



Fixed Wing Aircraft Systems Trainer

Introduction

Fixed Wing Aircraft Systems Trainer enables typical aircraft functional tests and fault-diagnosis procedures to be taught by either instructor demonstration or by student self-paced learning. The high-fidelity screen-based graphical interface replicates realistic scenarios, enabling students to carry out a range of practical training exercises on the system, which they can interact with like they would the real equipment of a virtual fixed wing aircraft, thus enabling progressive understanding of aircraft systems.

The Fixed Wing Aircraft Systems Trainer is designed to support training methods that may be used to satisfy the theoretical training element in the classroom. The modular and object-oriented design, along with common object libraries, promotes easy updates and thus maximises concurrency with any aircraft configuration.

The emulation element of the software architecture provides the behaviour of the aircraft systems and is based on aircraft connectivity information elicited from aircraft maintenance publications and other supporting documentation.

The emulation includes normal behaviours and the behaviour of the system under fault conditions. A set of propagation algorithms within the emulation engine together with the component models build a fully integrated virtualised representation of the aircraft systems and connectivity to simulate the target aircraft.

To enhance training realism the student is expected to use the operational checklists, maintenance details and procedures, wiring diagrams and other information contained in the published aircrew and maintenance manuals as the reference data for procedural exercises.

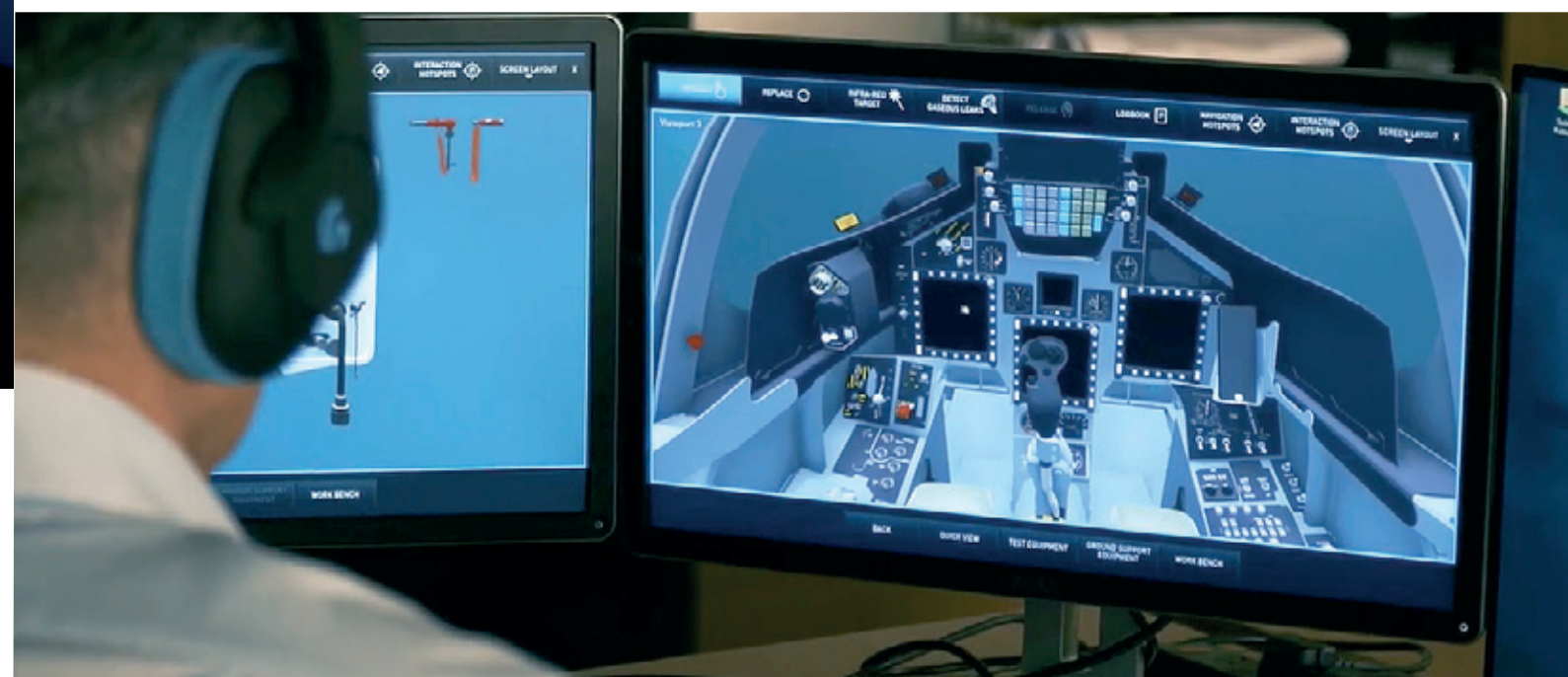
The student is also able to call up test sets and ground support equipment, with full graphic emulation and simulated functionality appropriate to the task.



