



**Operator Maintenance Manual (OMM) for
FIDELITY TYPE SPECIFIC (FTS) BEEHCRAFT KING AIR C90
ADVANCED AVIATION TRAINING DEVICE (AATD)**

Provided by:

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CHAPTER 1 Introduction

This manual contains information regarding the operation and maintenance of the Fidelity Type Specific (FTS) Beechcraft King Air C90B certified as an Advanced Aviation Training Device (AATD). The AATD replicates the operation of the Beechcraft King Air C90B, providing the flight crew with simulated scenarios for training purposes. The AATD includes replicated cockpit environment composed of a combination of refurbished parts, new Original Equipment Manufacturer (OEM) parts, and mechanically/digitally replicated parts to the layout of the King Air C90B.

AATD components and features include:

- Replicated King Air C90B Cockpit
- X-Plane 11 flight simulation software
- External visual display with five (5) monitor LCD Mosaic Wall
- Instructor Operating Station (IOS)
- Computer & control rack
- AATD Certification per FAA AC 61-136B

1.1 Purpose

The purpose of this document is to provide general instruction and procedures for the operators to successfully operate and maintain the training device.

The intended audience for this document is the FTS C90 AATD instructors and operators.

NOTE

This manual is intended to provide the end user operational instruction of the FTS C90 AATD. This manual does not provide aircraft or pilot specific tasks such as inspection or in-flight operating procedures. Refer to the aircraft's flight manual or pilot operating handbook for all aircraft or pilot specific tasks.

1.2 Theory of Operation

The AATD is a full-scale replica of the Beechcraft King Air C90 aircraft cockpit complete with seating for the student pilot and student copilot. The enclosed cockpit of the C90 AATD is comprised of hardware and software to provide the physical and functional characteristics of a King Air C90B aircraft. The training device consists of instruments, equipment, panels, and controls common to the aircraft cockpit environment including the assemblage of equipment and computer software programs necessary to represent the airplane in ground and flight conditions. The flight/engine model uses a default X-Plane 11 C90B flight model modified to meet AATD criterion. The device is designed to function for training in normal, abnormal, and emergency operation procedures. The AATD will function with the following items:

- King Air C90 Flight Model and Controls
- Out-The-Window (OTW) Visual/Instrument Display
- Simulation system designed to run X-Plane Version 11 software
- AATD certification
- IOS including Guardian specific failures

The AATD includes a visual system to provide the student pilots an OTW view displayed on five (5) LCD screens. A detached Instructor's Operating Station (IOS), located to the rear of the cockpit enclosure, provides seating for one pilot instructor. The IOS has additional room to allow other personnel

to observe and can arrive/leave as necessary during training without interrupting the session. The IOS is fitted with 4 LCD screens, a mouse, and keyboard to be used to monitor and control the training session. The LCD monitors allow the instructor to control the training session while viewing avionic instrumentation from the cockpit instrument panel.

NOTE

This device is comprised of many extracted items from an actual aircraft, Commercial Off The Shelf (COTS) products, and F2Si manufactured components. This manual does not include information found in the aircraft manuals or COTS product manuals. This manual only covers items incorporated by F2Si. Refer to the aircraft or COTS manuals for operations and maintenance.

1.3 Definitions and Acronyms

Acronym	Description
AATD	Advanced Aviation Training Device
ATC	Air Traffic Control
CH	Channels
COTS	Commercial Off The Shelf
CSCI	Computer Software Configuration Items
DLL	Dynamically Linked Library
F2Si	Fidelity Flight Simulation Incorporated
FASA	F2Si Analog Scaling Application
FOV	Field of View
GUI	Graphical User Interface
IG	Image Generator
I/O	Inputs and Outputs
IOS	Instructor Operating System
MIP	Main Instrument Panel
OEM	Original Equipment Manufacturer
OMM	Operator Maintenance Manual
OTW	Out-The-Window
PTT	Push-To-Talk
SIP	Supplemental Instructor Panel
VNC	Virtual Network Computing

1.4 Scope

This manual addresses the operation and maintenance of the computer systems and components of the AATD. This manual includes the following:

Section 2 describes the operation and location of the Emergency and Safety buttons.

