, roll, and yaw, the control shall be forced to its maximum extreme position for the following distinct rates. These tests would be conducted at typical taxi, takeoff, cruise, and landing conditions.

(a) Static Test—Slowly move the control such that approximately 100 seconds are required to achieve a full sweep. A full sweep is defined as movement of the controller from neutral to the stop, usually aft or right stop, then through the neutral position to the opposite stop, then to the neutral position.

(b) Slow Dynamic Test—Achieve a full sweep in approximately 10 seconds.

(c) Fast Dynamic Test—Achieve a full sweep in approximately 4 seconds.

(**Note:** Dynamic sweeps may be limited to forces not exceeding 100 lb.)

f. Tolerances.

(1) Static Test—Items 2.a.(1) (2) and (3) of this attachment.

(2) Dynamic Test—2 lb. or 10 percent on dynamic increment above static test.

g. The NPSM is open to alternative means such as the one described above. Such alternatives, however, would have to be justified and found appropriate to the application. For example, the method described here may not apply to all manufacturers' systems and certainly not to airplanes with reversible control systems. Hence, each case must be considered on its own merit on an ad hoc basis. If the NSPM finds that alternative methods do not result in satisfactory simulator performance, then more conventionally accepted methods must be used.

End Information

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6. Ground Effect

Begin Information

a. During landing and takeoff, airplanes operate close to the ground for brief time intervals. The presence of the ground significantly modifies the air flow past the airplane and changes the aerodynamic characteristics. The close proximity of the ground imposes a barrier which inhibits the downward flow normally associated with the production of lift. The downwash is a function of height with the effects usually considered to be negligible above a height of approximately one wingspan. There are three main effects of the reduced downwash:

(1) A reduction in downwash angle at the tail for a conventional configuration.

(2) An increase in both wing and tail lift because of changes in the relationship of lift coefficient to angle of attack (increase in lift curve slope).

(3) A reduction in the induced drag.

b. Relative to out-of-ground effect flight (at a given angle of attack), these effects result in higher lift in ground effect and less power required for level flight. Because of the associated effects on stability, they also cause significant changes in elevator (or stabilizer) angle to trim and stick (column) forces required to maintain a given lift coefficient in level flight near the ground.

c. For a simulator to be used for takeoff and in particularly landing credit, it must faithfully reproduce the aerodynamic changes which occur in ground effect. The parameters chosen for simulator validation must obviously be indicative of these changes. The primary validation parameters for longitudinal characteristics in ground effect are:

(1) Elevator or stabilizer angle to trim.

(2) Power (thrust) required for level flight (PLF).

(3) Angle of attack for a given lift coefficient.

(4) Height/altitude.

(5)Airspeed.

d. The above list of parameters assumes that ground effect data is acquired by tests during ''fly-bys'' at several altitudes in and out of ground effect. These test altitudes would normally, as a minimum, be at 10 percent, 30 percent, and 70 percent of the airplane wingspan and one altitude out of ground effect; *e.g.*, 150 percent of wingspan. Level fly-bys are required for Level D; and, while they are acceptable for all levels, they are not required for Level C and Level B.

e. If, in lieu of the level fly-by method for Levels B and C, other methods such as shallow glidepath approaches to the ground maintaining a chosen parameter constant are proposed, then additional validation parameters are important. For example, if constant attitude shallow approaches are chosen as the test maneuver, pitch attitude, and flight path angle are additional necessary validation parameters. The selection of the test methods and procedures to validate ground effect is at the option of the organization performing the flight tests; however, rationale must be provided to conclude that the tests performed do indeed validate the ground effect model.

f. Tolerances (longitudinal parameters) for validation of ground effect characteristics are:

(1) Elevator or Stabilizer Angle ±1°

(2) Power for Level Flight (PLF)±5%

(3) Angle of Attack ±1°

(4) Altitude/Height ±10% or 5 feet (1.5 m.)

(5) Airspeed ±3 Knots

(6) Pitch Attitude ±1°

g.The lateral-directional characteristics are also altered by ground effect. Because of the above-mentioned changes in lift curve slope, roll damping, as an example, is affected. The change in roll damping will affect other dynamic modes usually evaluated for simulator validation. In fact, Dutch-roll dynamics, spiral stability, and roll-rate for a given lateral control input are altered by ground effect. Steady heading sideslips will also be affected. These effects must be accounted for in the simulator modeling. Several tests such as ''crosswind landing,'' ''one engine inoperative landing,'' and ''engine failure on takeoff'' serve to validate lateral-directional ground effect since portions of them are accomplished while transiting altitudes at which ground effect is an important factor.

End Information

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7. Motion Cue Repeatability

Begin Information

a. The motion system characteristics in the Table of Objective Tests address basic system capability, but not pilot cueing capability. Until there is an objective procedure for determination of the motion cues necessary to support pilot tasks and stimulate the pilot response which occurs in an airplane for the same tasks, motion systems will continue to be ''tuned'' subjectively. Having tuned a motion system, however, it is important to involve a test to ensure that the system continues to perform as originally qualified. Any motion performance change from the initially qualified baseline can be measured objectively.

b. An objective assessment of motion performance change is accomplished at lease annually using the following testing procedure:

(1) The current performance of the motion system is assessed by comparison with the initial recorded test data.

(2) The parameters to be recorded are the outputs of the motion drive algorithms and the jack position transducers.

(3) The test input signals are inserted at an appropriate point prior to the integrations in the equations of motion (see figure 3 of this attachment).

(4) The characteristics of the test signal (see figure 4) are adjusted to ensure that the motion is exercised through approximately ⅔ of the maximum displacement capability in each axis. The time segment T_0–T_1, must be of sufficient duration to ensure steady initial conditions.

End Information

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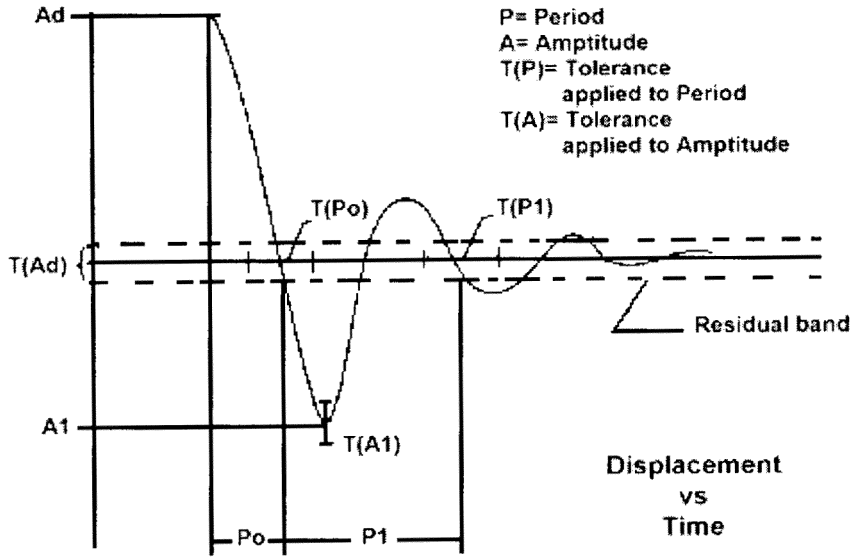
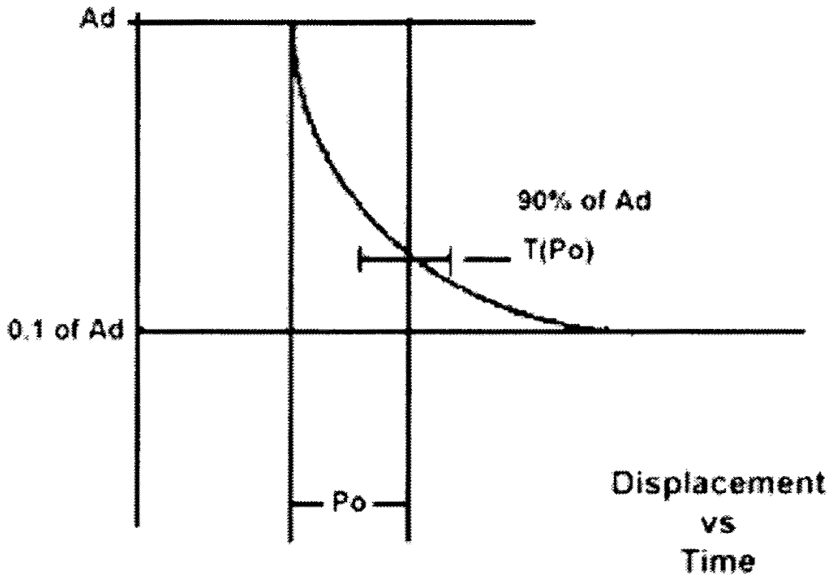


ATTACHMENT 2 TO APPENDIX A TO PART 60—

FIGURE 1. UNDER-DAMPED STEP RESPONSE

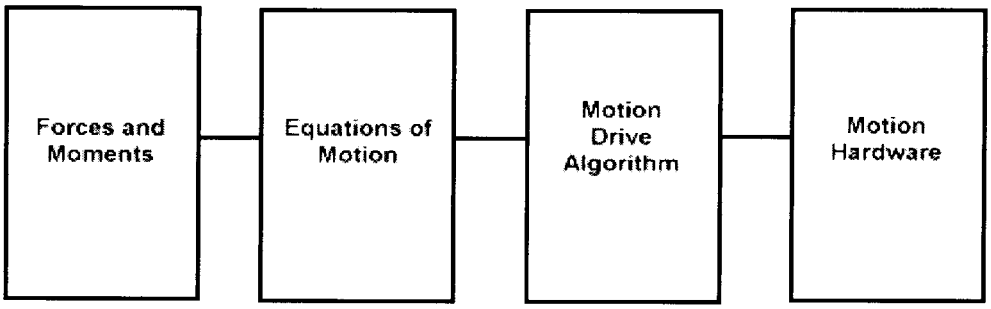


ATTACHMENT 2 TO APPENDIX A TO PART 60—

FIGURE 2. CRITICALLY-DAMPED STEP RESPONSE

ATTACHMENT 2 TO APPENDIX A TO PART 60—

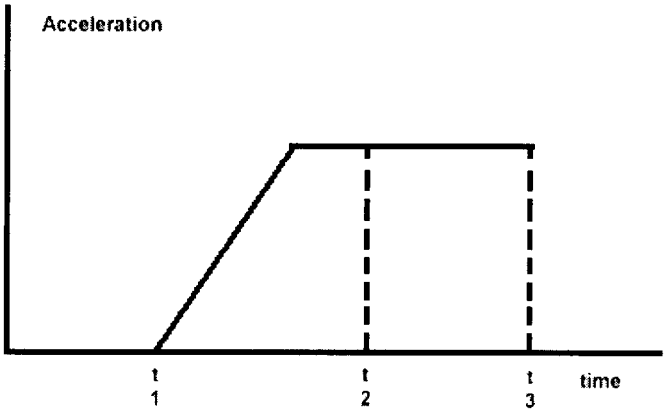
FIGURE 3. ACCELERATION TEST SIGNALS



Note to Figure 3: If the simulator weight changes for any reason (*i.e.*, visual change, or structural change), then the motion system baseline performance repeatability tests must be rerun and the new results used for future comparison.

ATTACHMENT 2 TO APPENDIX A TO PART 60—

FIGURE 4, ACCELERATION TEST SIGNAL



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Note to Figure 4: If the simulator weight changes for any reason (*i.e.*, visual change, or structural change), then the motion system baseline performance repeatability tests must be rerun and the new results used for future comparison.

8. Alternative Data Sources, Procedures, and Instrumentation: Level A and Level B Simulators Only

Begin Information

a. In recent years, considerable progress has been made by highly experienced aircraft and simulator manufacturers in improvement of aerodynamic modeling techniques. In conjunction with increased accessibility to very high powered computer technology, these techniques have become quite sophisticated. Additionally, those who have demonstrated success in combining these modeling techniques with minimal flight testing have incorporated the use of highly mature flight controls models and have had extensive experience in comparing the output of their effort with actual flight test data—and they have been able to do so on an iterative basis over a period of years.

b. It has become standard practice for experienced simulator manufacturers to use such techniques as a means of establishing data bases for new simulator configurations while awaiting the availability of actual flight test data; and then comparing this new data with the newly available flight test data. The results of such comparisons have, as reported by some recognized and experienced simulation experts, become increasingly consistent and indicate that these techniques, applied with appropriate experience, are becoming dependably accurate for the development of aerodynamic models for use in Level A and Level B simulators.

c. In reviewing this history, the NSPM has concluded that, with proper care, those who are experienced in the development of aerodynamic models for simulator application can successfully use these modeling techniques to acceptably alter the method by which flight test data may be acquired and, when applied to Level A or Level B simulators, does not compromise the quality of that simulation.

d. The information in the table that follows (Table of Alternative Data Sources,

Procedures, and Information) is presented to describe an acceptable alternative to data sources for simulator modeling and validation and as an acceptable alternative to the procedures and instrumentation found in the traditionally accepted flight test methods used to gather such modeling and validation data.

(1) Alternative data sources which may be used for part or all of a data requirement are the Airplane Maintenance Manual, the Airplane Flight Manual (AFM), Airplane Design Data, the Type Inspection Report (TIR), Certification Data or acceptable supplemental flight test data.

(2) The NSPM recommends that use of the alternative instrumentation noted in the following Table be coordinated with the NSPM prior to employment in a flight test or data gathering effort.

e. The NSPM position regarding the use of these alternative data sources, procedures, and instrumentation is based on three primary preconditions and presumptions regarding the objective data and simulator aerodynamic program modeling.

(1) While the data gathered through the alternative means does not require angle of attack (AOA) measurements or control surface position measurements for any flight test, AOA can be sufficiently derived if the flight test program insures the collection of acceptable level, unaccelerated, trimmed flight data. All of the simulator time history tests that begin in level, unaccelerated, and trimmed flight, including the three basic trim tests and ''fly-by'' trims, can be a successful validation of angle of attack by comparison with flight test pitch angle. (**Note:** Due to the criticality of angle of attack in the development of the ground effects model, particularly critical for normal landings and landings involving cross-control input applicable to Level B simulators, stable ''fly-by'' trim data will be the acceptable norm for normal and cross-control input landing objective data for these applications.)

(2) A rigorously defined and fully mature simulation controls system model that includes accurate gearing and cable stretch characteristics (where applicable), determined from actual aircraft measurements, will be used. Such a model does not require control surface position measurements in the flight test objective data in these limited applications.

(3) The authorized uses of Level A and Level B simulators (as listed in the appropriate Commercial, Instrument, or Airline Transport Pilot and/or Type Rating Practical Test Standards) for ''initial,'' ''transition,'' or ''upgrade'' training, still requires additional flight training and/or flight testing/checking in the airplane or in a Level C or Level D simulator.

f. The sponsor is urged to contact the NSPM for clarification of any issue regarding airplanes with reversible control systems. This table is not applicable to Computer Controlled Aircraft flight simulators.

g. Utilization of these alternate data sources, procedures, and instrumentation does not relieve the sponsor from compliance with the balance of the information contained in this document relative to Level A or Level B flight simulators.

End Information

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION INFORMATION

Table of objective test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
2.a.(1) Performance. Taxi. Minimum Radius turn.	X	X	TIR, AFM, or Design data may be used.	
2.a.(2) Performance. Taxi Rate of Turn vs. Nosewheel Steering Angle.		X	Data may be acquired by using a constant tiller position, measured with a protractor or full rudder pedal application for steady state turn, and synchronized video of heading indicator. If less than full rudder pedal is used, pedal position must be recorded.	A single procedure may not be adequate for all airplane steering systems, therefore appropriate measurement procedures must be devised and proposed for NSPM concurrence.
2.b.(1) Performance. Takeoff. Ground Acceleration Time and Distance.	X	X	Preliminary certification data may be used. Data may be acquired by using a stop watch, calibrated airspeed, and runway markers during a takeoff with power set before brake release. Power settings may be hand recorded. If an inertial measurement system is installed, speed and distance may be derived from acceleration measurements.	
2.b.(2) Performance. Takeoff. Minimum Control Speed—Ground (V_{mcg}) using aerodynamic controls only (per applicable Airworthiness Standard) or Low Speed, Engine Inoperative Ground Control Characteristics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and the force/position measurements of cockpit controls.	Rapid throttle reductions at speeds near V_{mcg} may be used while recording appropriate parameters. The nose wheel must be free to caster, or equivalently freed of sideforce generation.
2.b.(4) Performance. Takeoff. Normal Takeoff.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and the force/position measurements of cockpit controls. AOA can be calculated from pitch attitude and flight path.	
2.b.(5) Performance. Takeoff. Critical Engine Failure during Takeoff.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and the force/position measurements of cockpit controls.	Record airplane dynamic response to engine failure and control inputs required to correct flight path.

