Please note that this document is only applicable to the Piper Archer PA-28 BATD and AATD pilot training simulator and the FTD (Flight Training Device) Level 5 professional training simulator. For information regarding the Piper Archer PA-28 FFS Full Flight Simulator Level A-D or uncertified, please see the appropriate Volarent training document. (VT-28-IO-CO-P)

Contents:

5. **Training information**
6. **Simulated Systems**
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Changes for the Piper Archer PA-28 (Aviation Training Device / Basic Aviation Training Device) [ATD / BATD]

8. **Key Features**
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11. **Key Features**
12. **Technical Specifications and Requirements**
13. **Simulated Systems**

For a complete breakdown of Piper Archer PA-28 equipment and parts provided by Piper and other relevant technical document providers, please visit Volarent.aero/pa28downloads

All information in this technical specifications document is made in accordance with FAA AC 61-136B Appendix C and Appendix D for FAA ATD AATD certification.

Visual System Description

The non-collimated visual system consists of three digital video projectors (BENQ, MH535) located above the cabin. The white curved screen in front of the PA-28 simulator is used as the screen.

The visual simulation platform of P3D is used for image generation. The image of a terrestrial and celestial surface is projected on the curved screen with the dimensions of 400 x 200 cm. The horizontal field of view is 180° (or 220°) and the vertical field of view is 45°. The refresh rate can be shown on the screen from JetStream, indicating the visual current response rate for the visual system.

Glossary of terms and symbols used

ADF Automatic Direction Finder

AFM Aircraft Flight Manual

APU Auxiliary power unit

ATC Air Traffic Controller

ATD Aviation Training Device

AATD Advanced Aviation Training Device

BATD Basic Aviation Training Device

CDI Course Deviation Indicator

CLS Control Loading System

ECU Engine Control Unit

FAA Federal Aviation Authority

FD Flight Director

FPM Feet per minute

QAG Qualification and approval guide

GPS Global Position System

GS Glideslope

IFR Instrument Flight Rules

IOS Instructor Operating Station

ILS Instrument Landing System

KIAS Knots - Indicated Airspeed

KTAS Knots - True Airspeed

LOC Localizer

MFD Multi Functional Display

M/M Make/Model

NDB Non-directional Radio Beacon

NM Nautical Miles

PFD Primary Flight Display

RMI Radio Magnetic Indicator

SBT Scenario-Based Training

VFR Visual Flight Rules

VOR Very High Frequency Omni-directional Radio-range

VSI Vertical Speed Indicator

Technical Document Introduction

The operator of all certified FAA training devices is required to become proficient in all operations before using it to satisfy any pilot experience requirements specified in the code of federal regulations. This includes maintaining its condition and functionality. This PA-28 AATD (BATD or FTD) simulator must be maintained to its original performance and functionality, as demonstrated during the FAA functional evaluation after delivery. This PA-28 Volarent flight simulator cannot be used to log pilot time unless all components of the trainer are correct and in normal working order according to the Volarent user manual.

Only the Piper PA-28 configurations approved for this model may be utilized when satisfying FAA flight experience or training requirements. Any additions, changes, or modifications to this Piper PA-28 simulator, or the associated configurations, must be evaluated and approved in writing by the General and Commercial Division. This does not prohibit software updates that do not otherwise change the appearance of the systems operation. Operators who use these

Volarent flight simulator procedural trainers to satisfy FAA pilot training or experience requirements specified in part 61 or part 141 are obligated to allow FAA inspection to ensure acceptable function and compliance is being met.

Any questions concerning FAA approval or use of ATD simulators should be directed to the General Aviation and Commercial Division.

JetStream 1 & Instructor Station information

The JetStream 1 software and instructor station is located behind the pilot seats to ensure the ability to see the instrument panels directly and monitor students closely.

In the central part of the station the following pages of flight parameters are placed:

1. Common - loading flights, choosing airports, setting the plane on prescribed approach positions, and editing main flight parameters
2. Environment - managing the weather conditions
3. Instruments - Primary Flight Display and Multi Function Display
4. Map - map with navigation information and flight path

5. Profiles - horizontal and vertical flight profiles
6. Approach - trajectory for the approach for landing with ILS turned on
7. Failures - page showing the failures of various plane systems
8. Fuel / Cargo - cargo and fuel loading
9. Circuit Breakers - management of simulated component circuit breakers

The map section of JetStream 1 enables instructors to locate the aircraft at the beginning and during flight sessions. It displays the current position of the aircraft and its flight track during the session.

The section also has visual layers which can be enabled and disabled on the map such as runways, VOR/DME, NDB, ILS, Markers, and Paths.