Section 3 provides a system overview of the operating systems.

Section 4 provides equipment description of major components

Section 5 provides operation procedures to include pre-Startup checks, system start-up and shutdown, including training operation from the IOS and Supplemental Instructor Panel (SIP).

Section 6 describes basic Maintenance and Troubleshooting procedures.

CHAPTER 2 Emergency and Safety

Emergency Stop and Pause buttons are located inside the cockpit on the Center Pedestal Panel shown in Figure 1. The buttons are used for student safety and convenience to halt training.



Figure 1 Center Pedestal Panel Pause and Emergency Stop Buttons

2.1 Pause Button

The Pause button (Figure 2) will place the simulator in a temporary halted state. The pause button should be pressed by a pilot to briefly stop the simulation in the event of sickness, a health condition, or other personal reasons. The pause button is located towards the rear of the center console and is accessible to both Pilot and Copilot. When pressed, “Pause” is displayed on the visuals in the upper right corner. Training can be resumed when ready and the situation has been rectified. Press the pause button a second time to resume training.



Figure 2 Pause Button

2.2 Emergency Button

WARNING

Due to the abrupt nature of this action, this button should only be used during extreme circumstance such as fire, flood or eminent danger to personnel.

An Emergency Stop (E-Stop) button (Figure 3) is located on back of the center console accessible to both Pilot and Copilot. The red E-Stop button is a safety feature used to stop training in the event of an extreme emergency to protect personnel and equipment. Pushing the E-Stop button will abruptly stop training and cut power to the entire system.



Figure 3 Emergency Button

CHAPTER 3 System Overview

The King Air C90 AATD system uses a distributed design architecture that groups common functionality according to computer resources, network architecture and bandwidth, system level requirements and overall complexity. This distributed software system organizes and categorizes both developed and COTS software into a Computer Software Configuration Items (CSCI). The system CSCIs interface with other CSCIs connecting major systems and sub-systems forming distributed communication protocols. Figure 4 shows the high-level system architecture of the King Air C90 AATD. Major systems include the Computer, Cockpit, Visual, IOS, and Audio Systems. The system hardware consists of seven (7) machines; six (6) Windows machines and one (1) Linux machine. The AATD CSCI baseline system software is listed in Table 1 which provides a description and identifies the author. The following sections will describe functionality and capabilities of the systems.