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION INFORMATION—Continued

Table of objective test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
2.b.(6) Performance. Takeoff. Crosswind Takeoff.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and the force/position measurements of cockpit controls.	The ''1:7 law'' to 100 feet (30 meters) is an acceptable wind profile.
2.b.(7) Performance. Takeoff. Rejected Takeoff.	X	X	Data may be acquired with a synchronized video of: Calibrated airplane instruments, thrust lever position, engine parameters, and distance (e.g., runway markers). A stop watch is required.	
2.c.(1) Performance. Climb. Normal Climb.	X	X	Data may be acquired with a synchronized video of: calibrated airplane instruments and engine power throughout the climb range.	
2.c.(2) Performance. Climb. One engine Inoperative Second Segment Climb.	X	X	Data may be acquired with a synchronized video of: calibrated airplane instruments and engine power throughout the climb range.	
2.c.(4) Performance. Climb. One Engine Inoperative Approach Climb (if Approved AFM requires specific performance in icing conditions).	X	X	Data may be acquired with a synchronized video of: calibrated airplane instruments and engine power throughout the climb range.	
2.e.(1) Performance. Ground. Deceleration Time and Distance, using manual application of wheel brakes and no reverse thrust.	X	X	Data may be acquired during landing tests using a stop watch, runway markers, and a synchronized video of: calibrated airplane instruments, thrust lever position and the pertinent parameters of engine power.	
2.e.(2) Performance. Ground. Deceleration Time and Distance, using reverse thrust and no wheel brakes.	X	X	Data may be acquired during landing tests using a stop watch, runway markers, and a synchronized video of: calibrated airplane instruments, thrust lever position and the pertinent parameters of engine power.	
2.f.(1) Performance. Engines. Acceleration.	X	X	Data may be acquired with a synchronized video recording of: engine instruments and throttle position.	
2.f.(2) Performance. Engines. Deceleration.	X	X	Data may be acquired with a synchronized video recording of: engine instruments and throttle position.	
3.a.(1) Handling Qualities. Static Control Checks. Column Position vs. Force and Surface Position Calibration.	X	X	Surface position data may be acquired from flight data recorder (FDR) sensor or, if no FDR sensor, at selected, significant column positions (encompassing significant column position data points), acceptable to the NSPM, using a control surface protractor on the ground with winds less than 5 kts. Force data may be acquired by using a hand held force gauge at the same column position data points.	

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION INFORMATION—Continued

Table of objective test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
3.a.(2) Handling Qualities. Static Control Checks. Wheel Position vs. Force and Surface Position Calibration.	X	X	Surface position data may be acquired from flight data recorder (FDR) sensor or, if no FDR sensor, at selected, significant wheel positions (encompassing significant wheel position data points), acceptable to the NSPM, using a control surface protractor on the ground with winds less than 5 kts. Force data may be acquired by using a hand held force gauge at the same wheel position data points.	
3.a.(3) Handling Qualities. Static Control Checks. Rudder Pedal Position vs. Force and Surface Position Calibration.	X	X	Surface position data may be acquired from flight data recorder (FDR) sensor or, if no FDR sensor, at selected, significant rudder pedal positions (encompassing significant rudder pedal position data points), acceptable to the NSPM, using a control surface protractor on the ground with winds less than 5 kts. Force data may be acquired by using a hand held force gauge at the same rudder pedal position data points.	
3.a.(4) Handling Qualities. Static Control Checks. Nosewheel Steering Force & Position.	X	X	Breakout data may be acquired with a hand held force gauge. The remainder of the force to the stops may be calculated if the force gauge and a protractor are used to measure force after breakout for at least 25% of the total displacement capability.	
3.a.(5) Handling Qualities. Static Control Checks. Rudder Pedal Steering Calibration.	X	X	Data may be acquired through the use of force pads on the rudder pedals and a pedal position measurement device, together with design data for nose wheel position.	
3.a.(6) Handling Qualities. Static Control Checks. Pitch Trim Calibration (Indicator vs. Computed) and Rate.	X	X	Data may be acquired through calculations.	
3.a.(7) Handling Qualities. Static Control Checks. Alignment of Power Lever Angle vs Selected Engine Parameter (e.g., EPR, N_1, Torque, etc.).	X	X	Data may be acquired through the use of a temporary throttle quadrant scale to document throttle position. Use a synchronized video to record steady state instrument readings or hand-record steady state engine performance readings.	
3.a.(8) Handling Qualities. Static Control Checks. Brake Pedal Position vs. Force and Brake System Pressure.	X	X	Use of design or predicted data is acceptable. Data may be acquired by measuring deflection at ''zero'' and ''maximum'' and calculating deflections between the extremes using the airplane design data curve.	
3.c.(1) Handling Qualities. Longitudinal. Power Change Dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and throttle position.	
3.c.(2) Handling Qualities. Longitudinal. Flap/Slat Change Dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: calibrated airplane instruments and flap/slat position.	

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION INFORMATION—Continued

Table of objective test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
3.c.(3) Handling Qualities. Longitudinal. Spoiler/Speedbrake Change.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and spoiler/speedbrake position.	
3.c.(4) Handling Qualities. Longitudinal. Gear Change Dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and gear position.	
3.c.(5) Handling Qualities. Longitudinal. Alternate Landing Gear and Alternate Flap/Slat Operating Times.	X	X	May use design data, production flight test schedule, or maintenance specification, together with an SOC.	
3.c.(6) Handling Qualities. Longitudinal. Longitudinal Trim.	X	X	Data may be acquired through use of an inertial measurement system and a synchronized video of: the cockpit controls position (previously calibrated to show related surface position) and the engine instrument readings.	
3.c.(7) Handling Qualities. Longitudinal. Longitudinal Maneuvering Stability (Stick Force/g).	X	X	Data may be acquired through the use of an inertial measurement system and a synchronized video of: the calibrated airplane instruments; a temporary, high resolution bank angle scale affixed to the attitude indicator; and column force measurement indication.	
3.c.(8) Handling Qualities. Longitudinal. Longitudinal Static Stability.	X	X	Data may be acquired through the use of a synchronized video of: the airplane flight instruments and a hand held force gauge.	
3.c.(9) Handling Qualities. Longitudinal. Stick Shaker, Airframe Buffet, Stall Speeds.	X	X	Data may be acquired through a synchronized video recording of: a stop watch and the calibrated airplane airspeed indicator. Hand-record the flight conditions and airplane configuration—Airspeeds may be cross checked with those in the TIR and AFM.	
3.c.(10) Handling Qualities. Longitudinal. Phugoid Dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplaine instruments and the force/position measurements of cockpit controls.	
3.c.(11) Handling Qualities. Longitudinal. Short Period Dynamics.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and the force/position measurements of cockpit controls.	
3.d.(1) Handling Qualities. Lateral Directional. Minimum Control Speed, Air (V_{mca}), per Applicable Airworthiness Standard or Low Speed Engine. Inoperative Handling Characteristics in Air.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and the force/position measurements of cockpit controls.	
3.d.(3) Handling Qualities. Lateral Directional. Roll Response to Cockpit Roll Controller Step Input.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments and the force/position measurements of cockpit controls.	

TABLE OF ALTERNATIVE DATA SOURCES, PROCEDURES, AND INSTRUMENTATION INFORMATION—Continued

Table of objective test—test reference number and title	Sim level		Aternative data sources, procedures, and instrumentation	Notes and reminders
	A	B		
3.d.(4) Handling Qualities. Lateral Directional. Spiral Stability.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls; and a stop watch.	
3.d.(5) Handling Qualities. Lateral Directional. Engine Inoperative Trim.	X	X	Data may be hand recorded in-flight using high resolution scales affixed to trim controls that have been calibrated on the ground using protractors on the control/trim surfaces with winds less than 5 kts OR Data may be acquired during second segment climb (with proper pilot control input for an engine-out condition) by using a synchronized video of: the calibrated airplane instruments; and the fore/position measurements of cockpit controls.	Trimming during second segment climb is not a certification task and should not be conducted until a safe altitude is reached.
3.d.(6) Handling Qualities. Lateral Directional. Rudder Response.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of rudder pedals.	
3.d.(7) Handing Qualities. Lateral Directional. Dutch Roll, (Yaw Damper OFF).	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: a calibrated airplane instruments; the force/position measurements of cockpit controls.	
3.d.(8) Handling Qualities. Laterial Directional. Steady State Sideslip.	X	X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls. Ground track and wind corrected heading may be used for sideslip angle.	
3.e.(1) Handling Qualities. Landings Normal Landing.		X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls.	
3.e.(3) Handling Qualities. Landings. Crosswind Landing.		X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls.	
3.e.(4) Handling Qualities. Landings. One Engine Inoperative Landing (Not required for Single-engine airplanes.).		X	Data may be acquired by using an inertial measurement system and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls. Normal and laterial acceleration may be recorded in lieu of AOA and sideslip.	
3.f. Handling Qualities. Ground Effect. Demonstrate Longitudinal Ground Effect.		X	Data may be acquired by using an calibrated airplane instruments, an inertial measurement system, and a synchronized video of: the calibrated airplane instruments; the force/position measurements of cockpit controls.	

Attachment 3 to Appendix A to Part 60—Simulator Subjective Tests

1. Discussion

Begin Information

a. The subjective tests provide a basis for evaluating the capability of the simulator to perform over a typical utilization period; determining that the simulator satisfactorily meets the appropriate training/testing/checking objectives and competently simulates each required maneuver, procedure, or task; and verifying correct operation of the simulator controls, instruments, and systems. The items in the list of operations tasks are for simulator evaluation purposes only. They must not be used to limit or exceed the authorizations for use of a given level of simulator as found in the Pilot Qualification Performance Standards or as may be approved by the TPAA. All items in the following paragraphs are subject to an examination of function.

b. The List of Operations Tasks in paragraph 2 of this attachment addresses pilot functions, including maneuvers and procedures (called flight tasks), and is divided by flight phases. The performance of these tasks by the NSPM includes an operational examination of the visual system and special effects. There are flight tasks included to address some features of advanced technology airplanes and innovative training programs. For example, ''high angle-of-attack maneuvering'' is included to provide a required alternative to ''approach to stalls'' for airplanes employing flight envelope protection functions.

c. The List of Simulator Systems in paragraph 3 of this attachment addresses the overall function and control of the simulator including the various simulated environmental conditions; simulated airplane system operation (normal, abnormal, and emergency); visual system displays; and special effects necessary to meet flightcrew training, evaluation, or flight experience requirements.

d. All simulated airplane systems functions will be assessed for normal and, where appropriate, alternate operations. Normal, abnormal, and emergency operations associated with a flight phase will be assessed during the evaluation of flight tasks or events within that flight phase. Simulated airplane systems are listed separately under ''Any Flight Phase'' to ensure appropriate attention to systems checks. Operational navigation systems (including inertial navigation systems, global positioning systems, or other long-range systems) and the associated electronic display systems will be evaluated if installed. The NSP pilot will include in his report to the TPAA, the effect of the system operation and any system limitation.

e. Simulators demonstrating a satisfactory circling approach will be recommended for approval for the circling approach maneuver as determined by the TPAA in the sponsor's FAA-approved flight training program. To be considered satisfactory here, the circling approach will be flown at maximum gross weight for landing, with minimum visibility, and must allow proper alignment with a landing runway at least 90° different from the instrument approach course while allowing the pilot to keep an identifiable portion of the airport in sight throughout the maneuver (reference—14CFR, § 91.175(e)).

f. At the request of the TPAA, the NSP Pilot may assess the simulator for a special aspect of a sponsor's training program during the functions and subjective portion of an evaluation. Such an assessment may include a portion of a Line Oriented Flight Training (LOFT) scenario or special emphasis items in the sponsor's training program. Unless directly related to a requirement for the qualification level, the results of such an evaluation would not affect the qualification of the simulator.

End Information

2. List of Operations Tasks

Begin QPS Requirements

The NSPM will evaluate the simulator in the following Operations Tasks, as applicable to the airplane and simulator level, using the sponsor's approved manuals and checklists.

a. Preparation for Flight

Preflight. Accomplish a functions check of all installed switches, indicators, systems, and equipment at all crewmembers' and instructors' stations, and determine that the cockpit design and functions replicate the appropriate airplane.

b. Surface Operations (Pre-Takeoff)

(1) Engine start.
(a) Normal start.
(b) Alternate start operations.
(c) Abnormal starts and shutdowns (hot start, hung start, *etc.*).
(2) Pushback / Powerback.
(3) Taxi
(a) Thrust response.
(b) Power lever friction.
(c) Ground handling.
(d) Nosewheel scuffing.
(e) Brake operation (normal and alternate/emergency).
(f) Ground hazard.
(g) Surface Movement and Guidance System (SMGS).
(h) Other.

c. Takeoff

(1) Normal. (Day, Night, Dusk (or Twilight))
(a) Propulsion system checks (*e.g.*, engine parameter relationships; propeller and mixture controls).
(b) Airplane acceleration characteristics.
(c) Nosewheel and rudder steering.
(d) Crosswind (maximum demonstrated).
(e) Special performance.
(f) Lowest visibility takeoff.
(g) Landing gear, wing flap, leading edge device operation.
(h) Other.
(2) Abnormal/Emergency.
(a) Rejected, with brake fade (if applicable) due to rising brake temperature.
(b) Rejected, special performance.
(c) With propulsion system malfunction:
(i) Prior to V_1 (decision) speed.
(ii) Between V_1 and V_r (rotation speed).
(iii) Between V_r and 500 feet above ground level.
(d) Flight control system failure modes.
(e) Other.

d. Inflight Operation

(1) Climb.
(a) Normal.
(b) One engine inoperative operations.
(c) Other.
(2) Cruise.
(a) Performance characteristics (speed vs. power).
(b) Normal turns and turns with/without spoilers (speed brake) deployed.
(c) High altitude handling.
(d) High indicated airspeed handling, over-speed warning.
(e) Mach effects on control and trim.
(f) Normal and steep turns.
(g) Performance turns.
(h) Approach to stalls in the following configurations:
(i) Cruise;
(ii) Takeoff or approach; and
(iii) Landing.
(a) High angle of attack maneuvers in the following configurations:
(i) Cruise;
(ii) Takeoff or approach; and
(iii) Landing.
(j) Inflight engine shutdown.
(k) Inflight engine restart.
(l) Maneuvering with one or more engines inoperative, as applicable.
(m) Slow flight.
(n) Specific flight characteristics.
(o) Manual flight control reversion (*i.e.*, loss of all flight control power).
(p) Other flight control system failure modes.
(q) Holding.
(r) Airborne hazard.
(s) Operations during icing conditions.
(t) Upset / disturbance recovery.
(u) Unusual attitude recovery.
(v) Traffic alert and collision avoidance.
(w) Effects of airframe icing.
(x) Other.
(3) Descent.
(a) Normal.
(b) Maximum rate (clean, with speedbrake extended, etc.) and recovery.
(c) Flight Control System Failure Modes (*e.g.*, manual flight control reversion; split controls, *etc.*).
(d) High rate of sink and recovery.
(a) Other.

e. Approaches

(1) Instrument Approach Maneuvers.
(a) Non-precision:
(i) Non-Directional Beacon (NDB).
(ii) VHF Omni-Range (VOR), Area Navigation (RNAV), Tactical Air Navigation (TACAN).
(iii) Distance Measuring Equipment, Arc (DME ARC).
(iv) ILS Localizer Back Course (LOC/BC).
(v) Localizer Directional Aid (LDA), ILS Front Course Localizer (LOC), Simplified Direction Facility (SDF).
(vi) Airport Surveillance Radar (ASR).
(vii) Global Positioning System (GPS).
(viii) With one engine inoperative.

(ix) Missed approach.
(b) Precision:
(i) Instrument Landing System (ILS)
A. Category I published:
1. Manually controlled with and without flight director to 100 feet below published decision height.
2. With maximum demonstrated crosswind.
3. With windshear.
4. One engine inoperative.
B. Category II published:
1. With and without use of autopilot, autothrottle, and autoland, as applicable.
2. One engine inoperative.
C. Category III published:
1. With minimum/standby electrical power.
2. With generator/alternator failure (transient).
3. With 10 knot tail wind.
4. With 10 knot crosswind.
5. Rollout.
6. One engine inoperative.
D. Missed approach.
1. All engines operating.
2. One engine inoperative.
(ii) Precision Approach Radar (PAR)
A. Normal.
B. With crosswind.
C. With one engine inoperative.
D. Missed approach.
(iii) Digital Global Positioning System (DGPS)
A. Normal.
B. With crosswind.
C. With one engine inoperative.
D. Missed approach.
(iv) Microwave landing system (MLS).
A. Normal.
B. With crosswind.
C. With one engine inoperative.
D. Missed approach.
(v) Steep Glide Path.
A. Normal.
B. With crosswind.
C. With one engine inoperative.
D. Missed approach.
(2) Visual Approach Maneuvers.
(a) Abnormal wing flaps/slats.
(b) Without glide slope guidance or visual vertical flightpath aid.
(3) Abnormal/emergency.
(a) With one engine inoperative.
(b) With standby (or minimum) electric/hydraulic power.
(c) With longitudinal trim malfunction.
(d) With jammed or mis-trimmed horizontal stabilizer.
(e) With lateral-directional trim malfunction.
(f) With worst case failure of flight control system (most significant degradation of the computer controlled airplane which is not extremely improbable).
(g) Other flight control system failure modes as dictated by training program.
(h) Land and hold short operations.
(i) Other.

f. Missed Approach

(1) Manual.
(2) Automatic (if applicable).

g. Visual Segment and Landing

(1) Normal (Night visual scene for Level A and Level B simulators; Night and Dusk (or Twilight) visual scenes for Level C simulators; and Night, Dusk (or Twilight), and Daylight visual scenes for Level D simulators.)
(a) From visual traffic pattern.
(b) From non-precision approach.
(c) From precision approach.
(d) With maximum demonstrated crosswind.
(e) From circling approach.
(2) Abnormal/emergency.
(a) With engine(s) inoperative—
(i) For 2-engine airplanes, one engine inoperative.
(ii) For 3-engine airplanes, one wing-mounted and the center engine inoperative.
(iii) For other multi-engine airplanes, a 50% power loss on one side of the airplane.
(b) Rejected landing.
(c) With standby (or minimum) electric/hydraulic power.
(d) With longitudinal trim malfunction
(e) With jammed or mis-trimmed horizontal stabilizer.
(f) With lateral-directional trim malfunction.
(g) With worst case failure of flight control system (most significant degradation of the computer controlled airplane which is not extremely improbable).
(h) Other flight control system failure modes as dictated by training program.
(i) Land and hold short operations.
(j) Other.

h. Windshear

(1) Takeoff.
(2) Climb.
(3) Approach.

i. Surface Operations (Post Landing)

(1) Landing roll.
(2) Spoiler operation.
(3) Reverse thrust operation.
(4) Wheel brake operation.
(5) Ground hazard.
(6) Surface Movement and Guidance System (SMGS).
(7) Other.