Disclaimer: Information in this document pertaining to the real aircraft (not specifically flight simulators) may not be accurate or current with the actual aircraft or Piper Aviation and is not valid for flight planning or any other aircraft operations. No warranty of fitness for any purpose is made or implied. Flight planning or any other aircraft operations should only be done using official technical information provided by Piper Aviation or FAA. (Information provided by GlobalAir)

To view a list of all requirements and details listed in Parts 61/141 of the FAA Code of Federal Regulations, visit http://www.volarent.aero/ecfr.html.

Piper Archer PA-28 ATD / AATD

1. Simulator Profile

The Volarent Aerospace Piper Archer PA-28 Commercial Procedural Trainer (VT-28-IO-CO-P) is the ATD (Aviation Training Device) AATD (Advanced Aviation Training Device) edition of the PA-28 build from Volarent Aerospace. The purpose of this aircraft is for training airline pilots on procedures and familiarizing them with the aircraft while in-flight, arrival, and departure. The features included in the Volarent Piper Archer PA-28 far exceed the requirements set by FAA AATD, and make it among the most capable AATD trainers in the industry for airlines, flight schools, and other professional clients.

The Piper PA-28 is a flight simulator that meets the criteria outlined in the FAA Advisory Circular requirements for an Aviation Training Device AATD. The system provides an adequate training platform for both procedural and operational performance tasks specific to the ground and flight training requirements for the Private Pilot Certificate, Commercial Pilot Certificate, Airline Transport Pilot (ATP), and Flight Instructor Certificate per parts 61 and parts 141 of the FAA documentation. The simulator also provides an adequate platform and design for both procedural and operational performance tasks required for instrument experience, and the instrument proficiency checks (IPC) including pilot time.

The Volarent Aerospace Piper Archer PA-28 is based on the dimensions and layout of the production PA-28 airplane. This simulator closely represents the overall functionality, performance, and instrumentation for the PA-28. The platform consists of a flight deck, instrument panels, avionics panel, and associated flight and instrument controls. A combination of hardware and software components are assembled and functionally checked by Volarent Aerospace. All hardware components are designed and installed so the flight deck has the appearance and feel of an actual Piper PA-28 aircraft.

This PA-28 simulator provides a realistic flight deck design, avionics interface, and reliable hardware/software performance. This platform provides an effective training environment for students and pilots in training. This includes the ability to accomplish scenario based flight training activities, instrument procedures, pilot proficiency evaluations, simulated equipment failures, emergency procedures, and facilitates increased pilot competency.

2. Key Features

The Volarent Aerospace Piper Archer PA-28 (FAA ATD, AATD) Commercial Procedural Trainer (VT-28-IO-CO-P) contains the following features as an accurate simulator replica.

The Volarent PA-28 simulator includes a realistic shrouded enclosed cockpit design with instrument panel arrangement representing the actual PA-28 aircraft as a specific model design.

All cockpit knobs, system controls, switches, and/or switch panels are realistically sized and designed appropriately to each intended PA-28 function. In addition, they are all in the proper positions and distances from the pilot's seated position and representative of the actual PA-28 aircraft.

The primary flight and navigation instruments are appropriately sized and properly arranged according to the actual PA-28 aircraft. All navigation instruments are free from excessive stepping or transport delays. A digital avionics panel is also included.

The GPS navigator contains a moving map display, and is interchangeable with most desired navigational equipment requested by the customer.

Two-axis autopilot is available depending on the specific configuration selected by the customer.

Pitch trim (manual or electric pitch trim depending on the selected configuration) permitting indicator movement either electrically or analog (depending on selection) is included within the accurate PA-28 trim ratio.

In addition, an independent visual system panel is included providing realistic cues in both day and night VFR/IFR meteorological conditions to enhance a pilot's visual orientation in the vicinity of an airport including:

- Adjustable visibility parameters
- Adjustable ceiling parameters

The PA-28 simulator includes a fixed pilot seat appropriate to the actual PA-28 aircraft configuration, including adjustable height and adjustable forward/aft seat position. Below this are rudder pedals secured to the PA-28 cockpit floor structure that are physically secured in proper relation to the flight deck orientation.

A push-to-talk switch is located on the control yoke for air traffic control services provided by the software selected, or additional add-on networks such as PilotEdge, IVAO, or VATSIM.

The included instructor station is capable of effective interaction without interruption of the flight, allowing the instructor to oversee the pilot's horizontal and vertical flight profiles in real time/space. This also includes the ability within Volarent Jetstream 1 to do the following:

1. Oversee tracks along published airways, holding entries and patterns, and LOC and GS alignment/deviation (or other approaches with a horizontal and vertical track).