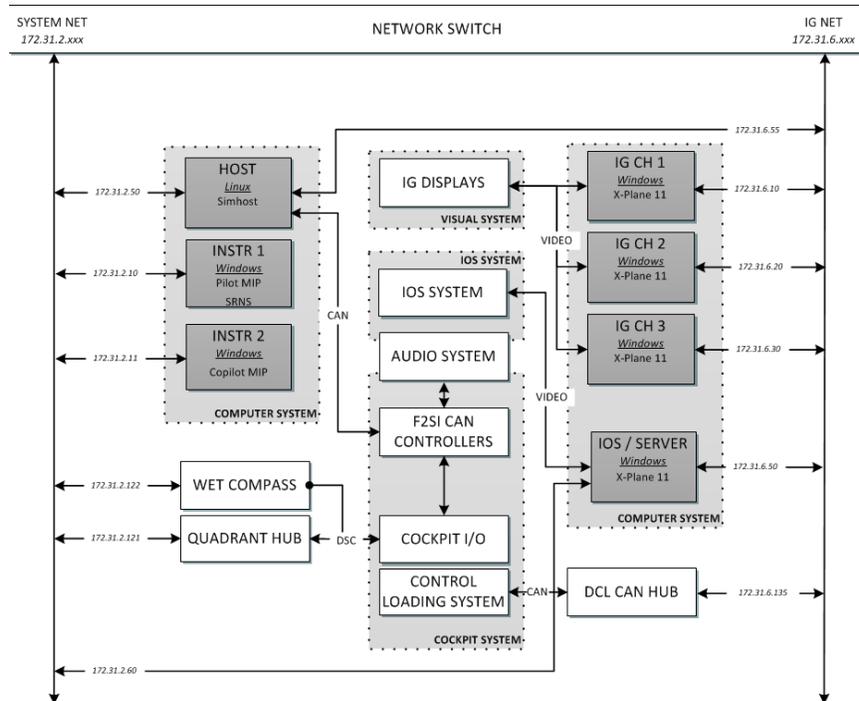


Figure 4 High-Level System Architecture

Table 1 CSCI Software

CSCI	Description	Source
Avidyne MFD OEM Firmware	OEM firmware	Avidyne
C90 Flight Model	C90 aerodynamic model	F2Si
Compass Controller	Microcontroller firmware controlling the magnetic compass	F2Si
Copilot Instrument Panel	Digital emulation of copilot instrument panel	F2Si
Debugger	Utility program providing Realtime simulation debug data	F2Si
Dynamic Control Loading (DCL)	CLS2Sim, E2Can	Brunner
F2Si Analog Scaling Application (FASA)	Utility program assisting in converting raw analog data to scaled values	F2Si
Flight Illusions Hub	Microcontroller firmware controlling mechanical COTS gauges	Flight Illusions
Garmin 625 OEM Firmware	OEM firmware	Garmin
Image Generator	3D visual scene displayed on 5 OTW monitors	X-Plane

IOS Graphical User Interface (GUI)	Instructor interface control of simulation environment	X-Plane
Pilot Instrument Panel	Digital emulation of pilot instrument panel	F2Si
Quadrant Controller	Microcontroller firmware controlling the quadrant	F2Si
Radio Ident Player	Audio program plays radio idents	F2Si
Remrun	Software and configuration startup and shutdown of simulation	F2Si
Short Range Navigation System (SRNS)	Navigation database and radio receiver model for all short-range radios (VOR, ILS, ADF, TACANS)	F2Si
SimHost	Central processing system for aircraft modeling and subsystem intercommunication	F2Si
Supplemental Instructor Panel (SIP)	Supplemental instructor interface control of simulation (malfunctions, circuit breaker activation, instructor intercom)	F2Si
X-Plane Audio Assist Plugin	Communication interface between SimHost and X-Plane for audio alert queuing	F2Si
X-Plane Data Comm Plugin	Communication interface between SimHost and X-Plane for all common data reference variables	F2Si

3.1 Simulation Host (SimHost)

The developed SimHost runs on a Linux computer (HOST) located in the nose of the cockpit. SimHost auto-starts on PC boot up and functions as a hardware input/output (I/O) data processor. The SimHost functions as a central processing system for aircraft modeling and subsystem intercommunication. The SimHost uses standard communication protocols (UDP, CAN Open, RS-232) for the subsystem intercommunications. The system connection allows access from IOS monitor for maintenance purposes. The aircraft system modeling includes:

- Electrical
- Avionics
- Fuel
- Engine
- AFCS
- Flight Controls
- Ice & Rain
- Landing Gear & Brakes
- Lighting
- Master Warning
- Pressurization
- Propeller
- Radio

3.2 CAN Controllers

The CAN Controller hardware uses CANOpen developed software to serve as a protocol conversion communication hub between the SimHost and cockpit hardware. The CAN Controller interfaces with the SimHost to send control and switch input positions to the cockpit hardware and receive annunciator output states.

3.3 Cockpit System

The King Air C90B cockpit layout is composed of a combination of refurbished parts, new OEM parts, and mechanically/digitally replicated parts. The cockpit components communicate with the system directly or through the SimHost communication protocols for subsystem intercommunications. Figure 5 provides the cockpit component architecture of the panels and controls communication with the system.