J. Any Flight Phase

(1) Air conditioning.
(2) Anti-icing/deicing.
(3) Auxiliary powerplant.
(4) Communications.
(5) Electrical.
(6) Fire detection and suppression.
(7) Flaps/Slats.
(8) Flight controls (including spoiler/speedbrake).
(9) Fuel and oil.
(10) Hydraulic.
(11) Landing gear.
(12) Oxygen.
(13) Pneumatic.
(14) Propulsion System.
(15) Pressurization.
(16) Flight management and guidance systems.
(17) Automatic landing aids.
(18) Automatic pilot.
(19) Thrust management/auto-throttle.
(20) Flight data displays.
(21) Flight management computers.
(22) Flight director/system displays.
(23) Flight Instruments.
(24) Heads-up flight guidance system.
(25) Navigation systems.
(26) Weather radar system.
(27) Stall warning/avoidance.
(28) Stability and control augmentation.
(29) ACARS.
(30) Other

k. Engine Shutdown and Parking

(1) Systems operation.
(2) Parking brake operation.

3. List of Simulator Systems

a. Instructor Operating Station (IOS)

(1) Power switch(es).
(2) Airplane conditions.
(a) Gross weight, center of gravity, fuel loading and allocation, *etc.*
(b) Airplane systems status.
(c) Ground crew functions (*e.g.*, external power connections, push back, *etc.*)
(d) Other.
(3) Airports.
(a) Number and selection.
(b) Runway selection.
(c) Runway surface condition (*e.g.*, rough, smooth, icy, wet, dry, *etc.*)
(d) Preset positions (*e.g.* ramp, gate, #1 for takeoff, takeoff position, over FAF, *etc.*)
(e) Lighting controls.
(f) Other.
(4) Environmental controls.
(a) Clouds (base and tops).
(b) Visibility (statute miles (kilometers)).
(c) Runway visual range (in feet (meters)).
(d) Temperature.
(e) Climate conditions (*e.g.*, ice, snow, rain, *etc.*).
(f) Wind speed and direction.
(g) Windshear.
(h) Other.
(5) Airplane system malfunctions.
(a) Insertion/deletion.
(b) Problem clear.
(c) Other
(6) Locks, Freezes, and repositioning.
(a) Problem (all) freeze/release.
(b) Position (geographic) freeze/release.
(c) Repositioning (locations, freezes, and releases).
(d) Two times or one-half ground speed control.
(e) Other
(7) Remote IOS.
(8) Other.

b. Sound Controls—On/Off/Rheostat

c. Motion/Control Loading System

(1) On/off/emergency stop.
(2) Crosstalk (motion response in a given degree of freedom not perceptible in other degrees of freedom).
(3) Smoothness (no perceptible ''turn-around bump'' as the direction of motion reverses with the simulator being ''flown'' normally).

d. Observer Stations

(1) Position.
(2) Adjustments.
(3) Positive seat restraint system.

End QPS Requirements

Attachment 4 to Appendix A to Part 60—Definitions and Abbreviations

1. Definitions

Begin Regulatory Language (14 CFR Part 1 and § 60.3)

(From Part 1—Definitions)

Flight simulation device (FSD) means a flight simulator or a flight training device.

Flight simulator means a full size replica of a specific type or make, model, and series aircraft cockpit. It includes the assemblage of equipment and computer programs necessary to represent the aircraft in ground and flight operations, a visual system providing an out-of-the-cockpit view, a system that provides cues at least equivalent to those of a three-degree-of-freedom motion system, and having the full range of capabilities of the systems installed in the device as described in part 60 of this chapter and the qualification performance standards (QPS) for a specific qualification level.

Flight training device (FTD) means a full size replica of aircraft instruments, equipment, panels, and controls in an open flight deck area or an enclosed aircraft cockpit replica. It includes the equipment and computer programs necessary to represent the aircraft or set of aircraft in ground and flight conditions having the full range of capabilities of the systems installed in the device as described in part 60 of this part and the qualification performance standard (QPS) for a specific qualification level.

(From Part 60—Definitions)

Certificate holder. A person issued a certificate under parts 119, 141, or 142 of this chapter or a person holding an approved course of training for flight engineers in accordance with part 63 of this chapter.

Flight test data. Actual aircraft performance data obtained by the aircraft manufacturer (or other supplier of data acceptable to the NSPM) during an aircraft flight test program.

FSD Directive. A document issued by the FAA to an FSD sponsor, requiring a modification to the FSD due to a recognized safety-of-flight issue and amending the qualification basis for the FSD.

Master Qualification Test Guide (MQTG). The FAA-approved Qualification Test Guide with the addition of the FAA-witnessed test, performance, or demonstration results, applicable to each individual FSD.

National Simulator Program Manager (NSPM). The FAA manager responsible for the overall administration and direction of the National Simulator Program (NSP), or a person approved by the NSPM .

Objective test. A quantitative comparison of simulator performance data to actual or predicted aircraft performance data to ensure FSD performance is within the tolerances prescribed in the QPS.

Predicted data. Aircraft performance data derived from sources other than direct physical measurement of, or flight tests on, the subject aircraft. Predicted data may include engineering analysis and simulation, design data, wind tunnel data, estimations or extrapolations based on existing flight test data, or data from other models.

Qualification level. The categorization of the FSD, based on its demonstrated technical and operational capability as set out in the QPS.

Qualification Performance Standard (QPS). The collection of procedures and criteria published by the FAA to be used when conducting objective tests and subjective tests, including general FSD requirements, for establishing FSD qualification levels.

Qualification Test Guide (QTG). The primary reference document used for evaluating an aircraft FSD. It contains test results, performance or demonstration results, statements of compliance and capability, the configuration of the aircraft simulated, and other information for the evaluator to assess the FSD against the applicable regulatory criteria.

Set of aircraft. Aircraft that share similar handling and operating characteristics and similar operating envelopes and have the same number and type of engines or power plants.

Sponsor. A certificate holder who seeks or maintains FSD qualification and is responsible for the prescribed actions as set out in this part and the QPS for the appropriate FSD and qualification level.

Subjective test. A qualitative comparison to determine the extent to which the FSD performs and handles like the aircraft being simulated.

Training Program Approval Authority (TPAA). A person authorized by the Administrator to approve the aircraft flight training program in which the FSD will be used.

Upgrade. The improvement or enhancement of an FSD for the purpose of achieving a higher qualification level.

End Regulatory Language (14 CFR Part 1 and § 60.3)

Begin QPS Requirements

1st Segment—is that portion of the takeoff profile from liftoff to gear retraction.

2nd Segment—is that portion of the takeoff profile from after gear retraction to initial flap/slat retraction.

3rd Segment—is that portion of the takeoff profile after flap/slat retraction is complete.

Airspeed—is calibrated airspeed unless otherwise specified and is expressed in terms of nautical miles per hour (knots).

Altitude—is pressure altitude (meters or feet) unless specified otherwise.

Automatic Testing—is simulator testing wherein all stimuli are under computer control.

Bank—is the airplane attitude with respect to or around the longitudinal axis, or roll angle (degrees).

Breakout—is the force required at the pilot's primary controls to achieve initial movement of the control position.

Closed Loop Testing—is a test method for which the input stimuli are generated by controllers which drive the simulator to follow a pre-defined target response.

Control Sweep—is movement of the appropriate pilot controller from neutral to an extreme limit in one direction (Forward, Aft, Right, or Left), a continuous movement back through neutral to the opposite extreme position, and then a return to the neutral position.

Computer Controlled Airplane—is an airplane where all pilot inputs to the control surfaces are transferred and augmented by computers.

Convertible Flight Simulator—is a simulator in which hardware and software can be changed so that the simulator becomes a replica of a different model, usually of the same type airplane. The same simulator platform, cockpit shell, motion system, visual system, computers, and necessary peripheral equipment can thus be used in more than one simulation.

Critical Engine Parameter—is the parameter which is the most accurate measure of propulsive force.

Deadband—is the amount of movement of the input for a system for which there is no reaction in the output or state of the system observed.

Distance—is the length of space between two points and is expressed in terms of nautical miles unless specified otherwise.

Driven—is a test method where the input stimulus or variable is positioned by automatic means, generally a computer input.

Free Response—is the response of the simulator after completion of a control input or disturbance.

Frozen—is a test condition where one or more variables are held constant with time.

Fuel used—is the amount or mass of fuel used (kilograms or pounds).

Ground Effect—is the change in aerodynamic characteristics due to modification of the air flow past the aircraft caused by the proximity of the earth's surface to the airplane.

Hands Off—is a test maneuver conducted or completed without pilot control inputs.

Hands On—is a test maneuver conducted or completed with pilot control inputs as required.

Heave—is simulator movement with respect to or along the vertical axis.

Height—is the height above ground level (or AGL) expressed in meters or feet.

Integrated Testing—is testing of the simulator such that all airplane system models are active and contribute appropriately to the results where none of the models used are substituted with models or other algorithms intended for testing only.

Irreversible Control System—is a control system in which movement of the control surface will not backdrive the pilot's control in the cockpit.

Locked—is a test condition where one or more variables are held constant with time.

Manual Testing—is simulator testing wherein the pilot conducts the test without computer inputs except for initial setup and all modules of the simulation are active.

Medium—is the normal operational weight for a given flight segment.

Nominal—is the normal operational weight, configuration, speed, etc., for the flight segment specified.

Non-Normal Control—is a term used in reference to Computer Controlled Airplanes

and is the state where one or more of the intended control, augmentation, or protection functions are not fully working. **Note:** Specific terms such as ALTERNATE, DIRECT, SECONDARY, BACKUP, etc., may be used to define an actual level of degradation.

Normal Control—is a term used in reference to Computer Controlled Airplanes and is the state where the intended control, augmentation, and protection functions are fully working.

Pitch—is the airplane attitude with respect to or around the lateral axis expressed in degrees.

Power Lever Angle—is the angle of the pilot's primary engine control lever(s) in the cockpit. This may also be referred to as PLA, THROTTLE, or POWER LEVER.

Protection Functions—are systems functions designed to protect an airplane from exceeding its flight maneuver limitations.

Pulse Input—is a step input to a control followed by an immediate return to the initial position.

Reversible Control System—is a control system in which movement of the control surface will backdrive the pilot's control in the cockpit.

Roll—is the airplane attitude with respect to or around the longitudinal axis expressed in degrees.

Sideslip—is the angular difference between the airplane heading and the direction of movement in the horizontal plane.

Simulation Data—are the various types of data used by the simulator manufacturer and the applicant to design, manufacture, and test the simulator.

Simulator Approval—is the extent to which a simulator may be used by a certificate holder as authorized by the FAA. It takes account of airplane to simulator differences and the training ability of the organization.

Simulator Latency—is the additional time beyond that of the response time of the airplane due to the response of the simulator.

Snapshot—is a presentation of one or more variables at a given instant of time.

Source Data—are, for the purpose of this document, performance, stability and control, and other necessary test parameters electrically or electronically recorded in an airplane using a calibrated data acquisition system of sufficient resolution and verified as accurate by the company performing the test to establish a reference set of relevant parameters to which like simulator parameters can be compared.

Statement of Compliance and Capability (SOC)—is a declaration that specific requirements have been met. It must declare that compliance with the requirement is achieved and explain how the requirement is met (*e.g.*, gear modeling approach, coefficient of friction sources, *etc.*). It must also describe the capability of the simulator to meet the requirement (*e.g.*, computer speed, visual system refresh rate, *etc.*). In doing this, the statement must provide references to needed sources of information for showing compliance, rationale to explain how the referenced material is used, mathematical equations and parameter values used, and conclusions reached.

Step Input—is an abrupt control input held at a constant value.

Surge—is simulator movement with respect to or along the longitudinal axis.

Sway—is simulator movement with respect to or along the lateral axis.

Time History—is a presentation of the change of a variable with respect to time.

Training Program Approval Authority (TPAA)—is the person who exercises authority on behalf of the Administrator in approving the aircraft flight training program for the appropriate airplane in which the simulator will be used. This person is the principal operations inspector (POI) for programs approved under 14 CFR parts 63, 121, 125, or 135; or the training center program manager (TCPM) for programs approved under 14 CFR part 141 or 142.

Transport Delay or ''Throughput''—is the total simulator system processing time required for an input signal from a pilot primary flight control until 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 airplane simulated.

Validation Data—are data used to determine if the simulator performance corresponds to that of the airplane.

Validation Test—is a test by which simulator parameters are compared to the relevant validation data.

Visual System Response Time—is the interval from a control input to the completion of the visual display scan of the first video field containing the resulting different information.

Yaw—is airplane attitude with respect to or around the vertical axis expressed in degrees.

End QPS Requirements

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2. Abbreviations

Begin QPS Requirements

AFM—Approved Flight Manual.
AGL—Above Ground Level (meters or feet).
AOA—Angle of Attack (degrees).
APD—Aircrew Program Designee.
CCA—Computer Controlled Airplane.
cd/m^2 candela/meter^2, 3.4263 candela/m^2 = 1 ft-Lambert.
CFR—Code of Federal Regulations.
cm(s)—centimeter, centimeters.
daN—decaNewtons, one (1) decaNewton = 2.27 pounds.
deg(s) degree, degrees.
DOF—Degrees-of-freedom
EPR—Engine Pressure Ratio.
FAA—Federal Aviation Administration (U.S.).
fpm—feet per minute.
ft—foot/feet, 1 foot = 0.304801 meters.\
ft-Lambert—foot-Lambert, 1 ft-Lambert = 3.4263 candela/m^2.
g—Acceleration due to Gravity (meters or feet/sec^2); 1g = 9.81 m/sec^2 or 32.2 feet/sec^2.
G/S—Glideslope.
IATA—International Airline Transport Association.
ICAO—International Civil Aviation Organization.
ILS—Instrument Landing System.
IQTG—International Qualification Test Guide.
km—Kilometers 1 km = 0.62137 Statute Miles.
kPa—KiloPascal (Kilo Newton/Meters2). 1 psi = 6.89476 kPa.
Kts—Knots calibrated airspeed unless otherwise specified, 1 knot = 0.5148 m/sec or—1.689 ft/sec.
lb(s)—pound(s), one (1) pound = 0.44 decaNewton.
M,m—Meters, 1 Meter = 3.28083 feet.
Min(s)—Minute, minutes.
MLG—h;Main Landing Gear.
Mpa—MegaPascals (1 psi = 6894.76 pascals).
ms—millisecond(s).
N—NORMAL CONTROL Used in reference to Computer Controlled Airplanes.
N1—Low Pressure Rotor revolutions per minute, expressed in percent of maximum.
N2—High Pressure Rotor revolutions per minute, expressed in percent of maximum.
N3—High Pressure Rotor revolutions per minute, expressed in percent of maximum.
nm—Nautical Mile(s) 1 Nautical Mile = 6,080 feet.
NN—NON-NORMAL CONTROL Used in reference to Computer Controlled Airplanes.
NWA—Nosewheel Angle (degrees).
PAPI—Precision Approach Path Indicator System.
PLA—Power Lever Angle.
Pf—Impact or Feel Pressure, often expressed as ''q.''.
PLF—Power for Level Flight.
psi—pounds per square inch.
QPS—Qualification Performance Standard.
RAE—Royal Aerospace Establishment.
R/C—Rate of Climb (meters/sec or feet/min).
R/D—Rate of Descent (meters/sec or feet/min).
REIL—Runway End Identifier Lights.
RVR—Runway Visual Range (meters or feet).
s—second(s).
sec(s)—second, seconds.
sm—Statute Mile(s) 1 Statute Mile = 5,280 feet.
SOC—Statement of Compliance and Capability.
Tf—Total time of the flare maneuver duration.
Ti—Total time from initial throttle movement until a 10% response of a critical engine parameter.
TIR—Type Inspection Report.
T/O—Takeoff.
Tt—Total time from Ti to a 90% increase or decrease in the power level specified.
VASI—Visual Approach Slope Indicator System.
VGS—Visual Ground Segment.
Vmc—Minimum Control Speed.
Vmca—Minimum Control Speed in the air.
Vmcg—Minimum Control Speed on the ground.
Vmcl—Minimum Control Speed—Landing.
Vmu—The speed at which the last main landing gear leaves the ground.
Vr—Rotate Speed.

Vs—Stall Speed or minimum speed in the stall.
WAT—Weight, Altitude, Temperature.

End QPS Requirements

Attachment 5 to Appendix A to Part 60—Sample Documents

Table of Contents

Title of Sample

BILLING CODE 4910–13–P

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 1 – Sample Letter of Request.