Key Features

- Virtual aircraft with:
 - Intuitive navigation and operation
 - Detailed aircraft bays and LRUs
 - Integrated aircraft systems simulation
 - Realistic real-time aircraft responses
- Training management system for:
 - Training scenario creation
 - Planning, delivery and real-time monitoring of training scenarios
 - Automatic student assessment and report generation
- Electronic technical publications suite for the virtual aircraft
- Can be installed on a standalone Windows PC or networked for use in a classroom environment
- Covers up to 23 aircraft systems and mechanical elements
- Integrated Training Management System (ITMS)
- Provides a fully navigable representation of the simulated aircraft including access to, and operation of, all equipment in the aircraft cockpit and bays around the aircraft.

“ I have found as a training provider that Pennant’s Fixed Wing Aircraft Systems Trainer offers a learning environment where students are able to practically consolidate their fault finding and diagnostic skills on modern integrated avionics systems, while being complimented with the use of technical publications that are analogous to real life aircraft technical publications. This quality of training is usually difficult to achieve on physical aircraft training aids. ”



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Aviation Regulations Alignment

EASA/EMAR PT 66	FAA	CITY & GUILDS	MEA UNITS
Module 11.4 Air Conditioning and Cabin Pressurisation	ATA 13 Aircraft structures and systems	4608-50 Level 2 Diploma in Aerospace and Aviation Engineering (Military Foundation Competence) Unit 240 & 259	MEA219 - Inspect, test and troubleshoot aircraft pressurisation control systems and components
Module 11.5 Instruments/Avionic Systems	ATA 21 Air Conditioning		MEA222 - Inspect, test and troubleshoot aircraft oxygen systems and components
Module 11.6 Electrical Power	ATA 24 Electrical Power	4608-30 Level 3 Diploma in Aviation Maintenance (Development Competence) Unit 308, 309, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 344, 347, 350, 353	MEA223 - Inspect aircraft electrical systems and components
Module 11.7 Equipment and Furnishings	ATA 25 Equipment and Furnishings		MEA224 - Inspect aircraft instrument systems and components
Module 11.8 Fire Protection	ATA 26 Fire Protection		MEA226 - Inspect aircraft electronic systems and components
Module 11.9 Flight Controls	ATA 27 Flight Controls	4608-60 Level 3 Diploma in Aviation Maintenance (Development Competence) – Military Unit 354, 355, 367, 368, 369, 370, 371, 372, 373, 374, 375, 389, 390, 391, 392, 393, 394, 396, 427	MEA227 - Test and troubleshoot aircraft electrical systems and components
Module 11.10 Fuel Systems	ATA 28 Fuel Systems		MEA228 - Test and troubleshoot aircraft instrument systems and components
Module 11.11 Hydraulic Power	ATA 29 Hydraulic Power		MEA229 - Test and troubleshoot aircraft radio frequency navigation and communications systems and components
Module 11.12 Ice and Rain Protection	ATA 30 Ice and Rain Protection		MEA232 - Test and troubleshoot aircraft pulse systems and components
Module 11.15 Oxygen	ATA 31 Indicating/Recording Systems		MEA235 - Perform advanced troubleshooting in aircraft avionic maintenance
Module 12.7 Instruments/Avionic Systems	ATA 32 Landing Gear		MEA294 - Inspect, test and troubleshoot advanced aircraft electrical systems and components
Module 12.14 Landing Gear	ATA 33 Lights		MEA295 - Use electrical test equipment to perform basic electrical tests on aircraft and components
Module 12.15 Lights	ATA 34 Navigation		MEA309 - Inspect, test and troubleshoot aircraft hydro-mechanical and landing gear systems and components
Module 14.2 Engine Indicating Systems	ATA 35 Oxygen		MEA310 - Inspect, test and troubleshoot aircraft pneumatic systems and components
Module 14.3 Starting and Ignition Systems	ATA 77 Engine Indicating Systems		MEA318 - Inspect aircraft hydro-mechanical, mechanical, gaseous and landing gear systems and components
Module 51.1 Weapons stores system	ATA 80 Starting		MEA320 - Test and troubleshoot aircraft hydro-mechanical, gaseous and landing gear systems and components
Module 53.1 Surveillance	ATA 92 Radar		MEA345 - Perform scheduled line maintenance activities on gas turbine engine fixed wing aircraft
	ATA 93 Surveillance		
	ATA 94 Weapon System		
	ATA 99 Electronic Warfare		

