

### APPENDIX 3. FUNCTIONS AND SUBJECTIVE TESTS

**1. DISCUSSION.** Accurate replication of helicopter systems functions will be checked at each flight crew-member position by an FAA Simulator Evaluation Specialist. This includes procedures using the operator's approved aircraft manuals and checklists. Handling qualities, performance, and simulator systems operation will be subjectively assessed by an FAA Simulator Evaluation Specialist qualified in the respective helicopter. This assessment is subject to include operations under the full range of environmental conditions (winds, density altitudes, etc.) in which the helicopter would normally be expected to perform.

At the request of a POI, the Simulator Evaluation Specialist may assess the simulator for a special aspect of an operator's training program during the functions and subjective portion of a recurrent evaluation. Such an assessment may include a portion of a Line Oriented Flight Training (LOFT) scenario or special emphasis items in the operator's training program. Unless directly related to a requirement for the current qualification level, the results of such an evaluation would not affect the simulator's current status.

Operational systems and the associated electronic display systems will be evaluated. The Simulator Evaluation Specialist will include in his report to the POI the effect of the system operation and system limitations.

**2. TEST REQUIREMENTS.** The ground and flight tests and other checks used for simulator qualification are listed in the Table of Functions and Subjective Tests. The table includes maneuvers and procedures to ensure that the simulator functions and performs appropriately for use in pilot training and checking in the maneuvers and procedures delineated in FAR Part 61 and other regulatory provisions. The portion of the table addressing pilot functions and maneuvers is divided by flight phases. Visual systems tests are listed separately as are special effects.

Where a number of similar procedures are listed, such as in approaches to landing, it is not intended that the simulator have equipment installed to perform all of the listed types of approaches. However, the simulator must have equipment required by the helicopter type design and for the type of operation intended.

Systems functions will be assessed for normal and, where appropriate, alternate operations. Normal, abnormal, and emergency procedures associated with a flight phase will be assessed during the evaluation of maneuvers or events within that flight phase. Systems are listed separately under "Any Flight Phase" to ensure appropriate attention to systems checks.

SIMULATOR STANDARDS	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
<b>1. FUNCTIONS AND MANEUVERS</b>					
<b>a. Preparation for Flight.</b>		X	X	X	
(1) Preflight. Accomplish a functions check of all switches, indicators, systems, and equipment at all cockpit crewmembers' and instructors' stations and determine that the cockpit design and functions are identical to that of the helicopter simulated.					
(2) APU/Engine start and runup.					
(a) Normal start procedures.					

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
(b) Alternate start procedures. (c) Abnormal starts and shutdowns (hot start, hung start, etc.) (d) Rotor engagement. (e) Systems checks. (f) Other.					
<b>b. Ground Taxi.</b> (1) Power required to taxi. (2) Brake effectiveness. (3) Ground handling. (4) Abnormal/emergency procedures, for example: (a) Brake system failure. (b) Ground resonance. (c) Other.		X	X	X	
<b>c. Hover.</b> (1) Takeoff to a hover. (2) Instrument response. (a) Engine instruments. (b) Flight instruments. (3) Hovering turns. (4) Hover power checks. (a) In ground effect (IGE). (b) Out of ground effect (OGE). (5) Crosswind/tailwind hover. (6) Abnormal/emergency procedures, for example: (a) Engine failure.			X	X	

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
(b) Hovering autorotation. (c) Fuel governing system failure. (d) Settling with power (OGE). (e) Stability system failure. (f) Directional control malfunction. (g) Other. (7) Translating tendency. (8) External load operations. (a) Hookup. (b) Release. (9) Winch operations.					
<b>d. Translational Flight.</b> (1) Forward. (2) Sideward. (3) Rearward.			X	X	
<b>e. Takeoff.</b> (1) Normal. (a) From ground. (b) From hover. 1. CAT A 2. CAT B (c) Running. (d) Crosswind/tailwind. (e) Maximum performance. (f) Instrument. (g) Confined area.					
			X	X	
			X	X	
		X	X	X	
		X	X	X	
			X	X	
			X	X	
			X	X	