INFORMATION

Date

Name, POI. _____(Certificate Holder)

FAA FSDO _____

Address

City, State, Zip

Dear Mr./Ms. _____:

(Sponsor's name) _____ requests evaluation of our (type) _____ airplane simulator for Level _____ qualification. The (name) _____ simulator with (name) _____visual system is fully defined on page _____ of the accompanying qualification test guide (QTG). We have completed tests of the simulator and confirm that it meets all applicable requirements of Title 14 of the Code of Federal Regulation (14 CFR) part 60 and the requirements of the Airplane Flight Simulator Qualification Performance Standards (QPS). Appropriate hardware and software configuration control procedures have been established.

Our pilot(s) (name) _____ [and (name)_____], who is(are) qualified on (type) _____ airplane, has(have) assessed the simulator and found that it conforms to the (sponsor name) _____ (type) _____ airplane cockpit configuration and that the simulated systems and subsystems have been evaluated and found to function equivalently to those in the airplane. The above named pilot(s) has(have) found that the simulator represents the respective airplane in accordance with the attached Configuration List. He/She(They) has(have) also subjectively assessed the performance and flying qualities of the simulator and state that it represents the airplane. He/She(They) has(have) not subjectively tested the simulator for those tasks on the attached Restrictions-to-Qualification list and we do not seek qualification in these areas.

(Added comments as desired.)

Sincerely,

(Signature of Appropriate Person)

ATTACHMENT 5 TO APPENDIX A TO PART 60--

Figure 2 – Sample Qualification Test Guide Cover Page

INFORMATION

SPONSOR NAME

SPONSOR ADDRESS

FAA QUALIFICATION TEST GUIDE

(SPECIFIC AIRPLANE MODEL)
for example
Stratos BA797-320A

(Type of Simulator)

(Simulator Identification Including Manufacturer, Serial Number, Visual System Used)

(Simulator Level)

(Qualification Performance Standard Used)

(Simulator Location)

FAA Initial Evaluation

Date: _____

_____ Date: _____
(Sponsor)

_____ Date: _____
Manager, National
Simulator Program, FAA

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 3 – Sample Simulator Information Page

INFORMATION

SPONSOR NAME	
SPONSOR SIMULATOR CODE:	BA-797 #1
AIRPLANE MODEL:	Stratos BA797-320A
AERODYNAMIC DATA REVISION:	BA797-320, CPX-8D, January 1988
ENGINE MODEL(S) AND REVISION:	CPX-8D; RPT-6, January 1988 DRQ-4002, RPT-3, April 1991
FLIGHT CONTROLS DATA REVISION:	BA707-320; May 1988
FLIGHT MANAGEMENT SYSTEM:	Berry XP
SIMULATOR MODEL AND MANUFACTURER:	MTD-797, Tinker Simulators, Inc.
DATE OF SIMULATOR MANUFACTURE:	1988
SIMULATOR COMPUTER:	CIA
VISUAL SYSTEM MODEL, MANUFACTURER, and DISPLAY TYPE:	ClearView, Inc. "Real World T2;" 5 Channel, 6-window CRT display
VISUAL SYSTEM COMPUTER:	LMB-6
MOTION SYSTEM:	Tinker 6 DOF

Information on this page must be updated and kept current with any modifications or changes made to the simulator and reflected on the log of revisions and the list of effective pages.

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 4 – Sample Statement of Qualification

INFORMATION

(subject to change)

Federal Aviation Administration
National Simulator Program

Statement of Qualification

This is to certify that representatives of the
National Simulator Program
Completed an evaluation of the

Go-Fast Training Center
Stratos BA-797 Flight Simulator
FAA Identification Number 701

And found it to meet the standards set forth
In the Qualification Performance Standards
For a simulator at

Level C

(date) for the NSPM

Subject to the attached
Configuration List and Restrictions

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 4A – Sample Statement of Qualification; Configuration List

INFORMATION

STATEMENT of QUALIFICATION
CONFIGURATION LIST
Go-Fast Training Center Stratos BA-797-232 -- Level C -- FAA ID# 701

Configuration		Date Qualified
Airplane Model:.....	BA-797-232.....	July 12, 1988
Re-configurable to:.....	BA-797-287 (see FAA ID#722)	
Engine Model(s) and Revision:...	☐ CPX-8D, RPT-6.....	July 12, 1988
	☐ DRQ-4002, RPT-3.....	April 1, 1991
Flight Management System:.....	Berry XP.....	July 12, 1988
Visual System / Manufacturer:	Real World T2, Clear View, Inc.	
☐ CRT Installation:.....	5 Channel, 6 Window.....	July 12, 1988
☐ Projected System:.....	__° Horizontal Viewing Angle.....	
Flight Instruments:		
☐ Electro-Mechanical:.....	.....	July 12, 1988
☐ Display (CRT, LCD, etc.).....		
☐ Combination		
☐ Heads-Up Display.....	Jones Industries.....	December 1, 1993
Flight Director:		
☐ Single Cue.....		
☐ Dual Cue.....	Sperry.....	July 12, 1988
☐ None.....		
Engine Instruments:		
☐ Electro-Mechanical.....	.....	July 12, 1988
☐ Display (CRT, LCD, etc.).....		
☐ Combination.....		
Navigation Type(s):		
☐ ADF.....	.....	July 12, 1988
☐ VOR/ILS.....	.....	July 12, 1988
☐ GPS.....		
☐ INS.....	.....	October 10, 1991
☐ IRS.....		
Weather Radar:	Jones Industries, Inc.	August 3, 1996
Windshear Equipment		
TCAS		
ACARS		

(Continue as Necessary)

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 4B – Sample Statement of Qualification; Qualified/Non-Qualified Tasks

INFORMATION

STATEMENT of QUALIFICATION
Qualified/Non-Qualified Tasks
Go-Fast Training Center
Stratos BA-797 -- Level C -- FAA ID# 701

The following are those items listed in the Airplane Flight Simulator Qualification Performance Standards (QPS), FAA-S-120-40C, dated (May 1, 2000) Appendix 3, Subjective Tests, indicating what tasks and systems are qualified **(Q)** *and what tasks and systems are not qualified* **(NQ).**

NQ	Q	TASK		NQ	Q	TASK
		A. Preparation for Flight.				2. Abnormal/Emergency.
	X	Preflight.			X	(a) Rejected, with brake fade
		B. Surface Ops (Pre-Takeoff).		X		(b) Rejected, special perf.
		1. Engine start.				(c) Propulsion system malfunction.
	X	(a) Normal start.			X	(i) prior to V_1
	X	(b) Alternate start operations.			X	(ii) between V_1 and V_r
	X	(c) Abnormal starts			X	(iii) between V_r and 500' AGL
	X	2. Pushback		X		(d) Flight control system failure.
X		3. Powerback.			X	(e) Other.
		4. Taxi				**D. In-flight Operation.**
	X	(a) Thrust response.				1. Climb.
	X	(b) Power lever friction.			X	(a) Normal.
	X	(c) Ground handling.			X	(b) One engine inoperative.
	X	(d) Nosewheel scuffing.			X	(c) Other.
	X	(e) Brake operation				2. Cruise.
	X	(f) Ground hazard.			X	(a) Performance (speed vs. power).
X		(g) SMGS			X	(b) Turns w/wo spoilers
	X	(h) Other.			X	(c) High altitude handling.
		C. Takeoff.			X	(d) High airspeed handling
		1. Normal. (Day/Dusk/Night)		X		(e) Mach effects
X		(a) Day			X	(f) Normal and steep turns.
	X	(b) Dusk (or Twilight)		X		(g) Performance turns.
	X	(c) Night				(h) Approach to stalls
	X	(d) Propulsion system checks			X	1) cruise
	X	(e) Airplane acceleration			X	2) takeoff or approach
	X	(f) Nosewheel/rudder steering			X	3) landing
	X	(g) Crosswind (max. demo)				(i) High AOA maneuvers
X		(h) Special performance.		X		1) cruise
	X	(i) Lowest visibility.		X		2) takeoff or approach
	X	(j) Landing gear, flap/slat ops.		X		3) landing
	X	(k) Other.			X	(j) In-flight engine shutdown

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	TASK (Con't.)		NQ	Q	TASK (Con't.)
	X	(k) In-flight engine restart				(ii) ILS Category II
	X	(l) Maneuver w/ engine(s) inop.			X	A. W/Wo Auto-Couple
X		(m) Slow flight.			X	B. Engine inoperative..
X		(n) Spec flight characteristics.				(iii) ILS Category III
X		(o) Manual flight control		X		A. Min./stnby. electrical power.
X		(p) Other flight control failures		X		B. Generator/alternator failure
	X	(q) Holding.		X		C. Tail wind 10 knots
	X	(r) Airborne hazard.		X		D. Crosswind 10 knots
	X	(s) Ops. in icing conditions		X		E. Rollout.
	X	(t) Upset / disturbance recovery		X		F. Engine inoperative.
	X	(u) Unusual attitude recovery				(iv). Missed approach
X		(v) TCAS			X	A. All engines operating.
	X	(w) Effects of airframe icing.			X	B. One engine inoperative.
	X	(x) Other.				(v) PAR
		3. Descent.		X		A. Normal
	X	(a) Normal.		X		B. With crosswind.
	X	(b) Max. rate and recovery		X		C. With one engine inoperative.
X		(c) Flight control failure		X		D. Missed approach.
	X	(d) High sink rate and recovery.				(vi) DGPS
	X	(e) Other.		X		A. Normal
		E. Approaches.		X		B. With crosswind.
		1. Instrument Approach		X		C. With one engine inoperative.
		(a) Non-precision:		X		D. Missed approach.
	X	(i) NDB				(vi) MLS.
	X	(ii) VOR,		X		A. Normal
X		(iii)RNAV,		X		B. With crosswind.
X		(iv)TACAN		X		C. With one engine inoperative.
	X	(v) DME Arc		X		D. Missed approach.
	X	(vi) LOC/FC.				(vii) Steep Glide Path.
	X	(vii) LOC/BC,		X		A. Normal
X		(viii) LDA,		X		B. With crosswind.
X		(ix) SDF		X		C. With one engine inoperative.
X		(x) ASR.		X		D. Missed approach.
X		(xi) GPS.				2. Visual Approach Maneuvers.
	X	(xii) With engine inoperative			X	(a) Abnormal wing flaps/slats
	X	(xiii) Missed approach.			X	(b) No G/S or visual flightpath aid.
		(b) Precision:		X		(c) Circling Approach.
		(i) ILS Category I				3. Abnormal/emergency.
	X	A. Manual w/wo flight director			X	(a) One engine inoperative.
	X	B. Max. crosswind			X	(b) Min. electric/hydraulic power.
	X	C. Windshear.			X	(c) Pitch trim malfunction.
	X	D. Engine inoperative.			X	(d) Jammed horizontal stabilizer.

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	TASK (Con't.)		NQ	Q	TASK (Con't.)
	X	(e) Roll/Yaw trim malfunction.			X	5. Ground hazard.
X		(f) Worst Flt Cont fail. (+CCA).		X		6. SMGS.
X		(g) Other failures / trng. prog.			X	7. Other.
X		(h) LAHSO ops.				**J. Any Flight Phase.**
	X	(i) Other.			X	1. Air conditioning.
		F. Missed approach.			X	2. Anti-icing/deicing.
	X	1. Manual.			X	3. Auxiliary powerplant.
X		2. Automatic (if applicable).			X	4. Communications.
		G. Visual Segment / Landing.			X	5. Electrical.
		1. Normal			X	6. Fire detection and suppression.
X		(a) Day			X	7. Flaps/Slats.
	X	(b) Dusk (or Twilight)			X	8. Flight cont (+ spoiler/spdbrake).
	X	(c) Night			X	9. Fuel and oil.
	X	(b) From visual traffic pattern.			X	10. Hydraulic.
	X	(c) From NP approach.			X	11. Landing gear.
	X	(d) From precision approach			X	12. Oxygen.
	X	(e) Max. crosswind.			X	13. Pneumatic.
X		(f) From circling approach.			X	14. Propulsion System.
		2. Abnormal/emergency.			X	15. Pressurization.
		(a) With engine(s) inoperative –			X	16. Flt mgmt / guidance systems.
X		(i) 2-eng airpl, one inop.			X	17. Auto landing aids.
X		(ii) 3-eng airpl, wing+ctr. inop.			X	18. Auto-pilot.
	X	(iii) 4+eng airpl, 50%, one side.			X	19. Auto-throttle.
	X	(b) Rejected landing.			X	20. Flight data displays.
	X	(c) Min. elect./hyd. power.			X	21. Flight mgmt computers.
	X	(d) Pitch trim malfunction			X	22. Flight Director.
	X	(e) Jammed horizontal stab.			X	23. Flight Instruments.
	X	(f) Roll/Yaw trim malfunction.			X	24. HUD system.
X		(g) Worst Flt Cont fail.(+CCA).			X	25. Navigation systems.
X		(h) Other failures in trng. prog.			X	26. Weather radar.
X		(i) LAHSO ops.			X	27. Stall warning/avoidance.
	X	(j) Other.		X		28. Stability augmentation.
		H. Windshear.		X		29. ACARS.
	X	1. Takeoff.			X	30. Other.
	X	2. Climb.				**K. Eng. Shutdown and Parking.**
	X	3. Approach.			X	1. Systems operation.
		I. Surface Ops (Post Landing).			X	2. Parking brake operation.
	X	1. Landing roll.				
	X	2. Spoiler operation.				
	X	3. Reverse thrust operation.				
	X	4. Wheel brake operation.				

Initials _____ Date_____

-- Continued Next Page --

NQ	Q	SIMULATOR SYSTEM		NQ	Q	SIMULATOR SYSTEM
		A. Inst. Ops. Station (IOS).				**B. Sound Controls.**
	X	1. Power switch(es).			X	-- On / off / rheostat
		2. Airplane conditions.				**C. Motion/Cont. Load. System.**
	X	(a) GW, CG, Fuel weight, etc.			X	1. On / off / emergency stop.
	X	(b) Airplane systems status.			X	2. Crosstalk
	X	(c) Ground crew functions			X	3. Smoothness
	X	(d) Other.				**D. Observer Stations.**
		3. Airports.			X	1. Position.
	X	(a) Number and selection.				
	X	(b) Runway selection.				
	X	(c) Runway surface condition				
	X	(d) Preset positions				
	X	(e) Lighting controls.				
	X	(f) Other.				
		4. Environmental controls.				
	X	(a) Clouds (base and tops).				
	X	(b) Visibility				
	X	(c) Runway visual range				
	X	(d) Temperature.				
	X	(e) Climate conditions				
	X	(f) Wind speed and direction.				
X		(g) Windshear.				
	X	(h) Other.				
		5. Airplane system malfunctions.				
	X	(a) Insertion / deletion.				
	X	(b) Problem clear.				
	X	(c) Other				
		6. Locks, freezes, repositioning.				
	X	(a) Problem freeze / release.				
	X	(b) Position freeze / release.				
	X	(c) Repositioning				
	X	(d) Ground speed control				
	X	(e) Other				
X		7. Remote IOS.				
	X	8. Other.				

Initials _____ Date_____

-- End --

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 5 – Sample Recurrent Evaluation Requirements Page

INFORMATION

Recurrent Evaluation Requirements ***Completed at conclusion of Initial Evaluation***	
Recurrent Evaluations to be conducted each _(fill in)__ months Allotting _____ hours of FTD time. Signed: _____ NSPM / Evaluation Team Leader	Recurrent evaluations are due as follows: _(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate) _____ Date

Revision: Based on (enter reasoning):	
Recurrent Evaluations are to be conducted each _(fill in)__ months. Allotting _____ hours. Signed: _____ NSPM Evaluation Team Leader	Recurrent evaluations are due as follows: _(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate) _____ Date

Revision: Based on (enter reasoning):	
Recurrent Evaluations are to be conducted each _(fill in)__ months. Allotting _____ hours. Signed: _____ NSPM Evaluation Team Leader	Recurrent evaluations are due as follows: _(month)__ and __(month)_ and __(month)_ (enter or strike out, as appropriate) _____ Date

(Repeat as Necessary)

ATTACHMENT 6 TO APPENDIX A TO PART 60—

Figure 6 – Sample Request for Initial, Upgrade, or Reinstatement Evaluation Date

INFORMATION

Mr. Edward Cook
Manager, National Simulator Program
Federal Aviation Administration
P.O. Box 20636 (AFS-205)
Atlanta, GA 30320

Dear Mr. Cook:

RE: Request for Initial [Upgrade / Reinstatement] Evaluation Date

This is to advise you of our intent to request an evaluation of our (Aircraft Type/Level) Simulator located in (City/State) at the (Facility) on (proposed evaluation date). [The proposed evaluation date shall not be more than 180 days following the date of this letter.] This simulator [has / has not] been previously qualified by the FAA [and had been issued FAA identification number XXX]. [The history of this simulator is as follows: _____.]

We agree to provide a Qualification Test Guide (QTG) to your staff not later than 45 days prior to the proposed evaluation date (if tests not run at training site, an additional "1/3 on-site" tests must be provided not later than 14 days prior the proposed evaluation date). If we are unable to meet the above date for the evaluation, this may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation.

[Added comments from Operator/Sponsor, if any]

Please contact (Name and Telephone Number of Sponsor's Contact) to confirm the date for this initial evaluation. We understand a member of your National Simulator Program staff will respond to this request within 14 days.