Note : VATS provides a synthetic aircraft training environment to assist in developing practical competencies



Supplied Documentation

Operators Manual
Aircraft Technical Publications

ITMS (Learning Management Tool)

The Fixed Wing Aircraft Systems Trainer can be used as a self-paced learning aid or Computer Aided Instructions (CAI), being designed to support training methods that may be used to satisfy the theoretical training element in the classroom. As a learning management tool, the application provides the benefits of multiple students working through tasks easily and effectively without requiring the need to wait or have a reduced number of students with one instructor working on physical equipment.

The Integrated Training Management System (ITMS) and the Fixed Wing Aircraft Systems Trainer have been developed and refined over twenty years and is a key element of Pennant’s product portfolio. It is maintained and updated to keep pace with advances in technology and capability both in terms of the capabilities of the PC equipment on which is delivered, and the aircraft systems represented in the simulation.

- Training scenario creation
- Planning, delivery and real-time monitoring of training scenarios
- Automatic student assessment and report generation





Supported Training

SYSTEM	SIMULATED TASK	SIMULATED FAULTS
AIR CONDITIONING	1. ECS (Environmental Control System) Functional 2. Cabin Pressurisation Failure Warning 3. Cabin Pressurisation Test	1. Canopy seal control valve stuck in shut position. Canopy seal will not inflate 2. Switch stuck in the off position. CWP CPR caption is on 3. Tear in Canopy seal. Canopy seal does not inflate 4. Over Pressure Protection switch open circuit 5. Internal failure. Cabin temperature does not increase 6. Internal failure. Cabin temperature does not decrease 7. Internal failure. Cabin temperature does not change
ELECTRICAL POWER	1. Inertia Switch - Reset Procedure 2. Main Generator Test 3. Auxillary Generator Test 4. Internal Electrical Power - Apply and Remove 5. External Electrical Power Disconnection 6. External Electrical Power – Connection 7. External Power Supply System Test	1. Inertia switch has operated 2. No.1 Battery charge low. No.1 Battery voltage reads less than 20 VDC 3. No.2 Battery discharged. No.2 Battery reads 0 VDC 4. Relay coil is open circuit 5. Terminals A1 and A2 are stuck in closed position. DC Voltmeter still reading voltage 6. Relay coil will not energise. CWP DC caption remains on 7. Relay coil open circuit. DC Voltmeter reads 0 VDC 8. Terminals A1 and A2 are stuck in closed position. DC Voltmeter still reading voltage 9. Switch contacts stuck in open position. DC Voltmeter reads 0 VDC 10. No output from TRU. CWP DC caption remains on when generator running 11. Relay coil open circuit. CWP DC caption remains on 12. Switch stuck in open position (pin 1 open circuit). DC Voltmeter reads 0 VDC 13. Switch stuck in open position 14. Overvoltage condition 15. Internal failure. Overvoltage condition 16. Internal failure. Busbar voltages incorrect 17. Coil open circuit. Main generator line contactor does not energise



SYSTEM	SIMULATED TASK	SIMULATED FAULTS
ELECTRICAL POWER		18. Relay coil is open circuit. No reading on DC Voltmeter with external power applied 19. Internal failure. No voltage on AC Busbar 20. Coil open circuit. APU Line Contactor does not energise 21. Contacts welded. No voltage on Busbar when APU Generator is running 22. Internal relay failure. External Power Available relay does not energise 23. Indicator stuck. Dolls eye remains latched when pressed to reset 24. Pin 5 stuck at pin 4. Dolls eye indicator does not come on 25. Pin 8 stuck at pin 7. Dolls eye indicator latched 26. Relay coil open circuit. Main Generator Ready relay contacts not energizing 27. Relay coil open circuit. GTS/APU Power Available relay contacts not energizing
ENGINE - FUEL AND CONTROL	1. ECA Functional	1. ECA internal failure. Lane No. 1 fault, CWP ECA caption comes on
ENGINE - IGNITION	1. Ignition Test	No Faults
ENGINE - INDICATING	No Tasks	1. Fluctuating RPM shown on the EMP 2. Switch pin 1 stuck at pin 2. APU start inhibited 3. Relay coil open circuit. CWP ECA caption does not come on 4. Relay coil open circuit. CWP T6NLcaption does not come on
ENGINE - STARTING	1. APU Starting and Stopping 2. APU Functional 3. APSCU Functional	1. Relay coil open circuit. Throttle relight switch inoperative 2. Flame-out causes the engine to run-down 3. Hung start as engine fails to reach idle RPM the EGT rises but the RPM hangs 4. Relay coil is open circuit. Throttle relight switch inoperative 5. Short circuit within APU Starter Motor. EMP GTS caption does not come on
EQUIPMENT AND FURNISHINGS	1. Brake Parachute – Installation 2. Brake Parachute – Removal	1. Microswitch open circuit. Parachute stowage compartment access door does not open 2. Switch contactor stuck at pin 1. Parachute stowage compartment access door does not open 3. Switch failure, open circuit. Parachute stowage compartment door does not open



