

## ELITE Advanced Aviation Training Device Model TH-22 Piston Rotary Wing AC 61-136



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ADVANCED AVIATION TRAINING DEVICE  
APPROVAL QUALIFICATION GUIDE  
FOR AZURE COMPUTING, INC (d.b.a. **ELITE** Simulation Solutions)  
. **ELITE**® ATD SYSTEMS

**MODEL: ELITE AATD TH-22 Helicopter**

**A. MODEL DESCRIPTION**

The purpose of this guide is to provide information to the FAA for evaluation of the **ELITE**® TH-22 Helicopter AATD system. This trainer is a generic single engine piston rotary wing aircraft modeled after the Robinson R22 Beta II. It is a dual pilot, dual seat, open cockpit training device for IFR and VFR training. All guidance and standards specified in AC 61-136 has been met.

1. The TH-22 software engine and visual scenery/navigation database was developed by Laminar Research (X-Plane 10), Columbia, South Carolina. The flight data model, instrument graphics and systems were modeled and/or modified by Daedalus Technologies and ELITE Simulation Solutions, Oviedo, Florida. The GNS430W or 530W and data updates was developed by FlyThisSim, LLC, San Luis Obispo, California
2. The FAA required compliance software utilities, assembly, quality assurance and technical support are provided by ELITE Simulation Solutions and Daedalus Technologies.

**B. CONTROL REQUIREMENTS: PHYSICAL CONTROLS**

Physical control requirements (as listed in Appendix A of this qualification guide) meet the requirements established under AC 61-136.

1. A cyclic stick that tilts the main rotor disk by changing the pitch angle of the blades in their cycle of rotation.
2. Anti-torque tail rotor pedals that allow continuous adjustment of the tail rotor/heading.
3. Collective pitch control that changes the pitch angle of all main rotor blades simultaneously.
4. Mixture, throttle, governor switch and clutch control that allows engine start / shutdown and allows for continuous movement from idle to full power settings. Also allows for proper corrective action for autorotations.
5. Physical controls applicable to the aircraft for the following:
  - a. Engine start
  - b. Warning horns as appropriate for the R22( low rotor RPM).
  - c. Pitot heat
  - d. Alternator
  - e. Battery
  - f. Magnetos
  - g. Radio master and avionics
  - h. Taxi, landing, anti-collision and position light switches
  - i. NAV/COM radio
  - j. ADF
  - k. DME
  - l. Transponder
  - m. GPS
  - n. Timer / stopwatch
  - o. Master caution panel
  - p. OAT gauge
  - q. Magnetic compass
6. Control Inputs: The transport delay between the control inputs to recognizable system response is less than 150 milliseconds for all controls. Calculated transport delay is approximately 25 milliseconds or less.

6a. At each startup the software runs a series of tests and will display a conformation message if all controls are working properly or appropriate warning messages if any design parameter is out of tolerance. It will also advise that weather parameters must comply with IFR conditions per 14 CFR if IFR credit is to be given.

## **C. DISPLAY REQUIREMENTS**

The rotary wing aircraft module in this qualification guide meets or exceeds the display requirements of AC61-136:

1. Instruments and indicators:
  - a. Flight instruments are in a Standard Configuration, represented as separate traditional round flight instruments or as an electronic primary flight instrument display with reversionary/backup flight instruments.
  - b. An adjustable altimeter that operates throughout the normal operating range of the aircraft being replicated which has incremental markings of 20 feet.
  - c. A magnetic compass which displays incremental markings typical of that shown in the family of airplanes represented
  - d. Heading indicator with incremental markings of 5 degrees and display on a 360 circle (for Standard Configuration).
  - e. An airspeed indicator with incremental markings appropriate to the aircraft being replicated.
  - f. Vertical speed indicator with incremental markings of 100 feet for the range of  $\pm 1000$  feet and incremental markings of 500 feet for the remaining  $\pm 2000$  feet or appropriate to the aircraft being replicated.
  - g. A skid and slip indicator with coordination information displayed in the conventional skid ball format with markings for the center position is present.
  - h. The attitude indicator is appropriate to the aircraft being replicated with incremental markings for each 5 degrees of pitch, from 25 degrees pitch up to 25 degrees pitch down. Left and right bank angles are marked at 10, 20, 30, and 60 of bank.
  - i. Engine instruments and markings for normal ranges and minimum and maximum limits applicable to the helicopter being replicated.
  - j. Rotor RPM displays with appropriate transient and red line limitations.
  - k. Suction gauge not applicable
  - l. Flap indicator not applicable
  - m. Pitch trim indicator not applicable
  - n. Communication radios with digital displays of the radio frequency in use.
    - o. One navigation radio for GPS/VNAV/VOR/ILS frequency in use, and one radio display for the NDB frequency in use. The navigation radio is equipped with an aural identification feature and there is a marker beacon receiver with audible and visual representation.
  - p. Stop watch/ timer that display minutes and seconds.
  - q. Magnetic compass with incremental markings of 5 degrees that display proper lead and lag / acceleration and deceleration during turns.
  - r. Transponder which displays the current transponder setting.
  - s. Fuel quantity indicator which displays the fuel remaining.