A copy of this letter of intent has been provided to our Principal Operations Inspector (POI) and/or Training Center Program Manager (TCPM).

Sincerely,

(Signature)

Acknowledgement:

____ We concur with your proposed dates.

____ The date requested is not available, however, we propose the following date:

____ Please provide us with the following information:

_____ _____
Scheduler, National Simulator Program Date

ATTACHMENT 5 TO APPENDIX A TO PART 60—

Figure 7 – Sample MQTG Index of Effective FSD Directives.

INFORMATION

Index of Effective FSD Directives Filed in this Section

Notification Number	Received From: (TPAA/NSPM)	Date of Notification	Date of Modification Completion

Continue as Necessary....

BILLING CODE 4910–13–C

Attachment 6 to Appendix A to Part 60—Simulator Qualification Requirements for Windshear Training Program Use

1. Applicability

Begin QPS Requirements

This attachment applies to all simulators used to satisfy the training requirements of 14 CFR part 121 that pertain to the sponsor's approved low-altitude windshear flight training program, or the training permitted in accordance with an FAA-approved training program under 14 CFR part 121, 135, or 142, that addresses low-altitude windshear encounters.

End QPS Requirements

2. Statement of Compliance and Capability (SOC)

Begin QPS Requirements

a. The sponsor must submit an SOC that confirms that the aerodynamic model is based on flight test data supplied by the airplane manufacturer, or other approved source, and that any change to environmental wind parameters, including variances in those parameters for windshear conditions, once inserted for computation, result in the correct simulated performance. This statement must also include examples of where environmental wind parameters are currently evaluated in the simulator (such as crosswind takeoffs, crosswind approaches, and crosswind landings).

b. For those simulators where windshear warning, caution, or guidance hardware was not provided as original equipment, the SOC must also state that the simulation of the added simulator hardware and/or software, including associated cockpit displays and annunciations, function the same or equivalent to the system(s) installed in the airplane and be accompanied by a block diagram that depicts the input and output signal flow, comparing that signal flow to the equipment installed in the airplane being simulated.

End QPS Requirements

3. Models

Begin QPS Requirements

The windshear models installed in the simulator software that will be used for the qualification evaluation must do the following:

a. Provide cues necessary for recognition of the onset of a windshear phenomena and potential performance degradation that would require a pilot to initiate recovery procedures. The cues must include all of the following, as may be appropriate for the appropriate portion of the flight envelope:

(1) Rapid airspeed change of at least ±15 knots (kts).

(2) Stagnation of airspeed during the takeoff roll.

(3) Rapid vertical speed change of at least ±500 feet per minute (fpm).

(4) Rapid pitch change of at least ±5°.

b. Be adjustable in intensity (or other parameter to achieve an intensity effect) to at least two (2) levels so that upon encountering the windshear the pilot may identify its presence by the cues described above, and that when the pilot applies the recommended procedures for escape from such a windshear:

(1) If the intensity is lesser, the performance capability of the simulated airplane in the windshear permits the pilot to maintain a satisfactory flightpath; and

(2) If the intensity is greater, the performance capability of the simulated airplane in the windshear does not permit

the pilot to maintain a satisfactory flightpath (crash).

Note: The means used to accomplish the ''nonsurvivable'' scenario of paragraph 3.b(2), of this attachment, that involve operational elements of the simulated airplane, must reflect parameters that fall within the dispatch limitations of the airplane.

c. Be available for use in the FAA-approved windshear flight training program.

End QPS Requirements

4. Demonstrations

Begin QPS Requirements

a. The sponsor must identify two of the required, survivable training windshear models—one takeoff and one approach. The sponsor must identify the wind components of the two models selected and present this information in graphical format so that all components of the windshear are shown, including initiation point, variance in magnitude, and either time or distance correlation as may be appropriate. The simulator must be operated at the same gross weight, airplane configuration, and initial airspeed in all of the following situations:

(1) Takeoff—through calm air.

(2) Takeoff—through the first selected survivable windshear.

(3) Approach—through calm air.

(4) Approach—through the second selected survivable windshear.

b. In each of these four situations, at an ''initiation point'' (that point being where the onset of windshear conditions is, or would have been recognized, depending on the test being run), the recommended procedures for windshear recovery are applied, and the results are recorded, as specified in paragraph 5 of this attachment.

c. These recordings are made without the presence of programmed random turbulence. Turbulence that results from the windshear model is to be expected, and no attempt may be made to neutralize turbulence from this source.

d. The definition of the models and the results of the demonstrations of all four (4) cases described in paragraph 4.a of this attachment, must be made a part of the MQTG.

End QPS Requirements

5. Recording Parameters

Begin QPS Requirements

a. In each of the four MQTG cases, an electronic recording (time history) must be made of the following parameters:

(1) Indicated or calibrated airspeed.

(2) Indicated vertical speed.

(3) Pitch attitude.

(4) Indicated or radio altitude.

(5) Angle of attack.

(6) Elevator position.

(7) Engine data (thrust, N_1, or throttle position).

(8) Wind magnitudes (simple windshear model assumed).

b. These recordings shall be initiated at least 10 seconds prior to the initiation point and continued until recovery is complete or ground contact is made.

End QPS Requirements

6. Equipment Installation and Operation

Begin QPS Requirements

All windshear warning, caution, or guidance hardware installed in the simulator must operate as it operates in the airplane being simulated. For example: If the simulator encounters a rapidly changing wind speed and/or direction that would have resulted in a windshear warning in the airplane were the same conditions encountered, the simulator must respond equivalently, without instructor/evaluator intervention.

End QPS Requirements

7. Qualification Test Guide

Begin QPS Requirements

a. All QTG material (performance demonstration recordings, etc.) will be forwarded to the NSPM.

b. The simulator will be scheduled for an evaluation in accordance with normal procedures. Use of recurrent evaluation schedules will be used to the maximum extent possible.

c. During the on-site evaluation, the evaluator will ask the operator to run the performance tests and record the results. The results of these on-site tests will be compared to those results previously approved and placed in the QTG or MQTG, as appropriate.

d. QTG's for new (or MQTG's for upgraded) simulators must contain or reference the information described in paragraphs 2, 3, 4, and 5 of this attachment.

End QPS Requirements

8. Subjective Evaluation

Begin Information

The NSPM will fly the simulator in at least two of the available windshear scenarios to examine the function of the simulator and the simulated airplane and to evaluate subjectively the performance of the simulator as it encounters the programmed windshear conditions according to the following:

a. One scenario will include parameters that enable the pilot to maintain a satisfactory flightpath.

b. One scenario will include parameters that will not enable the pilot to maintain a satisfactory flightpath (crash).

c. Other scenarios may be examined at the discretion of the NSPM.

End Information

9. Qualification Basis

Begin Information

The addition of windshear programming to a simulator in order to comply with the qualification for required windshear training does not change the original qualification basis of the simulator.

End Information

10. Demonstration Repeatability

Begin Information

For the purposes of demonstration repeatability, it is recommended that the simulator be flown by means of the simulator's autodrive function (for those simulators that have autodrive capability) during the demonstrations.

End Information

Attachment 7 to Appendix A to Part 60—Record of FSD Directives

Begin QPS Requirements

When the FAA determines that modification of a simulator is necessary for safety reasons, all affected simulators must be modified accordingly, regardless of the original qualification standards applicable to any specific simulator.

a. A copy of the notification to the sponsor from the TPAA or NSPM that a modification is necessary will be filed in and maintained as part of this attachment.

b. The effective FSD Directives, including the date of the directive, the direction to make these changes, and the date of completion of any resulting modification must be maintained in a separate section of the MQTG and indexed accordingly. The MQTG must also be updated to include the information described in § 60.15(b)(4) as may be appropriate as a result of the FSD Directive. See Attachment 5 for a sample Index of Effective FSD Directives.

End QPS Requirements

Appendix B to Part 60—Qualification Performance Standards for Airplane Flight Training Devices

Begin Information

This appendix establishes the standards for Airplane Flight Training Device (FTD) evaluation and qualification at one of the established levels. The Flight Standards Service, National Simulator Program (NSP) staff, under the direction of the NSP Manager (NSPM), is responsible for the development, application, and interpretation of the standards contained within this appendix.

The procedures and criteria specified in this document will be used by the NSPM, or a person or persons assigned by the NSPM (*e.g.*, FAA pilots and/or FAA aeronautical engineers, assigned to and trained under the direction of the NSP—referred to as NSP pilots or NSP engineers, other FAA

personnel, etc.) when conducting airplane FTD evaluations.

Table of Contents

1. Introduction

a. This appendix contains background information as well as information that is either directive or guiding in nature. Information considered directive is described in this document in terms such as ''will,'' ''shall,'' and ''must,'' and means that the actions are mandatory. Guidance information is described in terms such as ''should,'' or ''may,'' and indicate actions that are desirable, permissive, or not mandatory and provide for flexibility.

b. To assist the reader in determining what areas are directive or required and what areas are guiding or permissive—

(1) The text in this appendix is contained within sections, separated by horizontal lines; headings associated with these horizontal lines will indicate that a particular section begins or ends. All of the text falls into one of three sections: a direct quote or a paraphrasing of the Part 60 rule language; additional requirements that are also regulatory but are found only in this appendix; and advisory or informative material.

(2) The text presented between horizontal lines beginning with the heading ''Begin Rule Language'' and ending with the heading ''End Rule Language,'' is a direct quote or is paraphrased from Part 60 of the regulations. For example: The rule uses the terms ''flight simulation device (FSD)'' and ''aircraft;'' however, in this appendix the rule is paraphrased and the term ''simulator'' is used instead of FSD, and ''airplane'' is used instead of aircraft. Additionally, the rule uses the terms ''this part'' and ''appropriate QPS;'' however, in this appendix the rule is paraphrased and the terms ''Part 60'' and ''this appendix,'' respectively, are used instead. (Definitions are not paraphrased or modified in any way.) For ease of referral, the Part 60 reference is noted at the beginning and the end of the bordered area.

(3) The text presented between horizontal lines beginning with the heading ''Begin QPS Requirements'' and ending with the heading ''End QPS Requirements,'' is also regulatory but is found only in this appendix.

(4) The text presented between horizontal lines beginning with the heading ''Begin Information'' and ending with the heading ''End Information,'' is advisory or informative.

(5) The tables in this appendix have rows across the top of each table—

(a) The data presented in columns under the heading ''QPS REQUIREMENTS'' is regulatory but is found only in this appendix.

(b) The data presented in columns under the heading ''INFORMATION'' is advisory or informative.

Important Note: While this appendix contains quotes and paraphrasing directly from the rule, the reader is cautioned *not* to rely solely on this appendix for regulatory requirements regarding flight simulators. For regulatory references for airplane flight simulators, the reader is referred to paragraphs 3.a through h of this appendix.

c. Questions regarding the contents of this publication should be sent to: U.S. Department of Transportation, Federal Aviation Administration, Flight Standards Service, National Simulator Program Staff, AFS–205, PO Box 20636, Atlanta, Georgia 30320. Telephone contact numbers are: Phone, 404–305–6100; fax, 404–305–6118. The National Simulator Program Internet Web site address is: *www.faa.gov/nsp.* On this Web Site you will find an NSP personnel list with contact information, a list of qualified flight simulation devices, advisory circulars, a description of the qualification process, NSP policy, and an NSP ''In-Works'' section. Also linked from this site are additional information sources, handbook bulletins, frequently asked questions, a listing and text of the Federal Aviation Regulations, Flight Standards Inspector's handbooks, and other FAA links.

d. The NSPM encourages the use of electronic media for communication and the gathering, storage, presentation, or transmission of any record, report, request, test, or statement required by this QPS provided the media used has adequate provision for security and is acceptable to the NSPM. The NSPM recommends inquiries on system compatibility prior to any such activity. Minimum System requirements may be found on the NSP Website.

End Information

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2. Definitions

Begin Information

See attachment 4 of this appendix for a list of definitions and abbreviations. Attachment 4 contains definitions directly quoted from 14 CFR part 1 or part 60, contained within a bordered area with Red-colored left hand columns, indicating they are quoted from 14 CFR part 1 or part 60 and are regulatory. Additional definitions and abbreviations used in reading and understanding this document are contained within bordered areas with Blue-colored left hand columns, indicating they are also regulatory but appear only within this document. For purposes of accuracy, the definitions listed are directly quoted, and are not paraphrased.

End Information

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3. Related Reading References

Begin Information

a. 14 CFR part 60
b. 14 CFR part 61.
c. 14 CFR part 63.
d. 14 CFR part 121.
e. 14 CFR part 125
f. 14 CFR part 135.
g. 14 CFR part 141
h. 14 CFR part 142
i. Advisory Circular (AC) 120–28C, Criteria for Approval of Category III Landing Weather Minima.
j. AC 120–29, Criteria for Approving Category I and Category II Landing Minima for part 121 operators.
k. AC 120–35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation.
l. AC 120–41, Criteria for Operational Approval of Airborne Wind Shear Alerting and Flight Guidance Systems.
m. AC 120–57A, Surface Movement Guidance and Control System (SMGS).
n. AC 150/5300–13, Airport Design.
o. AC 150/5340–1G, Standards for Airport Markings.
p. AC 150/5340–4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems.
q. AC 150/5340–19, Taxiway Centerline Lighting System.
r. AC 150/5340–24, Runway and Taxiway Edge Lighting System.
s. AC 150/5345–28D, Precision Approach Path Indicator (PAPI) Systems
t. International Air Transport Association document, ''Flight Simulator Design and Performance Data Requirements, Fifth Edition (1996).

u. AC 25–7, Flight Test Guide for Certification of Transport Category Airplanes.

v. AC 23–8A, Flight Test Guide for Certification of Part 23 Airplanes.

w. International Civil Aviation Organization (ICAO) Manual of Criteria for the Qualification of Flight Simulators, First Edition, 1994 Doc 9625–AN/938.

x. Airplane Flight Simulator Evaluation Handbook, Volume I (February, 1995) and Volume II (July, 1996), The Royal Aeronautical Society, London, UK.

y. Airplane Flight Simulator Evaluation Handbook, Volume I (February, 1995) and Volume II (July, 1996), The Royal Aeronautical Society, London, UK.

z. FAA Publication FAA-S–8081 series (Practical Test Standards for Airline Transport Pilot Certificate, Type Ratings, Commercial Pilot, and Instrument Ratings).

End Information

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4. Background

Begin Information

a. The primary objective of flight training continues to be one of providing a means for flightcrew members to acquire the skills and knowledge necessary to perform to a desired safe standard. By the same measure, flight simulation continues to provide the most effective, viable environment for the instruction, demonstration, and practice of the maneuvers and procedures (called training events) pertinent to a particular airplane and crew member position. The complexity, operating costs, and operating environment of modern airplanes, together with the steady technological advances in flight simulation, have continued to encourage, and, in fact, have demanded, the expanded use of flight simulation (both FTDs and simulators) in the training and checking of flightcrew members.

b. The FAA has traditionally recognized the value of training devices and has awarded credit for their use in the completion of specific training and checking events in both general aviation and air carrier flight training programs and in pilot certification activities. Such credits are delineated in 14 CFR parts 61 and 121; and in other appropriate sources such as handbooks and guidance documents. These CFR sources, however, have, in the past, referred only to a ''training device'' or to a ''flight training device,'' with no further descriptive information. Other sources had referred to flight training devices in several categories such as Cockpit Procedures Trainers, Cockpit Systems Simulators, Fixed Base Simulators, and other descriptors. Prior to the advent of the predecessor to this document, these categories and names had no standard definition or design criteria within the industry and no single source guidance document had existed to categorize these devices, to provide qualification standards for each category, or to relate one category to another in terms of capability or technical complexity. As a result, approval of these devices for use in training programs had not always been equitable. This circumstance has changed. The recognizable and understood technical definitions and descriptions in previous documents has provided a foundation. Knowledge of the FAA-authorized uses of FTDs built on this foundation and has significantly influenced the flight training industry to increase the use of FTDs and has garnered support for multiplying that use in the future.

c. For information purposes, the following is a chronological listing of the documents preceding this document that have addressed the qualification criteria for airplane flight training device (FTD) evaluation and qualification by the FAA, including the effective dates of those documents: AC 120–45—05/11/87 to 02/05/92; AC 120–45A––02/05/92 to (date TBD).

End Information

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5. Quality Assurance Program

Begin Rule Language (§ 60.5)

a. After [date 6 months after the effective date of the final rule], no sponsor may use or allow the use of or offer the use of an FTD for flightcrew member training or evaluation or for obtaining flight experience to meet any requirement of this chapter unless the sponsor has established and follows a quality assurance (QA) program, acceptable to the NSPM, for the continuing surveillance and analysis of the sponsor's performance and effectiveness in providing a satisfactory FTD for use on a regular basis as described in this QPS.

b. The QA program must provide a process for identifying deficiencies in the program and for documenting how the program will be changed to address these deficiencies.

c. Whenever the NSPM finds that the QA program does not adequately address the procedures necessary to meet the requirements of this part, the sponsor must, after notification by the NSPM, change the program so the procedures meet the requirements of this part.

d. Each sponsor of an FTD must identify to the NSPM and to the TPAA, by name, one individual, who is an employee of the sponsor, to be the management representative (MR) and the primary contact point for all matters between the sponsor and the FAA regarding the qualification of that FTD as provided for in this part.