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
(h) Pinnacle/platform.			X	X	
(i) Slope.			X	X	
(j) External load operations.			X	X	
(2) Abnormal/emergency procedures, for example.					
(a) Takeoff with engine failure before and after critical decision point (CDP).		X	X	X	
1. CAT A					
2. CAT B					
(b) Rejected takeoff.		X	X	X	
1. Land					
2. Water (if float equipped)					
(c) Other.		X	X	X	
<b>f. Climb.</b>					
(1) Normal.		X	X	X	
(2) Obstacle clearance.		X	X	X	
(3) Vertical.			X	X	
(4) One engine inoperative.		X	X	X	
(5) Other.		X	X	X	
<b>g. Cruise.</b>					
(1) Performance.		X	X	X	
(2) Flying qualities.		X	X	X	
(3) Turns.		X	X	X	
(a) Timed.					
(b) Normal.					
(c) Steep.					
(4) Accelerations and decelerations.		X	X	X	

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
(5) High airspeed vibrations. (6) External load operations. (7) Abnormal/emergency procedures, for example: (a) Engine fire. (b) Engine failure. (c) Inflight engine shutdown and restart. (d) Fuel governing system failures. (e) Directional control malfunction. (f) Hydraulic failure. (g) Stability system failure. (h) Rotor vibrations. (i) Other.		X	X	X	
<b>h. Descent.</b> (1) Normal. (2) Maximum rate. (3) Autorotative. (a) Straight in. (b) With turn. (4) Other.		X	X	X	
<b>i. Approach.</b> (1) Non-precision. (a) All engines operating. (b) One or more engines inoperative. (c) Approach procedures, for example: 1. NDB 2. VOR, RNAV, TACAN		X	X	X	

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
3. ASR					
4. Circling (if requested by operator)					
<b>NOTE: Simulators with visual systems which permit completing a circling approach without violating FAR § 91.175(e) may be approved for that particular circling approach procedure.</b>					
5. Helicopter only					
6. Other					
(d) Missed approach.					
1. All engines operating					
2. One or more engines inoperative					
(2) Precision.		X	X	X	
(a) All engines operating.					
(b) One or more engines inoperative.					
(c) Approach procedures, for example:					
1. PAR					
2. MLS					
3. ILS					
-- Manual (raw data)					
-- Flight director only					
-- Auto pilot coupled					
-- CAT I					
-- CAT II					
4. Other					
(d) Missed approach.					
1. All engines operating					
2. One or more engines inoperative					

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
(3) Visual.					
(a) Normal.		X	X	X	
(b) Steep.		X	X	X	
(c) Shallow.		X	X	X	
(d) CAT A profile.		X	X	X	
(e) CAT B profile.		X	X	X	
(f) External load.			X	X	
(g) Visual segment from precision approach.		X	X	X	
(h) Visual segment from circling approach.		X	X	X	
(i) Abnormal/emergency procedures, for example:		X	X	X	
1. Directional control failure					
2. Hydraulics failure					
3. Fuel governing failure					
4. Autorotation					
5. Stability system failure					
6. Other					
j. Landing.					
(1) Normal.					
(a) From a hover.			X	X	
(b) Running.		X	X	X	
(c) Pinnacle/platform.			X	X	
(d) Confined area.			X	X	
(e) Slope.			X	X	
(f) Crosswind/tailwind.		X	X	X	
(2) Abnormal/emergency procedures, for example:					