SYSTEM	SIMULATED TASK	SIMULATED FAULTS
FIRE PROTECTION	1. Harness - Continuity and Insulation 2. Engine and APU Bay Fire Detection Test	1. Firewire element low impedance. Warning captions do not come on in test 2. Firewire element open circuit. Warning captions do not come on in test 3. Internal failure in Firewire Control Unit. Warning captions remain on
FLIGHT CONTROLS	1. HOTAS Switches Test 2. Aileron Trim Indicator Test 3. Yaw Damper Functional 4. Flap Control System Functional 5. Flap Standby Lowering System Test and Recovery 6. Explosive Start Valve Replacement and Standby Lowering System Electrical Circuit Check 7. Air Brake Test	1. Internal failure. Open winding failed. Actuator does not drive 2. Pin 1 stuck at pin 3. Switch fails to operate 3. Pin 3 open circuit. Switch fails to operate 4. Pin 2 stuck at pin 1. Airbrake remains retracted 5. Pins K stuck at pin L. Airbrake remains retracted 6. Pin 3 open circuit. Yaw damper inoperative 7. Internal failure. The Failure Relay does not energise when the test switch is operated 8. Internal failure. Rudder PFCU does not centre 9. Internal failure. Rudder PFCU does not respond to inputs 10. Internal failure. Valve fails to operate 11. Switch contacts stuck. Switch fails to operate 12. Wiper stuck. Aileron position indication remains constant 13. Internal failure. Pointer stuck at zero 14. Internal failure. Pointer stuck at zero 15. Transmitter open circuit. No position output to the trim indicators 16. Wiper stuck. Flap position indication remains constant 17. Internal failure. Coil is open circuit indicator does not latch.
FUEL	1. Fuel Dip Test 2. Fuel Contents and Low-Level Test 3. Fuel Flow and Pressure Test 4. External Fuel Tanks Fuel Flow and Pressure Test 5. DC Fuel Pump Test	1. Inoperative. No fuel flow indication 2. Open circuit within Junction Box. Fuel quantity reads zero 3. Fuel dip timer internal fault. Engine does not start 4. Relay coil open circuit. Fuel Dip relay contacts not energising 5. Switch stuck in the closed position. CWP TRANS caption remains on 6. Fuel pump wire broken. Low fuel pressure 7. Pin 2 stuck at pin 1. No fuel transfer to tank

SYSTEM	SIMULATED TASK	SIMULATED FAULTS
FUEL		8. Valve fails open. No fuel transfer 9. Relay coil open circuit. No refuel fuel flow 10. Contacts welded in relay energised position - Pressure switch stuck in closed position. CWP AAR caption comes on
HYDRAULIC POWER	1. External Hydraulic Power – Connection 2. External Hydraulic Power – Disconnection 3. RAT Test 4. RAT Extend/Retract Test 5. Hydraulic Indications and Warnings	1. No hydraulic pressure from EDP or external supply to all components 2. Nitrogen Leak 3. Indicator failure. A constant value of zero is displayed 4. Front hydraulic indicator reads higher than expected 5. Microswitch stuck in the open position 6. Switch contacts stuck in the A to B position 7. Switch contacts stuck in the D to E position. Audio warning does not come on 8. Internal failure. No electrical output from the No.1 Hyd Pressure Transducer
ICE & RAIN PROTECTION	1. Pitot/Static Probe Heater Failure Sensor Test.	1. Internal relay contacts stuck in closed position. PITOT CWP caption does not come on 2. Relay coil open circuit. PITOT CWP caption does not come on 3. Internal failure of Probe Heater Failure Sensor
INDICATING & RECORDING	1. Crash Protection Functional 2. CPI (Crash Position Indicator) Functional 3. FDR Download 4. AOA Functional 5. DTU Test 6. VMRS Test 7. HUMS Test 8. Data-bus Test 9. CWS Functional 10. Mission Computer (Functional) Test 11. MFD Functional (Test) 12. HUD Functional	1. Interface failure. DTU Fail on status page 2. Internal failure. No display symbology 3. DAU internal failure. CWP FDR caption comes on 4. Filaments ruptured. DAU Mem warning indicator does not come on 5. Internal failure. Cockpit Audio not recorded, CWP CAR caption comes on 6. Internal failure. Flight Data not recorded, CWP FDR caption comes on 7. Internal failure. LED pulses 4 times to indicate a fault 8. Coil Open Circuit 9. HYD2 bulb is open circuit 10. Filament ruptured. CWP YAW caption does not come on