2. Function as air traffic control (ATC) in providing vectors, etc., change in weather conditions, ceilings, visibilities, wind speed and direction, light/moderate/severe turbulence, and icing conditions.

3. Invoke failures in navigation and instruments, radio receivers, landing gear and flaps, engine power (partial/total), and other aircraft systems (pitot, electric, static, etc) by using the computer inputs.

Instructor Station

A separate instructor station is included with Volarent's JetStream 1 software (volarent.aero/jetstream) to permit effective interaction without interrupting the flight in overseeing the pilot's horizontal and vertical flight profiles in real time. The instructor station allows an instructor to oversee tracks along published airways, holding entries and patterns, LOC and GS alignment/deviation, and approaches with a horizontal and vertical track. In addition, it allows you to function as an air traffic control in providing vectors. Changes in weather conditions, ceilings, visiblities, wind speed and direction, turbulence settings, and icing conditions are all controlled from the instructor station.

An instructor may also launch failures during flight in navigation, instrument, radio, landing gear, flaps, engine power (partial or total), and other aircraft systems (pitot, electric, static, etc) by using the JetStream 1 software.

3. Technical Specifications and Requirements

The Volarent Piper Archer PA-28 (VT-28-IO-CO-P) simulator contains the following training content and logging provisions in accordance with AC 61-136B Appendix D of the FAA Advisory for FAA ATD AATD certification.

Flight Instruments

- Basic attitude flying
- Straight and level flight
- Change of airspeed
- Constant airspeed climbs
- Constant airspeed descents
- Constant rate climbs
- Constant rate descents
- Level turns (including standard rate turns)
- Climbing turns
- Descending turns
- Steep turns

Abnormal and Emergency Procedures

- Partial panel
- Timed turns
- Compass turns and associated errors (if installed)
- Instrument failures
- Automation failures (primary flight display (PFD), (global positioning system (GPS) navigation, systems management, etc

- Flight automation failures (such as autopilot failure) including recovery from potential loss of control,
- Encountering unexpected weather conditions
- Electrical, systems or equipment failures

- Procedures for turbulence
- Loss of control procedures (due to weather radar (WX) conditions, equipment failure, flight automation, etc.)
- Unusual attitude recovery
- Engine failure(s) (partial or complete)
- Hydraulic or boost failures

Radio Navigation Procedures

- Use of very high frequency omni-directional range (VOR), Localizer (LOC), ILS, and Area Navigation (RNAV) including GPS
- Holding patterns (VOR, ILS, LOC, GPS, Intersection, and waypoints (WPT)
- Use of distance measuring equipment (DME)
- Use of automatic direction finder (ADF)/non-directional radio beacon (NDB) (depending on configuration)
- Use of autopilot/flight director (depending on configuration of PA-28)

Instrument Approach Procedures (IAP)

Precision: (Depending on selected configuration)

- ILS

- Wide area augmentation system (WAAS)
- GPS Landing System (GLS)

Nonprecision: (Depending on selected configuration)

- VOR
- LOC
- RNAV (including GPS)
- WAAS (optional, selected configuration)
- ADF/NDB (optional, selected configuration)

- ILS/LOC back course (LOC BC)
- Missed Approach Procedures (MAP) for all of the procedures mentioned in the technical specifications document.

Communications Procedures

- Air traffic control (ATC) clearances
- Taxi clearance and instructions
- Departure clearance
- En route clearance
- Holding instructions
- Arrival clearances
- Missed approach and instructions and clearances

- Radio advisories and warnings

- Automatic Terminal Information System (ATIS) and common traffic advisory frequency (CTAF)

- Significant meteorological information (SIGMET), Airmen's Meteorological Information (AIRMET), Notice to Airmen (NOTAM), Flight Service Station (FSS), communications, and flight plan changes

Cross-Country Procedures

- Departure
- En route
- Diversion to alternate
- Arrival
- MAPs

4. Computers and Software

The Volarent Piper PA-28 Procedural Trainer (VT-28-IO-CO-P) contains all software, drivers, servers, and required processing power to competently and efficiently run the system. In addition to inclusion of an instructor station with monitoring software (JetStream 1) for flight instructor usage, the simulator is also able to be modified after-market by the client. Generally, the customer is able to request their preferences for install prior to delivery if they so wish. Software options of both Prepar3D and X-Plane 11 are also available with no difference in final

system price or maintenance restrictions. Integration with third party applications such as ForeFlight, X-Mapper, and FltPlan are also available as options for the client.