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
(a) From autorotation.			X	X	
(b) One engine inoperative.		X	X	X	
(c) Directional control failure.			X	X	
(d) Hydraulics failure.		X	X	X	
(e) Stability system failure.		X	X	X	
(f) Other.		X	X	X	
<b>k. Any Flight Phase.</b>					
(1) Helicopter and powerplant systems operation.		X	X	X	
(a) Air conditioning.					
(b) Anti-icing/deicing.					
(c) Auxiliary powerplant.					
(d) Communications.					
(e) Electrical.					
(f) Fire detection and suppression.					
(g) Stabilizer.					
(h) Flight controls.					
(i) Fuel and oil.					
(j) Hydraulic.					
(k) Landing gear.					
(l) Oxygen.					
(m) Pneumatic.					
(n) Powerplant.					
(o) Flight control computers.					
(p) Stability and control augmentation.					
(q) Other.					



SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
(2) Flight management and guidance system.		X	X	X	
(a) Airborne radar.					
(b) Automatic landing aids.					
(c) Autopilot.					
(d) Collision avoidance system.					
(e) Flight data displays.					
(f) Flight management computers.					
(g) Head-up displays.					
(h) Navigation systems.					
(i) Other.					
(3) Airborne procedures.		X	X	X	
(a) Holding.					
(b) Air hazard avoidance.					
(c) Retreating blade stall recovery.					
(d) Mast bumping.					
(e) Other.					
<b>1. Engine Shutdown and Parking.</b>		X	X	X	
(1) Engine and systems operation.					
(2) Parking brake operation.					
(3) Rotor brake operation.					
(4) Abnormal/emergency procedures.					
<b>2. VISUAL SYSTEM</b>					
a. Accurate portrayal of environment relating to simulator attitudes and position.		X	X	X	
b. The distances at which airport/heliport features are visible should not be less than those listed below. Distances are measured from runway threshold to a helicopter aligned with the runway on an extended 3-degree glideslope.		X	X	X	

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
<p>(1) Runway definition, strobe lights, approach lights, runway edge white lights and VASI/PAPI lights from 5 statute miles (8 kilometers) of the runway threshold.</p> <p>(2) Runway centerline lights, helipad perimeter lights, and taxiway definition from 3 statute miles (4.8 kilometers).</p> <p>(3) Threshold lights and touchdown zone lights from 2 statute miles (3.2 kilometers).</p> <p>(4) Runway and helipad markings within range of landing lights for night scenes; as required by 3 arc-minute resolution on day scenes.</p>					
<p>c. Representative airport/heliport scene content including the following:</p> <p>(1) Airport runways, helipads, and taxiways.</p> <p>(2) Runway/helipad definition.</p> <p>(a) Runway/helipad surface.</p> <p>(b) Lighting for the runway in use, including runway edge and centerline lighting, touchdown zone, VASI, and approach lighting of appropriate colors.</p> <p>(c) Helipad perimeter and taxiway lights.</p>		X	X	X	
d. Operational landing lights.		X	X	X	
<p>e. Instructor controls of the following:</p> <p>(1) Cloud base-cloud tops.</p> <p>(2) Visibility in statute miles (km) and RVR in feet (meters).</p> <p>(3) Airport/heliport selection.</p> <p>(4) Airport/heliport lighting.</p>		X	X	X	
f. Visual system compatibility with vehicle mathematical model.		X	X	X	
g. Visual cues to assess sink rate, translational rates, and height AGL during landings.		X	X	X	
<p>h. Dusk and night visual scene capability.</p> <p>(1) Surface on runways/helipads, taxiways, and ramps.</p>			X	X	