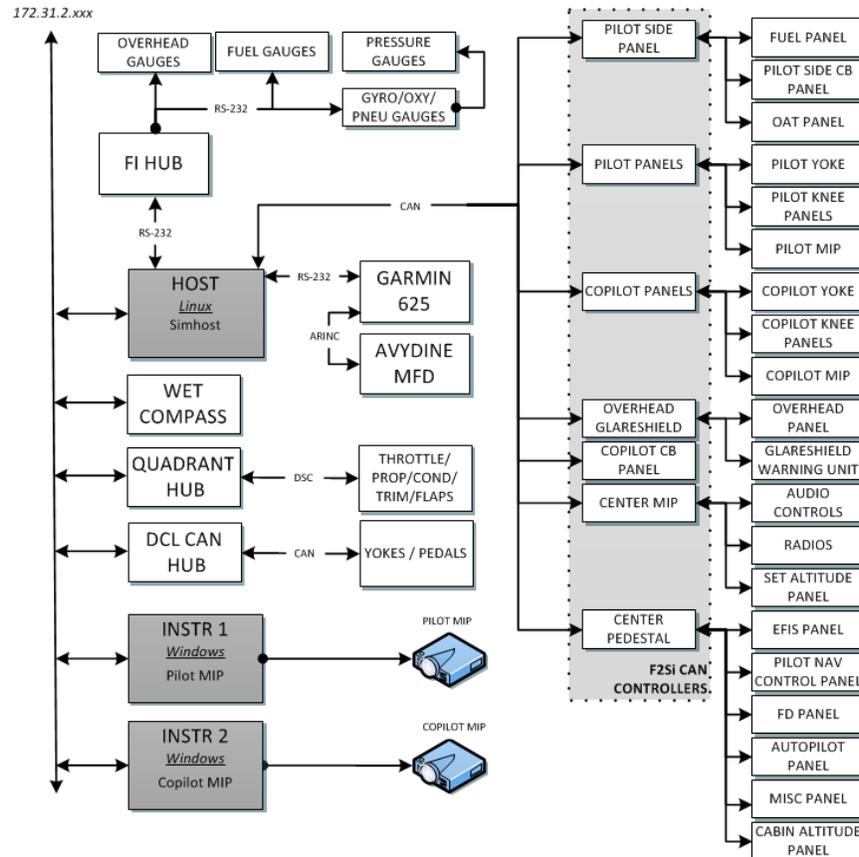


Figure 5 Cockpit Components Architecture

3.4 X-Plane Data Comm Plugin

The X-Plane Data Comm Plugin interpolates and maps data packet communication with the SimHost. The Data Comm Plugin runs within X-Plane as a loaded Dynamically Linked Library (DLL) on the (Windows 10) computer. The plugin is used to map each cockpit I/O data to X-Plane data reference; interface with Flight Model via X-Plane API protocol to send/receive I/O data; and interface with SimHost via UDP protocol to send/receive I/O data.

3.5 Instruments

OEM parts include the Garmin GTN 625 and Avidyne MFD communicate using OEM firmware. The MFD is directly cabled to Garmin to provide GPS position and flight plan input and output data which is processed through the SimHost. The cockpit hardware Inputs and Outputs (I/O) include the interior panels (Knee, Fuel, and Circuit Breaker Panels, etc.) interface with the SimHost through the CAN Controller. Mechanical COTS gauges, Throttle Quadrant, and compass are controlled through hubs using microcontroller firmware.

Instrument computers, identified as INSTR 1 (Pilot) and INSTR 2 (Copilot) in Figure 5, drive the digitally modelled instrumentation of the Main Instrument Panel (MIP). The pilot and copilot computers

are located behind the MIP in the nose of the cockpit, include projectors. GL Studios provide the digitally replicated gauges that are visually projected by two (2) Optoma UHD50 4K projectors onto a surface installed on the rear of MIP (Figure 6). The projected surface consists of custom fit plexiglass with a projection film applied to the rear surface. The uncoated side of the plexiglass serves as a protected surface in the cockpit interior. Bezels are actual tactile hardware replications. Bezels do not include backlighting. Refer to GL Studios and Optoma projectors COTS manuals for a full understanding of each product.