SYSTEM	SIMULATED TASK	SIMULATED FAULTS
LANDING GEAR	1. Landing Gear Functional 2. Emergency Lowering 3. Emergency Recovery 4. Wheel Brake Test 5. Anti-Skid Test 6. Nosewheel Steering Test 7. Landing Gear Down Warning Test	1. Pin A stuck at pin B. LH down indication extinguished 2. Pin A stuck at pin B. RH down indication extinguished 3. Pin D stuck at pin E. NO down indication extinguished 4. Internal failure (diode fault). Incorrect U/C position indications 5. No voltage to pin 1. RDU display blank 6. Open circuit 7. Proximity switch stuck in open position (open circuit). Alpha numeric failure code displayed on RDU 8. Internal fault within DCU processor. Alpha numeric failure code displayed on RDU 9. Feedback transducer open circuit. Alpha numeric failure code displayed on RDU
LIGHTING	1. Exterior Lighting Functional	1. Internal fault. Formation lights do not come on 2. Internal fault. Fin light does not come on
NAVIGATION	1. ADTS405F – Connection 2. ADTS405F – Disconnection 3. P/S Leak Test 4. P/S Leak Test (No Power) 5. Independent Leak Test 6. HDFD Test 7. Air Data Sensor Test 8. Air Pressure Operated Instruments Test 9. Standby Heading Test 10. Standby Compass Test 11. VOR/ILS Functional 12. RADALT Functional 13. Weather RADAR Functional 14. TAWS Functional 15. TCAS Functional 16. TAWS Terrain Database Loading 17. TACAN Functional 18. ADF Functional 19. INGPS Functional	1. Internal processor fail. BIT Fail 2. Internal cooling failure 3. Internal processor fail. BIT Fail 4. Internal cooling failure 5. Internal failure within Altimeter 6. Circuit breaker open circuit. No power supply to Directional Gyro Unit 7. Internal fault. INS Power Supply failure 8. Fault in Gyro Compass alignment 9. Open circuit 10. Circuit Breaker internal open circuit 11. The potentiometer associated with the CAMU output has an internal open circuit 12. Air data sensor failure. Loss of display information 13. Temperature probe failure. Incorrect OAT displayed 14. Internal failure. Returns all data information as invalid 15. Relay coil is open circuit. Unable to select rear cockpit 16. Contacts relay stuck in energised state 17. Internal failure within ADF Receiver. ADF info not displayed on HUD 18. Internal failure within TACAN Tx/Rx. TACAN info not displayed on HUD

SYSTEM	SIMULATED TASK	SIMULATED FAULTS
		19. Fuse open circuit. RADALT Indicator warning flag remains in view 20. Switch stuck in open circuit position 21. Power Up Built-In-Test Fails 22. Switch stuck in open circuit position 23. Power Up Built-In-Test (PUBIT) Fails 24. DTU fails to upload map data to mission computer 25. Circuit breaker open. No power supply to Wx RDR Power Control Relay 26. R/T unserviceable resulting in BIT failure 27. R/T does not transmit RF resulting in BIT failure 28. Azimuth motor failure 29. Waveguide damaged resulting in high VSWR on transmission
OXYGEN	1. Standby Oxygen Functional 2. Standby Oxygen Purge 3. OBOGS Functional	1. Relay coil open circuit. Control relay contacts do not energise to operate PRSOV 2. Relay is open circuit. Oxygen flow indicator fails to latch 3. Flow transducer internal fail. Oxygen flow indicator fails to latch 4. Switch open circuit. Back-Up oxygen system fails to operate 5. Internal fault. Pointer does not indicate content level 6. Internal fault. Does not convert BOS contents pressure into reading 7. Oxygen Generator internal fault. CWP OXY caption comes on 8. Relay coil open circuit. BOS Indication relay contacts do not energise 9. Relay is open circuit
PARKING, MOORING, STORAGE AND RETURN TO SERVICE	1. Parking	No Faults
RADAR	1. RSS (Radar Simulation System) Functional	No Faults