5. Training information

All information is verified and obtained by the FAA, through Advisory Circular AC_61-136B

The following information is relevant to the training requirements for the Piper Archer PA-28 (VT-28-IO-CO-P) AATD.

Training Requirements Notice

Please note that training requirements for pilot certifications that require cross-country, solo, night, or takeoff and landings cannot be accomplished by ATD systems (AATD or BATD). FAA training requirements specify that they must be accomplished in an actual aircraft.

For example, the 3 hours of control and maneuvering of an airplane solely by reference to instruments described in 14 CFR part 61, § 61.109(a)(3) for a private pilot must be accomplished in a single-engine airplane. Authorized instructors may teach such maneuvers and tasks in an FAA-approved training device (to the Airman Certification Standards (ACS)),

and then transition to the aircraft for those same maneuvers and tasks necessary to meet the aeronautical experience requirements required for pilot certification.

Logging Training Time and Experience.

Authorized instructors utilizing an FAA-approved ATD for airmen training, pilot time, and experience requirements are required to log the time as dual instruction and as basic aviation training device (BATD) or advanced aviation training device (AATD) time appropriately. Any columns that reference flight time should remain blank when logging ATD time. ATD time can only be logged as Instruction Received (Dual), Instrument Time, or Total Time as reflected on the pilot time section of FAA Form 8710-1, Airman Certificate and/or Rating Application. Simulated instrument time can be logged in an ATD, but only during the time when the visual component of the training session is configured for instrument meteorological conditions (IMC) and the pilot is maintaining control solely by reference to the flight instruments. Logging time in this fashion will allow a pilot to credit this time towards the aeronautical experience and instrument experience requirements as specified in part 61 or part 141. It is required under § 61.51(b)(1)(iv) that the type and identification of the ATD be included when logging pilot time as described in the letter of authorization (LOA). It is the responsibility of the flight instructor,

student, or certificated pilot to verify the device is qualified and approved for training or experience requirements. It would be appropriate for the person using the ATD to retain a copy of the LOA. Evaluators such as Designated Pilot Examiners (DPE) are instructed to request a copy of the LOA from applicants logging ATD pilot time, to verify the time acquired in the trainer qualifies for the minimum experience requirements for a certificate or rating.

Note:

There are no restrictions on the amount of training accomplished and logged in training devices. However, the regulatory limitations on maximum credit allowed for the minimum pilot certification requirements are specified by parts 61 and 141 and in the LOA. No approvals or authorizations are provided for aircraft type ratings using ATDs.

6. Simulated Systems

The following description will give insight into the Piper Archer PA-28 simulator and give specifications about several simulated systems.

Visual System

The system includes a wrap around visual system providing 180 degrees (or 220 degrees depending on specification) of horizontal vision. The vertical visual system is 45 degrees.

Type training

Automated ATC communications through online networks, scenario-based training (SBT), and line-oriented type training in which the instructor can evaluate pilot performance without having to act as an ATC controller in included in this system.

Failures

Simulated loss of performance and aerodynamic changes from ice accretion is included for failure simulation through Volarent's JetStream 1 instructor software.

Sounds

Realistic Piper Archer PA-28 aircraft engine sounds appropriate to the Piper Archer PA-28 aircraft configuration with power settings and speed is built in.

Compass

A magnetic compass with incremental markings each 5 degrees, that displays the proper lead or lag during turns, and displays incremental markings as shown in the PA-28 aircraft is included in the simulator.

The following simulated systems are those included in the Piper Archer PA-28 specifically as requested by the FAA in AC_61-136B. The systems including but not limited to those below are timed to be exactly accurate to the actual Piper Archer PA-28 aircraft.

Pre Takeoff

- Engine start
- Taxi and brake operation

Takeoff

- Airplane Takeoff

❏ Run-up and powerplant checks

❏ Acceleration characteristics

❏ Nosewheel and rudder steering

❏ Effect of crosswind

❏ Instrument

❏ Landing gear, wing flap operation

In-Flight Operation

- Climb
  - ❏ Normal and max. Performance
  - ❏ One-engine inoperative procedures
- Cruise
  - ❏ Performance characteristics (speed vs. power)
  - ❏ Normal and steep turns
  - ❏ Approach to stalls (i.e., stall warning), stalls, and, recovery. (Executed from takeoff, cruise, and approach and landing configurations)
  - ❏ In-flight engine shutdown
  - ❏ Fuel selector function
  - ❏ In-flight engine start
- Approach
  - ❏ Normal (with and without flaps) (check gear warning)

- ❏ Best glide no power

- Landings

Instrument Approaches

- Nonprecision

  - ❏ GPS and LPV
  - ❏ GPS-WAAS
  - ❏ All engines operating
  - ❏ One or more engines inoperative