End Rule Language (§ 60.5)

Begin QPS Requirements

e. The Director of Operations for a Part 119 certificate holder, the Chief Instructor for a Part 141 certificate holder, or the equivalent for a Part 142 or Flight Engineer School sponsor must designate a management representative (MR) who has the responsibility and authority to establish and modify the sponsor's policies, practices, and procedures regarding the QA program for the recurring qualification of, and the day-to-day use of, each FTD.

f. An acceptable Quality Assurance (QA) Program must contain a complete, accurate, and clearly defined written description of and/or procedures for—

(1) The method used by management to communicate the importance of meeting the regulatory standards contained in Part 60 and this QPS and the importance of establishing and meeting the requirements of a QA Program as defined in this paragraph.

(2) The method(s) used by management to determine that the regulatory standards and the QA program requirements are being met, and if or when not met, what actions are taken to correct the deficiency and prevent its recurrence.

(3) The method used by management to determine that the sponsor is, on a timely and regular basis, presenting a qualified FTD.

(4) The criteria for and a definition or description of the workmanship expected for normal upkeep, repair, parts replacement, modification, etc., on the FTD and how, when, and by whom such workmanship is determined to be satisfactorily accomplished.

(5) The method used to maintain and control appropriate technical and reference documents, appropriate training records, and other documents for—

(a) Continuing FTD qualification; and

(b) The QA program.

(6) The criteria the sponsor uses (*e.g.*, training, experience, etc.) to determine who may be assigned to duties of inspection, testing, and maintenance (preventive and corrective) on FTDs.

(7) The method used to track inspection, testing, and maintenance (preventive and corrective) on each FTD.

(8) The method used by the sponsor to inform the TPAA in advance of each scheduled NSPM-conducted evaluation and, after completion, the results of each such evaluation.

(9) The method used to ensure that FTD instructors, check airmen, and those who conduct the daily preflight are capable of determining what circumstance(s) constitute(s) a discrepancy regarding the FTD and its operation.

(10) The method used to ensure that instructors, check airmen, and those who conduct the daily preflight, record in the FTD discrepancy log each FTD discrepancy and each missing, malfunctioning, or inoperative FTD component.

(11) The method used to ensure that instructors and check airmen are completely and accurately logging the number of disruptions and time not available for training or for obtaining flight experience during a scheduled FTD use-period, including the cause(s) of the disruption.

(12) The method used by the sponsor to notify users of the FTD of missing, malfunctioning, or inoperative components that restrict the use of the FTD.

(13) The method of recording NSPM-conducted evaluations and other inspections (*e.g.*, daily preflight inspections, NASIP inspections, sponsor conducted quarterly inspections, etc.), including the evaluation or inspection date, test results, discrepancies and recommendations, and all corrective actions taken.

(14) The method for ensuring that the FTD is configured the way the airplane it represents is configured and that if the configuration is authorized to be changed that the newly configured system(s) function(s) correctly.

(15) The method(s) for:
(a) Determining whether or not proposed modifications to the airplane will affect the performance, handling, or other functions or characteristics of the airplane;
(b) Determining whether or not proposed modifications to the FTD will affect the performance, handling, or other functions or characteristics of the FTD; and
(c) Coordinating and communicating items 5.f.(15)(a) and (b) of this appendix, as appropriate, with the sponsor's training organization, other users (*e.g.*, lease or service contract users), the TPAA, and the NSPM.
(16) How information found in the discrepancy log is used to correct discrepancies and how this information is used to review and, if necessary, modify existing procedures for FTD maintenance.
(17) The method for how and when software or hardware modifications are accomplished and tracked, documenting all changes made from the initial submission.
(18) The method used for determining that the FTD meets appropriate standards each day that it is used.
(19) The method for acquiring independent feedback regarding FTD operation (from persons recently completing training or obtaining flight experience; instructors and check airmen using the FTD for training or flight experience sessions; and FTD technicians and maintenance personnel) including a description of the process for addressing these comments.
(20) How devices used to test, measure, and monitor correct FTD operation are calibrated and adjusted for accuracy, including traceability of that accuracy to a recognized standard, and how these devices are maintained in good operating condition.
(21) How, by whom, and how frequently internal audits of the QA program are conducted and where and how the results of such audits are maintained and reported to Responsible Management, the NSPM, and the TPAA.

End QPS Requirements

Begin Information

g. Additional Information.
(1) In addition to specifically designated QA evaluations, the NSPM will evaluate the sponsor's QA program as part of regularly scheduled recurrent FTD evaluations and no-notice FTD evaluations, focusing in large part on the effectiveness and viability of the QA program and its contribution to the overall capability of the FTD to meeting the requirements of this part.
(2) The sponsor, through the MR, may delegate duties associated with maintaining the qualification of the FTD (*e.g.*, corrective and preventive maintenance, scheduling for and the conducting of tests and/or inspections, functional preflight checks, etc.) but retains the responsibility and authority for the initial and day-to-day qualification and quality of the FTD. One person may serve in this capacity for more than one FTD, but one FTD would not have more than one person serving in this capacity.
(3) Should a sponsor include a ''foreign FTD'' (*i.e.*, one maintained by a non-US certificate holder) under their sponsorship, the sponsor remains responsible for the QA program for that FTD. However, if that foreign FTD is maintained under a QA program accepted by that foreign regulatory authority and that authority and the NSPM have agreed to accept each other's QA programs (*e.g.*, the Joint Aviation Authorities, JAA, of Europe), the sponsor will be required only to perform an ''external audit'' of the non-US certificate holder's compliance with the accepted foreign QA program, with the results of that audit submitted to and accepted by the NSPM.

End Information

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6. Sponsor Qualification Requirements

Begin Rule Language (§ 60.7)

a. A person is eligible to apply to be a sponsor of an FTD if the following conditions are met:
(1) The person holds, or is an applicant for, a certificate under part 119, 141, or 142 of this chapter; or holds, or is an applicant for, an approved flight engineer course in accordance with part 63 of this chapter.
(2) The FTD will be used, or will be offered for use, in the sponsor's FAA-approved flight training program for the airplane being simulated as evidenced in a request for evaluation submitted to the NSPM through the TPAA.
b. A person is a sponsor of the FTD if the following conditions are met:
(1) The person is a certificate holder under part 119, 141, or 142 of this chapter or has an approved flight engineer course in accordance with part 63 of this chapter.
(2) The person has operations specifications authorizing the use of the airplane type or set of airplanes being simulated by the FTD or has training specifications or a course of training authorizing the use of an FTD for that airplane type or set of airplanes.
(3) The person has an approved quality assurance program in accordance with § 60.5.
(4) The NSPM has approved the person as the sponsor of the FTD and that approval has not been withdrawn by the FAA.
c. A person continues to be a sponsor of an FTD, if the following conditions are met:
(1) Beginning 12 calendar months after the initial qualification and every 12 calendar months thereafter, the FTD must have been used within the sponsor's FAA-approved flight training program for the airplane type or set of airplanes for a minimum of 600 hours.
(2) The use of the FTD described in paragraph (c)(1) of this section must be dedicated to meeting the requirements of parts 61, 63, 91, 121, or 135 of this chapter.
(3) If the use requirements of paragraphs (c)(1) and (2) of this section are not met, the person will continue to sponsor the FTD on a provisional basis for a period not longer than 12 calendar months; and—
(i) If the FTD is used as described in paragraphs (c)(1) and (2) of this section within this additional 12 calendar month period, the provisional status will be removed and regular sponsorship resumed; or
(ii) If the FTD is not used as described in paragraphs (c)(1) and (2) of this section within the additional 12 calendar month period, the FTD is not qualified and the sponsor will not be eligible to apply to sponsor that FTD for at least 12 calendar months.

End Rule Language (§ 60.7)

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7. Additional Responsibilities of the Sponsor

Begin Rule Language (§ 60.9)

a. The sponsor must not allow the FTD to be used for flightcrew member training or evaluation or for attaining flight experience for the flightcrew member to meet any of the requirements under this chapter unless the sponsor, upon request, allows the NSPM to inspect immediately the FTD, including all records and documents relating to the FTD, to determine its compliance with this part.
b. The sponsor must, for each FTD—
(1) Establish a mechanism for the following persons to provide comments regarding the FTD and its operation and provide for receipt of those comments:
(i) Flightcrew members recently completing training or evaluation or recently obtaining flight experience in the FTD;
(ii) Instructors and check airmen using the FTD for training, evaluation, or flight experience sessions; and
(iii) Simulator technicians and maintenance personnel performing work on the FTD.
(2) Examine each comment received under paragraph (b)(1) of this section for content and importance and take appropriate action.
(3) Maintain a liaison with the manufacturer of the airplane being simulated by the FTD to facilitate compliance with § 60.13(f) when necessary.
(4) Post in or adjacent to the FTD the Statement of Qualification issued by the NSPM.

End Rule Language (§ 60.9)

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8. FTD Use

Begin Rule Language (§ 60.11)

No person may use or allow the use of or offer the use of an FTD for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification unless, in accordance with the QPS for the specific device—
a. It has a single sponsor who is qualified under § 60.9. The sponsor may arrange with another person for services of document preparation and presentation, as well as FTD inspection, maintenance, repair, and servicing; however, the sponsor remains responsible for ensuring that these functions are conducted in a manner and with a result of continually meeting the requirements of this part.
b. It is qualified as described in the Statement of Qualification that is required to be posted pursuant to § 60.9(b)(4)—

(1) For the make, model, and series of airplane or set of airplanes; and

(2) For all tasks and configurations.

c. It remains qualified, through satisfactory inspection, recurrent evaluations, appropriate maintenance, and use requirements in accordance with this part and the appropriate QPS.

d. Its software and active programming used during the training, evaluation, or flight experience is the same as the software and active programming that was evaluated by the NSPM.

End Rule Language (§ 60.11)

Begin QPS Requirements

e. Only those FTDs that are used by a certificate holder (as defined for use in Part 60 and this QPS) will be evaluated by the NSPM. However, other FTD evaluations may be conducted on a case-by-case basis as the Administrator deems appropriate, but only in accordance with applicable agreements.

End QPS Requirements

Begin Information

f. Each FTD must be evaluated as completely as possible. To ensure a thorough and uniform evaluation, each FTD is subjected to the objective tests listed in attachment 2 of this appendix and the subjective tests listed in attachment 3 of this document. The evaluation(s) described herein will include, but not necessarily be limited to the following, as appropriate, for the qualification level of the FTD:

(1) Aerodynamic responses, including longitudinal and lateral-directional control responses (see attachment 2 of this appendix);

(2) Performance in authorized portions of the simulated airplane's, or set of airplanes'', operating envelope, to include tasks suitable to the NSPM in the areas of ground operations, takeoff, climb, cruise, descent, approach, and landing (see paragraph 22 of this appendix) as well as abnormal and emergency operations (see paragraph 23 and attachment 2 of this appendix);

(3) Control checks (see attachment 1 and attachment 2 of this appendix);

(4) Cockpit configuration (see attachment 1 of this appendix);

(5) Pilot, flight engineer, and instructor station functions checks (see attachment 1 and attachment 3 of this appendix);

(6) Airplane, or set of airplanes, systems and sub-systems (as appropriate) as compared to the airplane or set of airplanes simulated (see attachment 1 and attachment 3 of this appendix);

(7) FTD systems and sub-systems, including force cueing (motion), visual, and aural (sound) systems, as appropriate (see attachment 1 and attachment 2 of this appendix); and

(8) Certain additional requirements, depending upon the complexity of the FTD qualification level sought, including equipment or circumstances that may become hazardous to the occupants. The sponsor may be subject to Occupational Safety and Health Administration requirements.

g. The NSPM administers the objective and subjective tests, which includes an examination of functions. The tests include a qualitative assessment of the FTD by an NSP pilot. The NSP evaluation team leader may assign other qualified personnel to assist in accomplishing the functions examination and/or the objective and subjective tests performed during an evaluation when required.

(1) Objective tests are used to compare FTD and airplane data objectively to ensure that the FTD performance and handling qualities are within specified tolerances.

(2) Subjective tests provide a basis for:

(a) evaluating the capability of the FTD to perform over a typical utilization period;

(b) determining that the FTD satisfactorily meets the appropriate training/testing/checking objectives and competently simulates each required maneuver, procedure, or task; and

(c) verifying correct operation of the FTD controls, instruments, and systems.

h. The tolerances for the test parameters listed in attachment 2 of this appendix are the maximum acceptable to the NSPM for FTD validation and are not to be confused with design tolerances specified for FTD manufacture. In making decisions regarding tests and test results, the NSPM relies on the use of operational and engineering judgment in the application of data (including consideration of the way in which the flight test was flown and way the data was gathered and applied) data presentations, and the applicable tolerances for each test.

i. In addition to the scheduled recurrent evaluation (see paragraph 13 of this appendix), each FTD is subject to evaluations conducted by the NSPM at any time with no prior notification to the sponsor. Such evaluations would be accomplished in a normal manner (i.e., requiring exclusive use of the FTD for the conduct of objective and subjective tests and an examination of functions) if the FTD is not being used for flightcrew member training, testing, or checking. However, if the FTD were being used, the evaluation would be conducted in a non-exclusive manner. This non-exclusive evaluation will be conducted by the FTD evaluator accompanying the check airman, instructor, Aircrew Program Designee (APD), or FAA inspector aboard the FTD along with the student(s) and observing the operation of the FTD during the training, testing, or checking activities. While the intent is to observe the operation and interaction of the device and not the check airman, instructor, APD, FAA inspector, or student(s), the FTD evaluator is a qualified FAA operations inspector and must, without question, report any obvious lack of proficiency to the appropriate POI or TCPM.

End Information

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9. FTD Objective Data Requirements

Begin Rule Language (§ 60.13)

a. Except as provided in paragraphs (b) and (c) of this section, for the purposes of validating FTD performance and handling qualities during evaluation for qualification, the sponsor must submit the airplane manufacturer's flight test data to the NSPM.

b. The sponsor may submit flight test data from a source in addition to or independent of the airplane manufacturer's data to the NSPM in support of an FTD qualification, but only if this data is gathered and developed by that source in accordance with flight test methods, including a flight test plan, as described in the appropriate QPS.

c. The sponsor may submit alternative data acceptable to the NSPM for consideration, approval and possible use in particular applications for FTD qualification.

d. Data or other material or elements must be submitted in a form and manner acceptable to the NSPM.

e. The NSPM may require additional flight testing to support certain FTD qualification requirements.

f. When an FTD sponsor learns, or is advised by an airplane manufacturer or supplemental type certificate (STC) holder, that an addition to, an amendment to, or a revision of the data used to program and operate an FTD used in the sponsor's training program is available, the sponsor must immediately notify the NSPM.

End Rule Language (§ 60.13)

Begin QPS Requirements

g. Flight test data used to validate FTD performance and handling qualities must have been gathered in accordance with a flight test program containing the following:

(1) A flight test plan, that contains:

(a) The required maneuvers and procedures.

(b) For each maneuver or procedure —

(i) The procedures and control input the flight test pilot and/or engineer are to use.

(ii) The atmospheric and environmental conditions.

(iii) The initial flight conditions.

(iv) The airplane configuration, including weight and center of gravity.

(v) The data that is to be gathered.

(vi) Any other appropriate factors.

(2) Appropriately qualified flight test personnel.

(3) An understanding of the accuracy of the data to be gathered.

(4) Appropriate and sufficient data acquisition equipment or system(s), including appropriate data reduction and analysis methods and techniques, as would be acceptable to the FAA's Aircraft Certification Service.

(5) Calibration of data acquisition equipment and airplane performance instrumentation must be current and traceable to a recognized standard.

h. The data presented, regardless of source, must be presented:

(1) in a format that supports the FTD validation process;

(2) in a manner that is clearly readable and annotated correctly and completely;

(3) with resolution sufficient to determine compliance with the tolerances set forth in attachment 2 of this appendix.

(4) with any necessary guidance information provided; and

(5) without alteration, adjustments, or bias; however the data may be re-scaled, digitized, or otherwise manipulated to fit the desired presentation.

i. After completion of any additional flight test, a flight test report must be submitted in support of the objective data. The report must contain sufficient data and rationale to support qualification of the FTD at the level requested.

End QPS Requirements

Begin Information

j. Any necessary data and the flight test plan should be reviewed with the NSP staff well in advance of commencing the flight test.

End Information

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10. Special Equipment and Personnel Requirements for Qualification of the FTD

Begin Rule Language (§ 60.14)

a. When notified by the NSPM, the sponsor must make available all special equipment and specifically qualified personnel needed to accomplish or assist in the accomplishment of tests during initial, recurrent, or special evaluations.

End Rule Language (§ 60.14)

Begin Information

b. Examples of a special evaluation would be an evaluation conducted at the request of the TPAA or as a result of comments received from users of the FTD that, upon analysis and confirmation, might cause a question as to the continued qualification or use of the FTD.

c. The NSPM will notify the sponsor at least 24 hours in advance of the evaluation if special equipment or personnel will be required to conduct the evaluation. Examples of special equipment include spot photometers, flight control measurement devices, sound analyzer, etc. Examples of special personnel would be those specifically qualified to install or use any special equipment when its use is required.

End Information

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11. Initial (and Upgrade) Qualification Requirements

Begin Rule Language (§ 60.15)

a. For each FTD, the sponsor must submit a request through the TPAA to have the NSPM evaluate the FTD for initial qualification at a specific level. The request must be submitted in the form and manner described in the appropriate QPS.

b. The request must include all of the following:

(1) A statement that the FTD meets all of the applicable provisions of this part.