2. All instrument displays listed above are visible during all flight operations. The update rate of all displays provide an image that:
  - a. Does not appear to be out of focus.
  - b. Does not appear to jump or step to a distracting degree during operation.
  - c. Does not appear with distracting jagged lines or edges.
3. The display update varies with the speed of the computer processor, memory, and graphics card. If the computer system being used meets or exceeds the programs minimum system requirements, then the refresh rate will be faster than 10 Hz (approximate refresh rate will be 20 Hz or faster). Minimum IBM-compatible system requirements 2.6Ghz processor, 512 Mb RAM, 80 GB HD, 128 Mb nVidia or open GL compatible video card; USB, DVD drive, LAN connection (10/100) and Windows 2000, XP, Windows 7 or Windows 8 operating system.

“Display updates” display all changes that meet or exceed the values listed in AC61-136. The “display updates” display the following changes for each of the instruments listed below.

- a. Airspeed indicator: Displays ½ to 1 knot of change.
  - b. Attitude indicator: Displays 1/3 to ½ degree of pitch change and ½ to 1 degree of bank change.
  - c. Altimeter: Displays 2.78 feet of change.
  - d. Turn and Bank: Displays 1/20 of standard rate turn changes.
  - e. Heading Indicator: Displays ½ degree of change.
  - f. VSI: Displays 10 fpm of change.
  - g. Engine and Rotor Tachometers: Displays 20 RPM of change.
  - h. VOR/ILS: Displays ½ degree of change for VOR or 1/8 degree of change for ILS.
  - i. ADF: Displays 1/2 degree of change.
  - j. Timer: Displays 1 second of change.
4. All displays reflect the dynamic behavior of an actual aircraft display.

## **D. FLIGHT DYNAMICS**

1. The flight dynamics are comparable to the aircraft being replicated.
2. The aircraft performance parameters are comparable to the aircraft being replicated (including hovering/sideward/forward/rearward flight, IGE and OGE).
3. The vertical lift component changes as a function of bank comparable to the aircraft being replicated.
4. Changes of gear settings changes: NA
5. The presence and intensity of wind and turbulence are reflected in the handling and performance qualities comparable to the aircraft being replicated.

## **E. INSTRUCTIONAL MANAGEMENT**

1. The instructor has the ability to freeze the simulation at any point using the following controls listed: touchpad IOS (Instructor / Operator Station) and FREEZE button on the pilot station cyclic handle.
2. The instructor can manipulate the following system parameters via virtual controls independent of the simulation with the following methods or devices.
  - a. Aircraft geographic location: touchpad
  - b. Aircraft heading: touchpad
  - c. Aircraft airspeed: touchpad
  - d. Aircraft altitude: touchpad
  - e. Wind direction and speed: touchpad
  - f. Turbulence: touchpad
1. The system is capable of recording both horizontal and vertical tracks of the aircraft movement and can be stored and played back for review using: touchpad IOS.
2. The instructor can disable any of the instruments prior to the beginning of a training session and can simulate failure during a training session without stopping or freezing the simulation to effect the failure using: touchpad IOS.

3. The software has navigational databases for the entire United States. All navigational data is based on procedures as published in 14 CFR Part 97 and is updated and maintained by ELITE Simulation Solutions..

## **F. TASK REQUIREMENT LIST**

Using the **ELITE**® ATD configuration in this guide, a flight school could incorporate all of the items listed in AC61-136 under the Task Requirement List into an integrated ground and flight instrument training curriculum. Course syllabuses developed companies such as AOPA's Air Safety Foundation, ASA, Jeppesen, or by the school its self, should be acceptable, as long as it incorporates the items listed under the Task Requirement List in AC61-136.