  - ❏ Approach procedures (VOR, VOR/DME, LOC procedures, on an ILS, LDA, RNAV (RDP), RNAV (GPS) to LNAV, LNAV/VNAV, LPV)

- Precision

  - ❏ ILS
  - ❏ GLS
  - ❏ Effects of crosswind
  - ❏ With engine operative
  - ❏ Missed approach
    - ➔ Normal
    - ➔ With engine (1 and 2) inoperative

Surface Operations

- Surface Operations (Post Landing)

  - ❏ Approach and landing roll
  - ❏ Braking operation

Any Flight Phase

- Aircraft and Powerplant Systems
    - ❏ Electrical, mechanical, or hydraulic
    - ❏ Flaps
    - ❏ Fuel selector and oil temp/pressure
    - ❏ Landing gear
- Flight Management and Guidance Systems
    - ❏ Autopilot
    - ❏ Flight director/systems display
    - ❏ Navigation systems
    - ❏ Stall warning systems avoidance
    - ❏ Multi-function displays
- Airborne Procedures
    - ❏ Holding
    - ❏ Uncoordinated turns - slipping and skidding
    - ❏ Configuration and power changes and resulting pitch changes
    - ❏ Compass turns and appropriate errors
- Engine shutdown and parking
    - ❏ Systems operation
    - ❏ Parking brake operation

Is capable of simulating engine failure, including failures to simulated loss of oil pressure/fuel starvation.

Can simulate the following equipment failures:

- Alternator/generator failure
- Vacuum pump/pressure failure and the associated flight instrument failures
- Gyroscopic flight instrument failures
- Pitot/static system malfunction and the associated flight instrument failures
- Electronic flight deck display malfunctions
- Landing gear/flap malfunctions

7. Installation and shipping conditions

The final price of the Volarent PA-28 simulator includes shipping, delivery, installation on site, preparations of QTG, assistance at certification, staff training (operation & maintenance), and two years of warranty. In cases of sales outside of the USA, provisions according to local regulation and local aviation administrations will be made by Volarent Aerospace in order to insure certification is recognized by local authorities.

50% of the payment is required upfront, with the remaining 50% of payment required upon delivery. The normal production time is four to five months. However, during peak production times (May-September) the production time can increase to as much as nine months. However, we work very hard to reduce the production time as much as possible and seek to complete them earlier.

The final sales contract will finalize all unanswered details according to the specific sale. Any further questions should be directed to Volarent Aerospace directly.

Changes for the Piper Archer PA-28 ATD / BATD

8. Key Features

The PA-28 simulator's physical flight and associated systems are recognizable as to their functions and how they are to be manipulated solely from their appearance when contrasted to the actual aircraft.

Within the simulator, the pilot is able to operate the controls in the same manner as the actual aircraft. This includes the landing gear, wing flaps, cowl flaps, carburetor heat, mixture, propeller, and throttle controls appropriate to the aircraft model represented.

The physical arrangement, appearance, and operation of controls, instruments and switches closely follows the actual PA-28 aircraft represented. Realistically placed physical switches and other required controls present in the Volarent PA-28 BATD simulator include;

- Master/battery
- Magnetos for each engine
- Alternators or generators for each engine
- Auxiliaries or generators for each engine
- Auxiliary power unit (APU) (depending on configuration)
- Fuel boost pumps/prime boost pumps for each engine
-

- Avionics master
- Pitot heat
- Rotating beacon/strobe, navigation, taxi, and landing lights.

9. Technical Specifications and Requirements

The physical flight and aircraft systems present in the Volarent PA-28 simulator are included as follows:

1. A self-centering displacement yoke that allows for continuous adjustment of pitch and bank.
2. Self-centering rudder pedals that allows for continuous adjustment of yaw and corresponding reaction in heading and roll.

3. Throttle or power control(s) that allow for continuous movement from idle to full power settings and corresponding changes in pitch and yaw (depending on configuration).
4. Mixture/condition, propellers, and throttle/power control(s).
5. Controls for the following items, depending on configuration of PA-28, are included:
    - Wing flaps
    - Pitch trim
    - Communication and navigation radios
    - Clock or timer
    - Gear handle
    - Transponder
    - Altimeter
    - Carburetor heat
    - Cowl flaps

10. Simulated Systems

The following instruments and indicators will be accurately replicated and properly located as appropriate to the Piper Archer PA-28 aircraft:

Display Requirements

1. Flight instruments in a standard configuration representing the traditional “round” dial flight flight instruments (if analog configuration is selected), or electronic primary flight

displays (PFD) with reversionary and backup flight instruments (if digital configuration is selected).