(2) A statement that the sponsor has established a procedure to verify that the configuration of hardware and software present during the evaluation for initial qualification will be maintained, except where modified as authorized in § 60.23. The statement must include a description of the procedure.

(3) A statement signed by at least one pilot who meets the requirements of paragraph (c) of this section asserting that each pilot so approved has determined that the following requirements have been met:

(i) The FTD systems and sub-systems function equivalently to those in the airplane or set of airplanes.

(ii) The performance and flying qualities of the FTD are equivalent to those of the airplane or set of airplanes.

(iii) For type specific FTD's, the cockpit configuration conforms to the configuration of the airplane make, model, and series being simulated.

(4) A list of all of the operations tasks or FTD systems in the subjective test appendix of the appropriate QPS for which the FTD has not been subjectively tested (*e.g.*, circling approaches, windshear training, etc.) and for which qualification is not sought.

(5) A qualification test guide (QTG) that includes all of the following:

(i) Objective data obtained from airplane testing or another approved source.

(ii) Correlating objective test results obtained from the performance of the FTD as prescribed in the appropriate QPS.

(iii) The general FTD performance or demonstration results prescribed in the appropriate QPS.

(iv) A description of the equipment necessary to perform the evaluation for initial qualification and the recurrent evaluations for continuing qualification.

c. The pilot or pilots who make the statement required by paragraph (b)(3) of this section must—

(1) Be designated by the sponsor;

(2) Be approved by the TPAA; and

(3) Be qualified in —

(i) The airplane or set of airplanes being simulated; or

(ii) For airplane types not yet issued a type certificate, an airplane type similar in size and configuration.

d. The subjective tests that form the basis for the statements described in paragraph (b)(3) of this section and the objective tests referenced in paragraph (b)(5) of this section must be accomplished at the sponsor's training facility except as provided for in the appropriate QPS.

e. The person seeking to qualify the FTD must provide the NSPM access to the FTD for the length of time necessary for the NSPM to complete the required evaluation of the FTD for initial qualification, which includes the conduct and evaluation of objective and subjective tests, including general FTD requirements, as described in the appropriate QPS, to determine that the FTD meets the standards in that QPS.

f. When the FTD passes an evaluation for initial qualification, the NSPM issues a Statement of Qualification that includes all of the following:

(1) Identification of the sponsor.

(2) Identification of the make, model, and series of the airplane or set of airplanes being simulated.

(3) Identification of the configuration of the airplane of set or airplanes being simulated (*e.g.*, engine model or models, flight instruments, navigation or other systems, etc.).

(4) A statement that the FTD is qualified as a flight training device.

(5) Identification of the qualification level of the FTD.

(6) A list of all of the operations tasks or FTD systems in the subjective test appendix of the appropriate QPS for which the FTD has not been subjectively tested and for which the FTD is not qualified (*e.g.*, circling approaches, windshear training, etc.).

g. After the NSPM completes the evaluation for initial qualification, the sponsor must update the QTG, with the results of the FAA-witnessed tests and demonstrations together with the results of all the objective tests and demonstrations described in the appropriate QPS.

h. Upon issuance of the Statement of Qualification the updated QTG becomes the MQTG and must then be made available to the FAA upon request.

End Rule Language (§ 60.15)

Begin QPS Requirement

i. The QTG described in paragraph 11.b.(4) of this appendix, must provide the documented proof of compliance with the FTD objective tests in attachment 2 of this appendix.

j. The QTG is prepared and submitted by the sponsor, or the sponsor's agent on behalf of the sponsor, through the TPAA to the NSPM for review and approval, and must include, for each objective test:

(1) parameters, tolerances, and flight conditions;

(2) pertinent and complete instructions for the conduct of automatically and manually conducted tests;

(3) a means of comparing the FTD's test results to the objective data;

(4) statements of how a particular test was accomplished or that certain requirements have been met (see appendices to this document for additional information);

(5) other information appropriate to the qualification level of the FTD.

k. The QTG described in paragraph 11.b.(4) of this appendix, must include the following:

(1) A QTG cover page with sponsor and FAA approval signature blocks (see attachment 5, Figure 2, of this appendix for a sample QTG cover page).

(2) A recurrent evaluation schedule requirements page '' to be used by the NSPM to establish and record the frequency with which recurrent evaluations must be conducted and any subsequent changes that may be determined by the NSPM. See attachment 5, Figure 4, of this appendix for a sample Recurrent Evaluation Schedule Requirements page.

(3) An FTD information page that provides the information listed below (see attachement 5, Figure 3, of this appendix for a sample FTD information page). For convertible FTDs, a separate page is submitted for each configuration of the FTD.

(a) The sponsor's FTD identification number or code.

(b) The airplane model and series, or set of airplanes, being simulated.

(c) The aerodynamic data revision number or reference.

(d) The engine model(s) and its data revision number or reference.

(e) The flight control data revision number or reference.

(f) The flight management system identification and revision level.

(g) The FTD model and manufacturer.

(h) The date of FTD manufacture.

(i) The FTD computer identification.

(j) The visual system model and manufacturer, including display type.

(k) The motion system type and manufacturer, including degrees of freedom.

(4) A Table of Contents.

(5) A log of revisions and a list of effective pages.

(6) The source data.

(7) A glossary of terms and symbols used (including sign conventions and units).

(8) Statements of compliance and capability (SOC's) with certain requirements. SOC's must provide references to the sources of information for showing the capability of the FTD to comply with the requirement, a rationale explaining how the referenced material is used, mathematical equations and parameter values used, and the conclusions reached; *i.e.* that the FTD complies with the requirement. Refer to the ''Additional Details'' column in attachment 1 of this appendix, ''FTD Standards,'' or in the ''Test Details'' column in attachment 2 of this appendix, ''FTD Objective Tests,'' to see when SOC's are required.

(9) Recording procedures or equipment required to accomplish the objective tests.

(10) The following information for each objective test designated in attachment 2 of this appendix, as applicable to the qualification level sought.

(a) Name of the test.

(b) Objective of the test.

(c) Initial conditions.

(d) Manual test procedures.

(e) Automatic test procedures (if applicable).

(f) Method for evaluating FTD objective test results.

(g) List of all parameters driven or constrained during the automatically conducted test(s).

(h) List of all parameters driven or constrained during the manually conducted test(s).

(i) Tolerances for relevant parameters.

(j) Source of Airplane Test Data (document and page number).

(k) Copy of the Airplane Test Data (if located in a separate binder, a cross reference for the identification and page number for pertinent data location must be provided).

(l) FTD Objective Test Results as obtained by the sponsor. Each test result must reflect the date completed and must be clearly labeled as a product of the device being tested.

l. Form and manner of presentation of objective test results in the QTG:

(1) The sponsor's FTD test results must be recorded in a manner, acceptable to the NSPM, that will allow easy comparison of the FTD test results to airplane test data (*e.g.*, use of a multi-channel recorder, line printer, cross plotting, overlays, transpariencies, etc.).

(2) FTD results must be labeled using terminology common to airplane parameters as opposed to computer software identifications.

(3) Airplane data documents included in a QTG may be photographically reduced only if such reduction will not alter the graphic scaling or cause difficulties in scale interpretation or resolution.

(4) Scaling on graphical presentations must provide the resolution necessary to evaluate the parameters shown in attachment 2 of this appendix.

(5) For tests involving time histories, flight test data sheets (or transparencies thereof) and FTD test results must be clearly marked with appropriate reference points to ensure an accurate comparison between FTD and airplane with respect to time. Time histories recorded via a line printer are to be clearly identified for cross-plotting on the airplane data. Over-plots must not obscure the reference data.

m. The sponsor may elect to complete the QTG objective tests at the manufacturer's facility. Tests performed at this location must be conducted after assembly of the FTD has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate FTD performance at the sponsor's training facility by repeating a representative sampling of all the objective tests in the QTG and submitting these repeated test results to the NSPM. This sample must consist of at least one-third of the QTG objective tests. The QTG must be clearly annotated to indicate when and where each test was accomplished.

n. The sponsor may elect to complete the subjective tests at the manufacturer's facility. Tests performed at this location will be conducted after assembly of the FTD has been essentially completed, the systems and sub-systems are functional and operate in an interactive manner, and prior to the initiation of disassembly for shipment. The sponsor must substantiate FTD performance at the sponsor's training facility by having the pilot(s) who performed these tests originally (or similarly qualified pilot(s)), repeat a representative sampling of these subjective tests and submit a statement to the NSPM that the FTD has not changed from the original determination. The report must clearly indicate when and where these repeated tests were completed, but need not take more than one normal FTD period (*e.g.,* 4 to 8 hours) to complete.

o. The sponsor must maintain a copy of the MQTG at the FTD location. After [date 6 years from the effective date of the final rule] all MQTG's, regardless of initial qualification date of the FTD, must be available in an electronic format, acceptable to the NSPM. The electronic MQTG must include all objective data obtained from airplane testing, or another approved source (reformatted or digitized), together with correlating objective test results obtained from the performance of the FTD (reformatted or digitized) as prescribed in this document, the general FTD performance or demonstration results (reformatted or digitized) prescribed in this document, and a description of the equipment necessary to perform the evaluation for initial qualification and the recurrent evaluations for continuing qualification. This electronic MQTG must include the original airplane flight test data used to validate FTD performance and handling qualities in either the original digitized format from the data supplier or an electronic scan of the original flight test time-history plots that were provided by the data supplier. An electronic copy of MQTG must be provided to the NSPM.

End QPS Requirements

Begin Information

p. Problems with objective test results are handled according to the following:

(1) If a problem with an objective test result is detected by the NSP evaluation team during an evaluation, the test may be repeated and/or the QTG may be amended.

(2) If it is determined that the results of an objective test do not support the level requested but do support a lower level, the NSPM may qualify the FTD at that lower level. For example, if a Level 6 evaluation is requested and the FTD fails to meet the Level 6 Spiral Stability test tolerances but does meet the Level 5 tolerances, it could be qualified at Level 5.

q. After the NSPM issues a statement of qualification to the sponsor when an FTD is successfully evaluated, the FTD is recommended to the TPAA, who will exercise authority on behalf of the Administrator in approving the FTD in the appropriate airplane flight training program.

r. Under normal circumstances, the NSPM establishes a date for the initial or upgrade evaluation within 10 working days after determining that a complete QTG is acceptable. Unusual circumstances may warrant establishing an evaluation date before this determination is made; however, once a schedule is agreed to, any slippage of the evaluation date at the sponsor's request may result in a significant delay, perhaps 45 days or more, in rescheduling and completing the evaluation. A sponsor may commit to an initial evaluation date under this early process, in coordination with and the agreement of the NSPM, but the request must be in writing and must include an acknowledgment of the potential schedule impact if the sponsor slips the evaluation from this early-committed date. See attachment 5, figure 5 of this appendix, Sample Request for Initial Evaluation Date.

s. A convertible FTD is addressed as a separate FTD for each model and series airplane or set of airplanes to which it will be converted and for the FAA qualification level sought. An NSP evaluation is required for each configuration. For example, if a sponsor seeks qualification for two models of an airplane type using a convertible FTD, two QTG's, or a supplemented QTG, and two evaluations are required.

t. The numbering system used for objective test results in the QTG should closely follow the numbering system set out in attachment 2 of this appendix, FTD Objective Tests.

End Information

12. Additional Qualifications for Currently Qualified FTD's

Begin Rule Language (§ 60.16)

a. A currently qualified FTD is required to undergo an additional qualification process if a user intends to use the FTD for meeting training, evaluation, or flight experience requirements of this chapter beyond the qualification issued to the sponsor. This process consists of the following—

(1) The sponsor:

(i) Must submit to the NSPM all modifications to the MQTG that are required to support the additional qualification.

(ii) Must describe to the NSPM all modifications to the FTD that are required to support the additional qualification.

(iii) Must submit a statement to the NSPM that a pilot, designated by the sponsor in accordance with § 60.15(c) and approved by the TPAA for the user, has subjectively evaluated the FTD in those areas not previously evaluated.

(2) The FTD must successfully pass an evaluation—

(i) For initial qualification, in accordance with § 60.15, in those circumstances where the NSPM has determined that a full evaluation for initial qualification is necessary; or

(ii) For those elements of an evaluation for initial qualification (e.g., objective tests, performance demonstrations, or subjective tests) designated as necessary by the NSPM.

b. In making the determinations described in paragraph (a)(2) of this section, the NSPM considers factors including the existing qualification of the FTD, any modifications to the FTD hardware or software that are involved, and any additions or modifications to the MQTG.

c. The FTD is qualified for the additional uses when the NSPM issues an amended Statement of Qualification in accordance with § 60.15(f).

d. The sponsor may not modify the FTD except as described in § 60.23.

End Rule Language (§ 60.16)

13. Previously Qualified FTDs

Begin Rule Language (§ 60.17)

a. Unless otherwise specified by an FSD Directive, further referenced in the appropriate QPS, or as specified in paragraph (e) of this section, an FTD qualified before [the effective date of the final rule] will retain its qualification as long as it continues to meet the standards, including the performance demonstrations and the objective test results recorded in the MQTG, under which it was originally evaluated, regardless of sponsor, and as long as the sponsor complies with the applicable provisions of this part.

b. If the FTD qualification is lost under § 60.27 and not restored under § 60.27 for two (2) years or more, the qualification basis for the re-qualification will be those standards in effect and current at the time of re-qualification application.

c. Except as provided in paragraph (d) of this section, any change in FTD qualification level initiated on or after [the effective date of the final rule] requires an evaluation for initial qualification in accordance with this part.

d. The NSPM may downgrade a qualified FTD without requiring and without conducting an initial evaluation for the new qualification level. Subsequent recurrent evaluations will use the existing MQTG, modified as necessary to reflect the new qualification level.

e. When the sponsor has appropriate validation data available and receives approval from the NSPM, the sponsor may adopt tests and associated tolerances described in the current qualification standards as the tests and tolerances applicable for the continuing qualification of a previously qualified FTD. The updated test(s) and tolerance(s) must be made a permanent part of the MQTG.

End Rule Language (§ 60.17)

Begin Information

f. Other certificate holders or persons desiring to use an FTD may contract with FTD sponsors to use those FTDs already qualified at a particular level for an airplane type or set of airplanes and approved for use within an FAA-approved flight training program. Such FTDs are not required to undergo an additional qualification process, except as described in paragraph 12, of this appendix.

Note: The reader is reminded of the requirement that each FTD user obtain approval for use of each FTD in an FAA-approved flight training program from the appropriate TPAA.

End Information

14. Inspection, Maintenance, and Recurrent Evaluation Requirements

Begin Rule Information (§ 60.19)

a. Inspection. No sponsor may use or allow the use of or offer the use of an FTD for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification unless the sponsor does the following:

(1) Accomplishes all appropriate QPS Appendix 1 performance demonstrations and all appropriate QPS Appendix 2 objective tests each year. To do this, the sponsor must conduct a minimum of four evenly spaced inspections throughout the year, as approved by the NSPM. The performance demonstrations and objective test sequence and content of each inspection in this sequence will be developed by the sponsor and submitted to the NSPM for approval. In deciding whether to approve the test sequence and the content of each inspection, the NSPM looks for a balance and a mix from the performance demonstrations and objective test requirement areas listed as follows:

(i) Performance.

(ii) Handling qualities.

(iii) Motion system (where appropriate).

(iv) Visual system (where appropriate).

(v) Sound system (where appropriate).

(vi) Other FTD systems.

(2) Completes a functional preflight check in accordance with the appropriate QPS each calendar day prior to the start of the first FTD period of use that begins in that calendar day.

(3) Completes at least one functional preflight check in accordance with the appropriate QPS in every 7 consecutive calendar days.

(4) Maintains a discrepancy log.

(5) Ensures that, when a discrepancy is discovered, the following requirements are met:

(i) Each discrepancy entry must be maintained in the log until the discrepancy is corrected as specified in § 60.25(b) and for at least 30 days thereafter.

(ii) The corrective action taken for each discrepancy and the date that action is taken must be entered in the log. This entry concerning the corrective action must be maintained for at least 30 days thereafter.

(iii) The discrepancy log is kept in a form and manner acceptable to the Administrator and is kept in or immediately adjacent to the FTD.

b. Recurrent evaluation.

(1) This evaluation consists of performance demonstrations, objective tests, and subjective tests, including general FTD requirements, as described in the appropriate QPS or as may be amended by an FSD Directive.

(2) The sponsor must contact the NSPM to schedule the FTD for recurrent evaluations not later than 60 days before the recurrent evaluation is due.

(3) The sponsor must provide the NSPM access to the objective test results and general FTD performance or demonstration results in the MQTG, and access to the FTD for the length of time necessary for the NSPM to complete the required recurrent evaluations, weekdays between 6 o'clock AM (local time) and 6 o'clock PM (local time).

(4) No sponsor may use, or allow the use of, or offer the use of, an FTD for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of this chapter unless the FTD has passed an NSPM-conducted recurrent evaluation within the previous 12 calendar months or as otherwise provided for in the MQTG.

(5) Recurrent evaluations conducted in the calendar month before or after the calendar month in which these recurrent evaluations are required will be considered to have been conducted in the calendar month in which they were required.

c. Maintenance. The sponsor is responsible for continuing corrective and preventive maintenance on the FTD to ensure that it continues to meet the requirements of § 60.15(b).