## **G. ADVANCED ATD DESIGN CRITERIA**

The **ELITE**® **Model AATD TH-22 Helicopter** exceeds the requirements for Basic ATD approval criteria appropriate for Advanced ATD simulation technology:

1. A realistic cockpit design and instrument panel arrangement representing a generic model rotary wing aircraft cockpit;
2. Cockpit knobs/system controls/switches/switch panels in realistic sizes and design appropriate to each intended function, in the proper position and distance from the pilot's seated position, and representative of the class of airplane being represented;
3. Primary flight and navigation instruments approximately life sized that exhibit neither stepping nor excessive transport delay and arranged so as to observe trends and provide a realistic scan pattern.
4. Digital avionics panel (Optional OEM PFD and MFD which may provide functions of the digital avionics panel).
5. Pitch trim not applicable
6. A visual system that provides acceptable cues in both day and night VFR/IFR conditions to enhance a pilot's visual orientation in the vicinity of an airport;
7. A separate instructor station to permit effective interaction without interrupting the flight in overseeing the pilot's horizontal and vertical flight profiles in real time and space, change weather conditions (ceilings, visibilities, wind speed, direction, turbulence and icing conditions) and invoke failures in navigation, instruments, radio receivers, engine power and other airplane systems.
8. Adjustable cockpit seating accommodates proper ergonomics and spatial orientation for the pilot in relation to the cockpit, instruments and glare shield.
9. Anti-torque pedals are secured to the cockpit floor structure in proper relation to cockpit orientation

## **H. FUNCTION AND SUBJECTIVE TEST CRITERIA**

The ELITE Model TH-22 helicopter meets the criteria established for Basic and Advanced ATD status and complies with the checklist performance regulatory tasks/maneuvers and /or procedures as outlined in AC 61-136 as applicable under 14 CFR parts 61 and 141.

The TH-22 trainer components consist of:

1. ELITE dual flight controls, dual seat and open cockpit design based on the ergonomics of the R22.
2. TH-22 software (flight data model, navigation, engine and systems instrumentation) and Instructor / Operator Station (IOS) installed on a Windows touch screen tablet using WIFI connectivity to the host computer.
3. One OTS (off the shelf) 32/64 bit computer system with Windows 7 or Windows 8.x Operating System
4. One 22 inch widescreen and one 10 inch LED monitors for instrument displays
5. Three 55 inch or larger LED TVs with stands for external visual scenery display.
6. Operator's Manual



**Fig 1: Flight Deck Layout**



**Fig 2: Center Console**





**Fig 3: Master Caution and Warning Lights**



**Fig 4: Adjustable Seat & Hobbs Meter**



**Fig 5: Switch Panel**





**Fig 6: Main Instrument Panel**



**Fig 7: GNS 530 GPS (GNS 430 available)**



**Fig 8: Flight Controls; Cyclic, anti-torque pedals and Collective**



**Fig 9: Circuit Breaker Panel**

**APPENDIX B – Advanced ATD Checklist**

**Advanced ATD Checklist IAW AC 61-136**

**FIGURE 1. AVIATION TRAINING DEVICE CHECKLIST**

Functions and Maneuvers	Satisfactory? Yes/No
<b>a) Preparation for Flight</b>	
1) Preflight	YES
<b>b) Pre-Takeoff</b>	
1) Engine start	YES
2) Brake operation	NA
<b>c) Takeoff</b>	
<b>1) AIRPLANE Takeoff</b>	NA
i) Power plant checks	NA
ii) Acceleration characteristics	NA
iii) Nose wheel and rudder steering	NA
iv) Effect of crosswind	NA
v) Instrument	NA
vi) Landing gear, wing flap operation	NA
<b>2) HELICOPTER Takeoff</b>	
i) Power plant checks	YES
ii) From Hover	YES
iii) From Ground	YES
iv) Vertical	YES
v) Running	YES
<b>d) In-Flight Operation</b>	
<b>1) AIRPLANE In-flight Operation</b>	
i) Climb	NA
(a) Normal	NA
(b) One engine inoperative procedures	NA
ii) Cruise	NA
(a) Performance Characteristics (speed vs. power)	NA
(b) Normal & Steep Turns	NA
(c) Performance Turns	NA
(d) Approach to Stalls, i.e. stall warning	NA
(e) High Angle of Attack Maneuvers	NA
(f) In Flight engine Shutdown	NA
(g) In Flight engine Start	NA
<b>2) HELICOPTER In Flight Operation</b>	
i) Hovering	YES
(a) Forward	YES
(b) Rearward	YES
(c) Sideward	YES
(d) Turns	YES
ii) Climb	YES
iii) Cruise	YES
(a) Performance Characteristics	YES
(b) Turns	YES