2. A sensitive altimeter with incremental markings each 20 feet, operable throughout the normal operating range of the PA-28 aircraft.
3. A magnetic direction indicator.
4. A heading indicator with incremental markings each 5 degrees or less, displayed on a 360 degree circle.
5. A vertical speed indicator (VSI) with incremental markings each 100 feet per minute (fpm) for both climb and decent, for the first 1,000 fpm of climb and decent, and at each
6. 500 fpm climb and decent for the remainder of a minimum of 2,000 fpm total display as applicable for the Piper Archer PA-28 aircraft.
7. A gyroscopic rate-of-return indicator with appropriate markings for a rate of 3 degrees per second turn for left and right turns.

8. A slip and skid indicator with coordination information displayed in the conventional inclinometer format where a coordinated flight condition is indicated with the ball in the center position.
9. An attitude indicator with incremental markings each 5 degrees of pitch, from 20 degree pitch up to 40 degree pitch down as applicable to the Piper Archer PA-28 aircraft represented. Bank angles are identified as “wings level” and at 10, 20, 30 and 60 degrees of bank (with an optional additional identification at 45 degrees) at left and right bank angles.
10. Engine instruments as applicable to the PA-28 with provided markings for the normal ranges include the minimum and maximum limits.

11. A suction gauge or instrument pressure gauge depending on the PA-28 configuration selected by the customer will be included with the applicable display.
12. A flap setting indicator that displays the current flap setting.
13. Flap setting indications accurate to the PA-28 aircraft.
14. A pitch trim indicator with a display that shows zero trim and appropriate indices of airplane nose down and airplane nose up trim as found in the PA-28 aircraft.
15. Communication radio with a full range of selectable frequencies displaying on the radio frequency in use panel.
16. Navigation radios with a full range of selectable frequencies displaying the frequency in use and capable of replicating both precision and non precision instruments, including approach procedures (each with an aural identification feature), and a marker beacon receiver. For example, an instrument landing system (ILS), non-directional radio beacon (NDB), Global Positioning System (GPS), Localizer (LOC), Graduated markings as indicated below are present on each course deviation indicator (CDI):
    - One-half dot for course/glideslope (GS) deviation (i.e. VOR, LOC, or ILS) (Depending on selected configuration)
    - Five degrees for bearing deviation for automatic direction finder (ADF) and radio magnetic indicator (RMI)
17. A clock with incremental markings for each minute and second.
18. A transponder that displays the current transponder code.
19. A fuel quantity that indicates the fuel remaining.

All instruments listed below will be visible during all flight operations. Allowances for multifunction electronic displays that may not display all instruments simultaneously is permissible depending on the configuration selected by the customer. All of the displays provide an image of the instrument that is clear and:

- Not out of focus or illegible.
- Not appearing to “jump” or “step” during operation.
- Not appearing with distracting jagged lines or edges.
- Not appearing to lag relative to the action and use of the flight controls.

Control inputs are reflected by the flight instruments in real time and do not have any perceived delay in action. Display updates show all changes (within the total range of the replicated instrument) and are equal to the values stated below:

1. Airspeed indicator: change of 5 knots
2. Attitude indicator: change of 2 degrees in pitch and bank
3. Altimeter: change of 10 feet
4. Turn and bank: change of ¼ standard rate turn
5. Heading indicator: change of 2 degrees
6. VSI: change of 100 fpm
7. Tachometer: change of 25 rpm
8. VOR/ILS: change of 1 degree for VOR
9. ADF: change of 2 degrees

10. GPS: change as appropriate for the PA-28 GPS-based navigation system requested in the configuration
11. Clock: change of 1 second

Displays reflect the dynamic behavior of an actual PA-28 aircraft (e.g., a VSI reading of 500 fpm reflects a corresponding movement in altitude, and an increase in power reflects an increase in the rpm indication/power indicator.)

Flight Dynamics

Flight dynamics of the PA-28 simulator are comparable to the way the actual PA-28 aircraft performs and handles.

Aircraft performance parameters (such as maximum speed, cruise speed, stall speed, and maximum climb rate are comparable to the actual PA-28 aircraft.

Instructor Management

The instructor is able to pause the system at any time during the simulation for the purpose of administering instructor/procedural recommendations.

If a training session begins with the aircraft already in the air and ready for the performance of a particular procedural task, the instructor is then able to manipulate the following system parameters independently of the simulation:

- Aircraft geographic location
- Aircraft heading
- Aircraft airspeed
- Aircraft altitude
- Wind direction, speed, and turbulence

The system is also capable of recording both a horizontal and vertical track of aircraft movement during the entire training session for later playback and review.