End Rule Language (§ 60.19)

Begin QPS Requirement

d. The preflight inspections described in paragraphs 14.a.(2) and (3) of this appendix, must consist of, as a minimum—

(1) An exterior inspection of the FTD for appropriate hydraulic (if applicable), pneumatic, and electrical connections (*e.g.*, in place, not leaking, appear serviceable);

(2) A check that the area around the FTD is free of potential obstacles throughout the motion system range (if applicable);

(3) A review of the FTD discrepancy log;

(4) A functional check of the major FTD systems and simulated airplane, or set of airplanes, systems (*e.g.*, cockpit instrumentation, control loading, and adequate air flow for equipment cooling) by doing the following:

(a) Turn on main power, including motion system (if applicable), and allow to stabilize.

(b) Connect airplane power. This may be connected through ''quick start'' of airplane engines, auxiliary power unit, or ground power. Airplane operations will require operating engines.

(c) A general look for light bulb function, lighted instruments and switches, etc., as well as inoperative ''flags'' or other such indications.

(d) Check Flight Management System(s) (and other date-critical information) for proper date range.

(e) Select takeoff position and from either pilot position, if applicable, observe the visual system, for proper operation (including light-point color balance and convergence, edge-matching and blending, etc.).

(f) If applicable, adjust visibility value to inside of the far end of the runway and release ''position freeze or flight freeze.'' From either pilot position, advance power to taxi down the runway (if applicable, observe visual system; check sound system and engine instrument response) and apply spoiler/speed brake, if applicable, and wheel brakes (to check spoiler/speed brake and wheel brake operation); select reverse thrust, if applicable, to check normal operation and continued deceleration.

(g) Select position on final approach, at least five (5) miles out (if applicable, observe visual scene). From either pilot position, adjust airplane configuration appropriately (if applicable, check for normal gear and flap operation). If applicable, adjust visibility to see entire airport. Release ''position freeze'' or ''flight freeze.'' Make a rapid left and right bank (check control feel and freedom; observe proper airplane response; and exercise motion system, if applicable). Observe simulated airplane systems operation.

(h) Extend gear and flaps,

(i) Fly to and land at airport, or select takeoff position.

(j) Shut down engines, turn off lights, turn off main power supply and motion system, as applicable.

(k) Record ''functional preflight'' in the FTD discrepancy log book, including any item found to be missing, malfunctioning, or inoperative.

End QPS Requirements

Begin Information

e. If the NSP evaluator plans to accomplish specific tests during a normal recurrent evaluation that requires the use of special equipment or technicians, the sponsor will be notified as far in advance of the evaluation as practical; usually not less than 24 hours. These tests include latencies, control dynamics, sounds and vibrations, motion, and/or some visual system tests as may be applicable.

f. The recurrent evaluations described in paragraph 13.a.(7) of this appendix, require approximately eight (8) hours of FTD time and consist of the following:

(1) A review of the results of the objective tests and all the designated FTD performance demonstrations conducted by the sponsor since the last scheduled recurrent evaluation.

(2) At the discretion of the evaluator, a selection of approximately 20 percent of those objective tests conducted since the last scheduled recurrent evaluation and a selection of approximately 10 percent of the remaining objective tests in the MQTG. The tests chosen will be performed either automatically or manually, at the discretion of the evaluator.

(3) A subjective test of the FTD to perform a representative sampling of the tasks set out in appendix 3 of this document, selected at the discretion of the evaluator.

(4) An examination of the functions of the FTD, including, but not necessarily limited to the motion, visual, and sound system as applicable, and the instructor operating station, including the normal and simulated malfunctions of the simulated airplane systems.

End Information

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15. Logging FTD Discrepancies

Begin Rule Language (§ 60.20)

Each instructor, check airman, or representative of the Administrator conducting training or evaluation, or observing flight experience for flightcrew member certification or qualification, and each person conducting the preflight inspection (§ 60.19(a)(2), (3), and (4)), who discovers a discrepancy, including any missing, malfunctioning, or inoperative components in the FSD, must write or cause to be written a description of that discrepancy into the discrepancy log at the end of the FSD preflight or FSD use session.

End Rule Language (§ 60.20)

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16. [Reserved]

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17. Modifications to FTDs

Begin Rule Language (§ 60.23)

a. When the sponsor or the FAA determines that any of the following circumstances exist and the FAA determines that the FTD cannot be used adequately to train, evaluate, or provide flight experience for flightcrew members, the sponsor must modify the FTD accordingly:

(1) The airplane manufacturer or another approved source develops new data regarding the performance, functions, or other characteristics of the airplane or set of airplanes being simulated;

(2) A change in airplane performance, functions, or other characteristics occurs;

(3) A change in operational procedures or requirements occurs; or

(4) Other circumstances as determined by the NSPM.

b. When the FAA determines that FTD modification is necessary for safety of flight reasons, the sponsor of each affected FTD must ensure that the FTD is modified according to the FSD Directive regardless of the original qualification standards applicable to any specific FTD.

c. Before modifying a qualified FTD, the sponsor must notify the NSPM and the TPAA as follows:

(1) The notification must include a complete description of the planned modification, including a description of the operational and engineering effect the proposed modification will have on the operation of the FTD.

(2) The notification must be submitted in a form and manner as specified in the appropriate QPS.

d. If the sponsor intends to add additional equipment or devices intended to simulate airplane appliances; modify hardware or software which would affect flight or ground dynamics, including revising FTD programming or replacing or modifying the host computer; or if the sponsor is changing or modifying the control loading system (or motion, visual, or sound system for FTD levels requiring these tests and measurements), the following applies:

(1) The sponsor must meet the notification requirements of paragraph (c) of this section and must include in the notification the results of all objective tests that have been re-run with the modification incorporated, including any necessary updates to the MQTG.

(2) However, the sponsor may not use, or allow the use of, or offer the use of, the FTD with the proposed modification for flightcrew member training or evaluation or for obtaining flight experience for the flightcrew member to meet the requirements of this chapter unless or until the sponsor receives written notification from the NSPM approving the proposed modification. Prior to approval, the NSPM may require that the modified FTD be evaluated in accordance with the standards for an evaluation for initial qualification or any part thereof before it is placed in service.

e. The sponsor may not modify a qualified FTD until one of the following has occurred:

(1) For circumstances described in paragraph (b) or (d) of this section, the sponsor receives written approval from the NSPM that the modification is authorized.

(2) For circumstances other than those described in paragraph (b) or (d) of this section, either:

(i) Twenty-one days have passed since the sponsor notified the NSPM and the TPAA of the proposed modification and the sponsor

has not received any response from the NSPM or TPAA; or

(ii) The NSPM or TPAA approves the proposed modification in fewer than 21 days since the sponsor notified the NSPM and the TPAA of the proposed modification.

f. When a modification is made to an FTD, the sponsor must notify each certificate holder planning to use that FTD of that modification prior to that certificate holder using that FTD the first time after the modification is complete.

g. The MQTG must be updated with current objective test results in accordance with § 60.15(b)(5) and appropriate flight test data in accordance with § 60.13, each time an FTD is modified and an objective test is affected by the modification. If this update is initiated by an FSD Directive, the direction to make the modification and the record of the modification completion must be filed in the MQTG.

End Rule Language (§ 60.23)

Begin QPS Requirements

h. The notification described in paragraph 17.c.(1) of this appendix, will include a statement signed by a pilot, qualified in the airplane type, or set of airplanes, being simulated and designated by the sponsor, that, with the modification proposed—

(1) the FTD systems and sub-systems function equivalently to those in the airplane, or set of airplanes, being simulated;

(2) the performance and flying qualities of the FTD are equivalent to those of the airplane, or set of airplanes, being simulated; and

(3) the cockpit configuration conforms to the configuration of the airplane, or set of airplanes, being simulated.

End QPS Requirements

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18. Operation With Missing, Malfunctioning, or Inoperative Components

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Begin Rule Language (§ 60.25)

a. No person may use or allow the use of or offer the use of an FTD with a missing, malfunctioning, or inoperative component for meeting training, evaluation, or flight experience requirements of this chapter for flightcrew member certification or qualification during maneuvers, procedures, or tasks that require the use of the correctly operating component.

b. Each missing, malfunctioning, or inoperative component must be repaired or replaced within 30 calendar days unless otherwise authorized by the NSPM. Failure to repair or replace this component within the prescribed time may result in loss of FTD qualification.

c. Each missing, malfunctioning, or inoperative component must be placarded as such on or adjacent to that component in the FTD and a list of the currently missing, malfunctioning, or inoperative components must be readily available in or immediately adjacent to the FTD for review by users of the device.

End Rule Language (§ 60.25)

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19. Automatic Loss of Qualification and Procedures for Restoration of Qualification

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Begin Rule Language (§ 60.27)

a. An FTD is not qualified if any of the following occurs:

(1) The FTD is not used in the sponsor's FAA-approved flight training program in accordance with § 60.9(b)(4).

(2) The FTD is not maintained and inspected in accordance with § 60.19.

(3) The FTD is physically moved from one location to another, regardless of distance.

(4) The FTD is disassembled (*e.g.,* for repair or modification) to such an extent that it cannot be used for training, evaluation, or experience activities.

(5) The MQTG is missing or otherwise not available and a replacement is not made within 30 days.

b. If FTD qualification is lost under paragraph (a) of this section, qualification is restored when either of the following provisions are met:

(1) The FTD successfully passes an evaluation:

(i) For initial qualification, in accordance with § 60.15 in those circumstances where the NSPM has determined that a full evaluation for initial qualification is necessary; or

(ii) For those elements of an evaluation for initial qualification approved as necessary by the NSPM.

(2) The NSPM or the TPAA advises the sponsor that an evaluation is not necessary.

c. In making the determinations described in paragraph (b) of this section, the NSPM considers factors including the number of inspections and recurrent evaluations missed, the amount of disassembly and re-assembly of the FTD that was accomplished, and the care that had been taken of the device since the last evaluation.

End Rule Language (§ 60.27)

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20. Other Losses of Qualification and Procedures for Restoration of Qualification

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Begin Rule Language (§ 60.29)

a. Except as provided in paragraph (c) of this section, when the NSPM or the TPAA notifies the sponsor that the FTD no longer meets qualification standards, the following procedure applies:

(1) The NSPM or the TPAA notifies the sponsor in writing that the FTD no longer meets some or all of its qualification standards.

(2) The NSPM or the TPAA sets a reasonable period (but not less than 7 days) within which the sponsor may submit written information, views, and arguments on the FTD qualification.

(3) After considering all material presented, the NSPM or the TPAA notifies the sponsor of the FTD qualification.

(4) If the NSPM or the TPAA notifies the sponsor that some or all of the FTD is no longer qualified, it becomes effective not less than 30 days after the sponsor receives notice of it unless—

(i) The NSPM or the TPAA find under paragraph© of this section that there is an emergency requiring immediate action with respect to safety in air transportation or air commerce; or

(ii) The sponsor petitions for reconsideration of the NSPM or the TPAA finding under paragraph (b) of this section.

b. When a sponsor seeks reconsideration of a decision from the NSPM or the TPAA concerning the FTD qualification, the following procedure applies:

(1) The sponsor must petition for reconsideration of that decision within 30 days of the date that the sponsor receives a notice that some or all of the FTD is no longer qualified.

(2) The sponsor must address its petition to the Director, Flight Standards Service.

(3) A petition for reconsideration, if filed within the 30-day period, suspends the effectiveness of the determination by the NSPM or the TPAA that the FTD is no longer qualified unless the NSPM or the TPAA has found, under paragraph (c) of this section, that an emergency exists requiring immediate action with respect to safety in air transportation or air commerce.

c. If the NSPM or the TPAA find that an emergency exists requiring immediate action with respect to safety in air transportation or air commerce that makes the procedures set out in this section impracticable or contrary to the public interest:

(1) The NSPM or the TPAA withdraws qualification of some or all of the FTD and makes the withdrawal of qualification effective on the day the sponsor receives notice of it.

(2) In the notice to the sponsor, the NSPM or the TPAA articulates the reasons for its finding that an emergency exists requiring immediate action with respect to safety in air transportation or air commerce or that makes it impracticable or contrary to the public interest to stay the effectiveness of the finding.

End Rule Language (§ 60.29)

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21. Recordkeeping and Reporting

Begin Rule Language (§ 60.31)

a. The FTD sponsor must maintain the following records for each FTD it sponsors:

(1) The MQTG and each amendment thereto.

(2) A copy of the programming used during the evaluation of the FTD for initial qualification and for any subsequent upgrade qualification, and a copy of all programming changes made since the evaluation for initial qualification.

(3) A copy of all of the following:

(i) Results of the evaluations for the initial and each upgrade qualification.

(ii) Results of the quarterly objective tests and the approved performance demonstrations conducted in accordance with § 60.19(a) for a period of 2 years.

(iii) Results of the previous three recurrent evaluations, or the recurrent evaluations from

the previous 2 years, whichever covers a longer period.

(iv) Comments obtained in accordance with § 60.9(b)(1) for a period of at least 18 months.

(4) A record of all discrepancies entered in the discrepancy log over the previous 2 years, including the following:

(i) A list of the components or equipment that were or are missing, malfunctioning, or inoperative.

(ii) The action taken to correct the discrepancy.

(iii) The date the corrective action was taken.

(5) A record of all modifications to FTD hardware configurations made since initial qualification.

b. The FTD sponsor must keep a current record of each certificate holder using the FTD. The sponsor must provide a copy of this list to the NSPM at least semiannually.

c. The records specified in this section must be maintained in plain language form or in coded form, if the coded form provides for the preservation and retrieval of information in a manner acceptable to the NSPM.

d. The sponsor must submit an annual report, in the form of a comprehensive statement signed by the quality assurance primary contact point, certifying that the FTD continues to perform and handle as qualified by the NSPM.

End Rule Language (§ 60.31)

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22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements

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Begin Rule Language (§ 60.33)

a. No person may make, or cause to be made, any of the following:

(1) A fraudulent or intentionally false statement in any application or any amendment thereto, or any other report or test result required by this part or the QPS.

(2) A fraudulent or intentionally false statement in or omission from any record or report that is kept, made, or used to show compliance with this part or the QPS, or to exercise any privileges under this chapter.

(3) Any reproduction or alteration, for fraudulent purpose, of any report, record, or test result required under this part or the QPS.

b. The commission by any person of any act prohibited under paragraph (a) of this section is a basis for any one or any combination of the following:

(1) A civil penalty.

(2) Suspension or revocation of any certificate held by that person that was issued under this chapter.

(3) The removal of FTD qualification and approval for use in a training program.

c. The following may serve as a basis for removal of qualification of an FTD including the withdrawal of authorization for use of an FTD; or denying an application for a qualification:

(1) An incorrect statement, upon which the FAA relied or could have relied, made in support of an application for a qualification or a request for approval for use.

(2) An incorrect entry, upon which the FAA relied or could have relied, made in any logbook, record, or report that is kept, made, or used to show compliance with any requirement for an FTD qualification or an approval for use.

End Rule Language (§ 60.33)

23. [Reserved]

24. Levels of FTD.

Begin Information

a. The following is a general description of each level of FTD. Detailed standards and tests for the various levels of FTDs are fully defined in attachments 1 through 3 of this appendix.

(1) *Level 1.* Currently Reserved for possible future use.

(2) *Level 2.* A device that may have an open flight deck area, or an enclosed cockpit; a generic aero program that is representative of the simulated airplane, or set of airplanes; at least one fully functional system; and control loading that, as a minimum, is representative of the simulated airplane, or set of airplanes, only at an approach speed.

(3) *Level 3.* A device that has an enclosed generic cockpit with a generic aerodynamic program; all applicable operating systems; control loading that is representative of the simulated airplane, or set of airplanes, throughout it's ground and flight envelope; and significant sound representation.

(4) *Level 4.* A device that may have an open, airplane-specific, flight deck area, or an enclosed, airplane-specific cockpit; at least one operating system; and possessing at least air/ground logic (no aerodynamic programming required).

(5) *Level 5.* A device that may have an open, airplane-specific, flight deck area, or an enclosed, airplane-specific cockpit, with a generic aerodynamic program; at least one operating system; and control loading that as a minimum is representative of the simulated airplane only at an approach speed.

(6) *Level 6.* A device that has an enclosed, airplane-specific cockpit and aerodynamic program; all airplane systems operating; control loading that is representative of the simulated airplane throughout it's ground and flight envelope; and significant sound representation.

b. Non-visual simulators have been placed into Level 6 for reference purposes. The placement of these unique simulators into this level has not affected the standards or criteria of Level 6 FTDs, nor will these FTDs affect the standards or criteria of these simulators.

End Information

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25. [Reserved]

Attachment 1 to Appendix B to Part 60—General FTD Requirements

1. General

Begin QPS Requirements

a. Requirements

Certain FTD requirements included in this appendix must be supported with a Statement of Compliance and Capability (SOC) and, in designated cases, FTD performance must be recorded and the results made part of the QTG. In the following tabular listing of FTD standards, requirements for SOC's are indicated in the ''Additional Details'' column.

End QPS Requirements

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b. Discussion

Begin Information

(1) This attachment describes the minimum requirements for qualifying Level 2 through Level 6 flight training devices (information regarding Level 1 FTDs is found in paragraph 24 in the body of this QPS). To determine the complete requirements for a specific level FTD, the objective tests in attachment 2 and the subjective tests listed in attachment 3 for this QPS must be consulted.

(2) The material contained in this attachnment is divided into the following categories:

(a) General cockpit configuration.

(b) Simulator programming.

(c) Equipment operation.

(d) Equipment and facilities for instructor/evaluator functions.

(e) Sound system.

End Information