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
(2) Terrain features.					
<b>i. Minimum of three specific airport/heliport scenes.</b>  (1) Surfaces and markings on runways, helipads, taxiways, and ramps.  (2) Lighting of appropriate color for all landing areas including runway edge, centerline, VASI/PAPI, and approach lighting for the runway in use.  (3) Helipad perimeter and taxiway lighting.  (4) Ramps and terminal buildings and vertical objects which correspond to an operator's LOFT and Line Oriented Simulator scenarios (LOS).			X	X	
<b>j. General terrain characteristics and significant landmarks.</b>			X	X	
<b>k. At and below an altitude of 2,000 ft. (610 m) height above the airport/heliport and within a radius of 10 miles (16.1 kilometers) from the airport/heliport, weather representations, including the following:</b>  (1) Variable cloud density.  (2) Partial obscuration of ground scenes; the effect of a scattered to broken cloud deck.  (3) Gradual break out.  (4) Patchy fog.  (5) The effect of fog on airport/heliport lighting.			X	X	
<b>l. A capability to present ground and air hazards such as another aircraft crossing the active runway and converging airborne traffic.</b>			X	X	
<b>m. Operational visual scenes which provide a cue rich environment sufficient for precise low airspeed/low altitude maneuvering and landing.</b>			X	X	
<b>n. Operational visual scenes which portray representative physical relationships known to cause landing illusions such as short runways, landing approaches over water, uphill or downhill landing areas, rising terrain on the approach path, and unique topographic features.</b>				X	

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
o. Special weather representations of light, medium, and heavy precipitation near a thunderstorm on takeoff, approach, and landing at and below an altitude of 2,000 feet (610 m) above the airport/heliport surface and within a radius of 10 miles (16.1 kilometers) from the airport/heliport.				X	
p. Wet and snow-covered landing areas including runway/helipad lighting reflections for wet, partially obscured lights for snow, or suitable alternative effects.				X	
q. Realistic color and directionality of airport/heliport lighting.				X	
r. Weather radar presentations in helicopters where radar information is presented on the pilot's navigation instruments. Radar returns should correlate to the visual scene.				X	
s. Dynamic visual representation of rotor disk tip path plane.				X	
t. Freedom from apparent quantization (aliasing).				X	
<b>3. SPECIAL EFFECTS.</b>					
a. Buffet rumble, oleo deflections, effects of groundspeed and uneven surface characteristics.		X	X	X	
b. Buffet due to transverse flow effect.		X	X	X	
c. Buffet during extension and retraction of landing gear.		X	X	X	
d. Buffet due to retreating blade stall.		X	X	X	
e. Buffet due to settling with power.		X	X	X	
f. Representative touchdown cues for landing gear.		X	X	X	
g. Rotor vibrations.		X	X	X	
h. Representative brake and tire failure dynamics and decreased brake efficiency due to high brake temperatures based on helicopter related data. These representations must be realistic enough to cause pilot identification of the problem and implementation of appropriate procedures. Simulator pitch, side loading, and directional control characteristics should be representative of the helicopter.			X	X	

SIMULATOR STANDARDS—Continued	SIMULATOR LEVEL				COMMENTS
	A	B	C	D	
i. Sound of precipitation and significant helicopter noises perceptible to the pilot during normal operations and the sound of a crash when the simulator is landed in excess of landing gear limitations. Significant helicopter noises should include engine, rotor, transmission, landing gear, and other airframe sounds to a comparable level as that found in a helicopter. The sound of a crash should be related in some logical manner to landing in an unusual attitude or in excess of the structural gear limitations of the helicopter.			X	X	
j. Effects of airframe icing (if applicable).			X	X	

**FIGURE 1. SAMPLE LETTER OF REQUEST**

Name, POI, \_\_\_\_\_ (Operator)

FAA FSDO \_\_\_\_\_

Address

City, State, Zip

Dear Mr. \_\_\_\_\_ :

(name)\_\_\_\_\_ requests evaluation of our (type)\_\_\_\_\_ helicopter 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 certify that it meets all applicable requirements of Advisory Circular (AC) 120-XX. Appropriate hardware and software configuration control procedures have been established. Our pilots, (name)\_\_\_\_\_ have assessed the simulator and found that it conforms to the (type)\_\_\_\_\_ helicopter cockpit configuration and that the simulated systems and subsystems function equivalently to those in the helicopter. Our pilots have also assessed the performance and handling qualities of the simulator and find that it represents the respective helicopter.