The instructor is then able to disable any of the instruments prior to or during a training session and able to simulate failures of any of the instruments without stopping or freezing the simulation to affect the failure.

This includes:

1. Simulated engine failures
2. Alternator/generator failures
3. Vacuum/pressure pump failures
4. Pitot static failures
5. Electronic flight display failures
6. Landing gear/flaps failures
7. Etc

Control Input Functionality and Response Criteria (FAA AC_61-136B)

Time from control input to recognizable system response is without delay (i.e., not appear to lag in any way).

Changes for the Piper Archer PA-28 FTD / Level 5

11. Key Features

In the Piper Archer PA-28 FTD Level 5 Simulator, the device has an enclosed PA-28-specific flight deck, generic aerodynamic programming, and control loading that is representative of the PA-28 aircraft.

The FTD Level 5 certification type is a very advanced level of certification and has strict tests and QPS requirements according to FAA CFR Part 60. Included below are data source tables directly from the FAA that detail QPS requirements for multi-engine (turbo-propeller) aircraft. This information applies to the PA-28 aircraft and is shown in the table below:

Entry Number	Applicable Test Title and Procedure	Authorized Performance Range
1.	**Performance.**	See next
1.c	**Climb.**	See next
1.c.1.	Normal climb with nominal gross weight, at best rate-of-climb airspeed.	Climb airspeed = 120 – 140 knots. Climb rate = 1000 – 3000 fpm (5 - 15 m/sec)
1.f.	**Engines.**	See next
1.f.1.	Acceleration; idle to takeoff power.	2 - 6 Seconds.
1.f.2.	Deceleration; takeoff power to idle.	1 - 5 Seconds.
2.	**Handling Qualities.**	See next
2.c.	**Longitudinal Tests.**	See next
2.c.1.	Power change force.	Test (a) or (b) required
2.c.1.(a)	a) Trim for straight and level flight at 80 percent of normal cruise airspeed with necessary power. Reduce power to flight idle. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	8 lbs (3.5 daN) of Push force to 8 lbs (3.5 daN) of Pull force.
2.c.1.(b)	b) Trim for straight and level flight at 80 percent of normal cruise airspeed with necessary power. Add power to maximum setting. Do not change trim or configuration. After stabilized, record column force necessary to maintain original airspeed.	12 - 22 lbs (5.3 – 9.7 daN) of force (Pull).
2.c.2.	Flap/slat change force.	Test (a) or (b) required
2.c.2.(a)	a) Trim for straight and level flight with flaps fully retracted at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Extend the flaps to 50 percent of full flap travel. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Push).
2.c.2.(b)	b) Trim for straight and level flight with flaps extended to 50 percent of full flap travel, at a constant airspeed within the flaps-extended airspeed range. Do not adjust trim or power. Retract the flaps to zero. After stabilized, record stick force necessary to maintain original airspeed.	5 - 15 lbs (2.2 - 6.6 daN) of force (Pull).

Entry Number	Applicable Test Title and Procedure	Authorized Performance Range
2.c.4.	Gear change force.	Test (a) or (b) required
2.c.4.(a)	a) Trim for straight and level flight with landing gear retracted at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Extend the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Push).
2.c.4.(b)	b) Trim for straight and level flight with landing gear extended, at a constant airspeed within the landing gear-extended airspeed range. Do not adjust trim or power. Retract the landing gear. After stabilized, record stick force necessary to maintain original airspeed.	2 - 12 lbs (0.88 - 5.3 daN) of force (Pull).
2.c.5.	Longitudinal trim.	Must be able to trim longitudinal stick force to "zero" in each of the following configurations: cruise; approach; and landing.
2.c.7.	Longitudinal static stability.	Must exhibit positive static stability.
2.c.8.	Stall warning (actuation of stall warning device) with nominal gross weight; wings level; and a deceleration rate of not more than three (3) knots per second.	See next
2.c.8.(a)	a) Landing configuration.	80 - 100 knots; ± 5° of bank.
2.c.8.(b)	b) Clean configuration.	Landing configuration speed + 10 - 20 percent.
2.c.9.b.	Phugoid dynamics.	Must have a phugoid with a period of 30 - 60 seconds. May not reach ½ or double amplitude in less than 2 cycles.
2.d.	**Lateral Directional Tests.**	See next
2.d.2.	Roll response. Roll rate must be measured through at least 30 degree of roll. Aileron control must be deflected 1/3 (33.3 percent) of maximum travel.	Must have a roll rate of 4 - 25 degree /second.
2.d.4.c.	Spiral stability. Cruise configuration and normal cruise airspeed. Establish a 20 - 30 dgree bank. When stabilized, neutralize the aileron control and release. Must be completed in both directions of turn.	Initial bank angle (± 5°) after 20 seconds.
2.d.6.b.	Rudder response. Use 25 percent of maximum rudder deflection. (Applicable to approach or landing configuration.)	3 - 6 degree /second yaw rate.
2.d.8.	Steady state sideslip. Use 50 percent rudder deflection. (Applicable to approach and landing configurations.)	2 - 10 degree of bank; 4 - 10 degree of sideslip; and 2 -10 degree of aileron.