SYSTEM	SIMULATED TASK	SIMULATED FAULTS
SERVICING - ROUTINE MAINTENANCE	1. Electrical Safety - Make the Aircraft Electrically Safe and Restore Aircraft Electrically	No Faults.
	2. Battery On-Load Voltage Test	
	3. Failure Indicators - Test Procedure	
	4. APU and Engine Pre-Start Checks	
	5. Engine Ground Run	
	6. Making Armed Aircraft Safe	
	7. Canopy - Open and Close	
	8. Make Safe For Maintenance	
	9. Blanks and Covers – Remove	
	10. Blanks and Covers – Install	
	11. Landing Gear Ground Locks – Remove	
	12. Landing Gear Ground Locks – Install	
	13. Ejection Seats and MDC - Safety Conditions	
	14. Engine Start/Stop	
	15. Engine Wet and Dry Motoring	
	16. Electrical Safety - Make the Aircraft Selectively Safe and Close Circuit Breakers/Refit Fuses	
	17. ECATS Test Set – Connect	
	18. ECATS Test Set – Remove	
	19. Roughness (Vibration) Test Set Type D – Connect	
	20. Roughness (Vibration) Test Set Type D – Remove	
	21. Engine Operating Limitations	
	22. Engine Ground Running	
	23. Pressure Refuelling	
	24. Defuelling	
	25. Gravity Refuelling	
	26. Emergency System Accumulator - Check Contents and Replenish	
	27. Landing Gear Standby Lowering	
	28. Flap Standby Lowering System	
	29. No.1 Hydraulic System Accumulator - Check Pressure and Replenish	
	30. No.2 Hydraulic System Accumulator - Check Pressure and Replenish	
	31. Wheel Brake Accumulator - Check Pressure and Replenish	

SYSTEM	SIMULATED TASK	SIMULATED FAULTS
SERVICING - ROUTINE MAINTENANCE	32. Hydraulic System Reservoirs - Check Contents & Pressures and Replenish 33. Brake Master Cylinders Reservoir – Replenish 34. Engine Oil - Check Contents and Replenish 35. Auxiliary Power Unit Oil - Check Contents and Replenish 36. Main Generator Cooling System Oil 37. Backup Oxygen System - Check Contents and Replenish 38. Emergency Oxygen System - Check Contents and Replenish 39. Tyre - Check Pressure and Inflate 40. Nose Undercarriage Unit - Check Pressure/ Extension and Replenish	
SURVEILLANCE	1. IFF Functional	1. Internal fault. Mode 2 interrogation fails 2. Internal failure. Mode 3A test fails 3. Internal switch failure, constant output from pin 2. Incorrect Mode 2 Emerg test code 4. Internal switch failure, constant output from pin 2. Incorrect Mode 2 Emerg test code.
TACTICAL COMMUNICATIONS	1. Radio 1 Test	1. Faulty Rotactor. Scratchpad not displayed 2. Internal coil failure. Command does not transfer 3. Internal SRC Panel failure. RT Fault displayed 4. Internal failure. Degraded flag on the MFD/Standby Controller when the Radio runs an IBIT 5. Internal failure. Failure flag on the MFD/ Standby Controller when the Radio runs an IBIT 6. Internal failure. Fails IBIT 7. Internal failure. Fails IBIT
WEAPONS SYSTEMS	1. SMS IBIT 2. SMS Assisted BIT 3. WIP (Weapons Insertion Panel) Code	1. Internal power supply fault. BIT fail indication passed to the mission computers 2. VCR Dew present (condensation present within the VCR) 3. VCR fail (internal VCR fault) 4. Switch remains in the open position



Optional Accessories

Pennant will be happy to provide support services to assist with installation on End User equipment or to provision, install and commission appropriate PC equipment at the End User site.

Ordering Information

99100-000-0001A	Fixed Wing Aircraft Systems Trainer
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