(i) Recovery	YES
(ii) Skidding	YES
(iii) Slipping	YES
(c) In Flight Engine Shutdown	YES
(d) In Flight Engine Start	YES
iv) Decent	YES
e) Approaches	YES
1) Non-Precision	YES
i) GPS- WAAS (optional)	YES*
ii) GPS- LAAS (optional)	YES
iii) All Engines Operating	YES
iv) One or More Engines Inoperative	NA
v) Approach Procedures ( NDB, VOR, DME Arc, LOC/BC,	YES
2) Precision	YES
i) PAR – Normal	YES
ii) ILS	YES
iii) GLS	NA
iv) Effects of Crosswind	YES
v) With engine(s) inoperative	YES
vi) Missed Approach	YES
(a) Normal	YES
(b) With Engine(s) inoperative	NA
(c) From Steep Glide Slope	YES

<b>Functions and Maneuvers</b>	<b>Satisfactory? Yes/No</b>
<b>f) Surface Operations (AIRPLANE-Post Landing)</b>	
1) Landing roll	NA
2) Braking Operation	NA
3) Reverse thrust Operation, if applicable	NA
<b>g) Any Flight Phase</b>	
<b>1) Aircraft and Power Plant Systems</b>	
i) Electrical	YES
ii) Flaps (Airplane)	NA
iii) Fuel & Oil	YES
iv) Landing Gear(Airplane)	NA
<b>2) Flight Management and Guidance Systems</b>	
i) Auto Pilot (AATD only)	NA
ii) Flight Director (AATD only) / System Displays	NA
iii) Navigation Systems	YES
iv) Stall Warning Avoidance (Airplane)	NA
v) Multi-Function Displays	NA
<b>3) Airborne Procedures</b>	
i) Holding	YES
<b>4) Engine Shutdown and Parking</b>	
i) Systems operation	YES
ii) Parking Brake Operation (Airplane)	NA

\*GPS WAAS available with OEM Garmin equipment only.

**APPENDIX C - Aircraft Performance Information – TH-22 Single Engine Piston Helicopter**

<b>Instruments</b>	<b>Markings</b>	<b>Range</b>
<b>Airspeed Indicator</b>	<b>Green Arc Red Line</b>	<b>50 to 102 KIAS 102 KIAS</b>
<b>Rotor Tachometer</b>	<b>Upper red line Yellow arc Green arc, O-360 eng Green arc, O-320 eng* Yellow arc, O-360 eng Yellow arc, O-320 eng* Lower red line Yellow arc</b>	<b>110% 104% to 110% 101% to 104% 97% to 104% 90% to 101% 90% to 97% 90% 60% to 70%</b>
<b>Engine Tachometer</b>	<b>Upper red arc Green arc, O-360 eng Green arc, O-320 eng* Lower red arc, O-360 eng Lower red arc O-320 eng* Yellow arc</b>	<b>104% to 1120% 101% to 104% 97% to 104% 90% to 101% 90% to 97% 60% to 70%</b>
<b>Engine Oil Pressure</b>	<b>Lower red line Lower yellow arc Green arc Upper yellow arc Upper red line</b>	<b>25 psi 25 to 55 psi 55 to 95 psi 95 to 115 psi 115 psi</b>
<b>Engine Oil Temperature</b>	<b>Green arc Red line</b>	<b>75 to 245 deg F (24 to 118C) 245 deg F (118 C)</b>
<b>Cylinder Head Temperature</b>	<b>Green arc Red Line</b>	<b>200 to 500 deg F (93 to 260 C) 500 deg F (260 C)</b>
<b>Manifold Pressure</b>	<b>Standard R22 Yellow arc Red line</b>	<b>23.2 to 25.9 in. Hg 25.9 in. Hg</b>
<b>Carburetor Air Temperature</b>	<b>Yellow arc</b>	<b>-15 to 5 deg C</b>
<ul style="list-style-type: none"> <li>Tachometers which show green arc from 101% to 104% RPM may be installed</li> </ul>		