Entry Number	Applicable Test Title and Procedure	Authorized Performance Range
6.	**FTD System Response Time.**	See next
6.a.	Flight deck instrument systems response to an abrupt pilot controller input. One test is required in each axis (pitch, roll, yaw).	300 milliseconds or less.

12. Technical Specifications and Requirements

The following information represents the FAA QPS requirement for functions. The following operations are present in the simulator and will be evaluated upon inspection by the FAA according to Part 60 of the Electronic Code of Federal Regulations.

Entry Number	Operations Tasks
1.	**Preflight.** Accomplish a functions check of all installed switches, indicators, systems, and equipment at all crewmembers' and instructors' stations, and determine that the flight deck (or flight deck area) design and functions replicate the appropriate airplane.
2.	**Surface Operations (pre-takeoff).**
2.a.	Engine start (if installed):
2.a.1.	Normal start.
2.a.2.	Alternative procedures start.
2.a.3.	Abnormal/Emergency procedures start / shut down.
3.	**In-Flight Operations.**
3.a.	Normal climb.
3.b.	Cruise:
3.b.1.	Performance characteristics (speed vs. power).
3.b.2.	Normal turns.
3.c.	Normal descent.
4.	**Approaches.**
4.a.	Coupled instrument approach maneuvers (as applicable for the systems installed).
5.	**Any Flight Phase.**
5.a.	Normal system operation (Installed systems).
5.b.	Abnormal/Emergency system operation (installed systems).
5.c.	Flap operation
5.d.	Landing gear operation
5.e.	Engine Shutdown and Parking (if installed).
5.e.1.	Systems operation.
5.e.2.	Parking brake operation.
6.	**Instructor Operating Station (IOS).**
6.a.	Power Switch(es).
6.b.	Preset positions – ground, air.
6.c.	Airplane system malfunctions (Installed systems).
6.c.1.	Insertion / deletion.
6.c.2.	Problem clear.

13. Simulated Systems

The following systems are objective tests present in the QPS requirements that will be inspected by the FAA upon certification. All system tests listed below are present in the Volarent PA-28 FTD Level 5 simulator:

1. Normal Climb, all engines operation
    - +/- 3 kt airspeed
    - +/- 0.5 m/s (100 ft/ min) (5% of rate of climb)
    - FTD performance is over interval of 300 m (1000ft)
2. Pitch controller position versus force
    - +/- 0.9 daN (2 lbf) breakout
    - +/- 2.2 daN (5 lbf) (10% of force)
3. Roll controller position versus force
    - +/- 0.9 daN (2 lbf) breakout
    - +/- 1.3 daN (3 lbf) (10% of force)
4. Rudder pedal position versus force
    - +/- 2.2 daN (5 lbf) breakout
    - +/- 2.2 daN (5 lbf) (10% of force)
5. Power Change Force
    - +/- 5 lb (2.2 daN) (20% of pitch control force)
6. Flap/Slat Change Force
    - +/- 5 lb (2.2 daN)
    - 20% pitch control force
7. Gear Change Force
    - +/- 5 lb (2.2 daN)
    - 20% pitch control force
8. Longitudinal Trim
    - +/- 1° elevator angle

- +/- 0.5° stabilizer (trim surface angle)
- +/- 1° pitch angle
- +/- 5% of net thrust

9. Longitudinal Static Stability
    - +/- 2.2 daN (5 lbf)
    - +/- 10% of pitch controller force
    - +/- 1° (10%) of the change of elevator angle
10. Stall Warning (actuation of stall warning device)
    - +/- 3kts airspeed
    - +/- 2° bank for speeds greater than actuation of stall warning device (initial buffet)
11. Phugoid Dynamics
    - +/- 10% period, PA-28 aircraft type damping
12. Roll Response (rate)
    - +/- 2° (10% of roll rate)
13. Spiral Stability
    - Correct trend (PA-28)
14. Rudder Response
    - Roll rate +/- 2°/sec
    - Bank angle: +/- 3°
15. Transport Delay
    - 300 milliseconds after controller movement for pitch, roll, and yaw