(Added comments, as desired)

Sincerely,

## FIGURE 2. SAMPLE SIMULATOR INFORMATION PAGE

### OPERATOR

OPERATOR SIMULATOR CODE:	H-62 #1
HELICOPTER MODEL:	Whirly H-62
AERODYNAMIC DATA REVISION:	H-62 CPX-8D July 1988
ENGINE MODEL AND REVISION:	CPX-8D-RPT-1 June 1988
FLIGHT CONTROLS DATA REVISION:	H-62 May 1988
FLIGHT MANAGEMENT SYSTEM:	Berry XP
SIMULATOR MODEL AND MANUFACTURER:	MTD-62 Tinker
DATE OF SIMULATOR MANUFACTURE:	1988
SIMULATOR COMPUTER:	CIA
VISUAL SYSTEM MODEL AND MANUFACTURER:	ClearView P-T 5 Channel
VISUAL SYSTEM COMPUTER:	LMB-6
MOTION SYSTEM:	Tinker 6 DOF

### FIGURE 3. SAMPLE QTG COVER PAGE

OPERATOR NAME

OPERATOR ADDRESS

FAA QUALIFICATION TEST GUIDE

(HELICOPTER MODEL)

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

(Simulator Location)

FAA Initial Evaluation

Date: \_\_\_\_\_

\_\_\_\_\_  
(Operator Approval)      Date: \_\_\_\_\_

\_\_\_\_\_  
FAA Manager, National  
Simulator Program      Date: \_\_\_\_\_



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## APPENDIX 5. ABBREVIATIONS AND ACRONYMS

A - Amplitude  
AC - Advisory Circular  
AGL - Above Ground Level  
APU - Auxiliary Power Unit  
ASR - Airport Surveillance Radar  
C - Centigrade  
CAT I - Category I Approach  
CAT II - Category II Approach  
CAT A - Category A Takeoff or Landing  
CAT B - Category B Takeoff or Landing  
CDP - Critical Decision Point  
CFR - Code of Federal Regulations  
CG - Center of Gravity  
daN - decaNewtons  
DOF - Degrees of Freedom  
FAA - Federal Aviation Administration  
FAR - Federal Aviation Regulations  
fpm - Feet Per Minute  
FSDO - Flight Standards District Office  
ft - Foot or Feet  
g - Gravity  
G/S - Glideslope  
IGE - In Ground Effect  
ILS - Instrument Landing System  
in - Inches  
k - Kilometers  
kt - Knot(s)  
lb - Pound(s)  
LDP - Landing Decision Point  
LOFT - Line Oriented Flight Training  
LOS - Line Oriented Simulator Scenarios

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## ABBREVIATIONS AND ACRONYMS - Continued

m - Meter(s)  
MLS - Microwave Landing System  
mm - Millimeter(s)  
MQTG - Master Qualification Test Guide  
m/sec - Meter(s) Per Second  
NDB - Nondirectional Beacon  
NSPM - National Simulator Program Manager  
OGE - Out of Ground Effect  
OTP - Optional Test Program  
P - Period  
PAPI - Precision Approach Path Indicator  
PAR - Precision Approach Radar  
POI - Principal Operations Inspector  
QTG - Qualification Test Guide  
RoD - Rate of Descent  
RNAV - Area Navigation  
RPM - Revolutions Per Minute  
RVR - Runway Visual Range  
SCIG - Simulator Component Inoperative Guide  
sec - Second(s)  
SOC - Statement of Compliance  
TACAN - Tactical Air Navigation  
T(A) - Tolerance Applied to Amplitude  
T(P) - Tolerance Applied to Period  
TBD - To Be Decided  
U.S. - United States  
VASI - Visual Approach Slope Indicator  
VGS - Visual Ground Segment  
VOR - Very High Frequency Omnidirectional Range