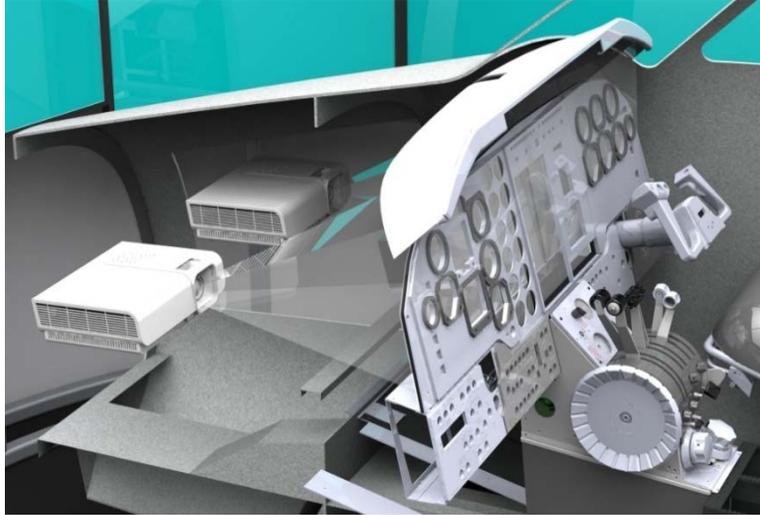


Figure 6 Projection of MIP Gauges

3.6 Dynamic Control Loading (DCL)

Flight controls incorporate Dynamic Control Loading (DCL) on each of the three main axes to provide varying forces and “feel” based on flight conditions (Figure 7). The C90 AATD utilizes a COTS product, Brunner Dynamic Control Loading System, to provide the force feedback of the Yoke and Pedals. The hardware controls interface with the host software using the Brunner’s CLS2Sim program. Force profiles for each axis (pitch, roll, yaw) reflect the force of C90 aircraft using the CLS2Sim interface. Refer to the COTS Brunner Dynamic Control Loading System Operation Manual for the description, capabilities, and functionality.

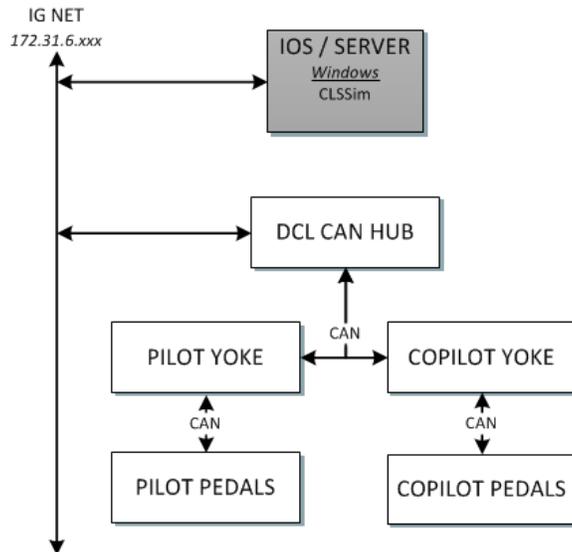


Figure 7 Control Loading System

3.7 C90 Flight Model

The C90 AATD flight/engine model uses a modified version of X-Plane 11 default C90B flight model. The X-Plane aircraft/engine model provides a representation of the actual aircraft flight model and easily integrates with the cockpit hardware components. The default model is designed to include all aerodynamic surfaces, weight and balance modeling, atmospheric and ground reactions, flight control inputs, propulsion systems, and the calculations to compute all interactions between the simulated air models and its surrounding environment.

Modifications were made to the flight model to meet AATD criterion and is a certified FAA AATD flight model. The certified model includes aircraft performance parameters for cruise speed, stall speed, maximum climb rate, and maximum speed comparable to the represented aircraft. Flight dynamics of the AATD are comparable to the actual C90B aircraft performance and handling. Changes in flap setting and gear position are accompanied by changes in flight dynamics. Refer to the COTS X-Plane 11 Desktop Manual and Pilots Operating Manual for the description, capabilities, and functionality.

3.8 Visual System

The Image Generator (IG) computer provides the OTW IG Channels (CH) for visual display monitors 1 – 5. IG CH 1 is displayed across the left and right aft monitors (offset 90 degrees to the center monitor), IG CH 2 is displayed on the center monitor, and IG CH 3 is displayed across the left and right forward monitors (offset 45 deg to the center monitor) as shown in Figure 8. The IG computer provides default global airports using the worldwide geotypical terrain database included with X-Plane 11. The IG processes the visual scene at a rate of approximately 60Hz to render the OTW visual scene and visual effects of all environmental conditions. The IG depicts environmental conditions set at the IOS to provide realistic cues in both day and night VFR and IFR meteorological conditions. This feature is used to enhance a pilot's visual orientation in the vicinity of an airport to include approach lights, generic roadways, rivers, terrain contours.

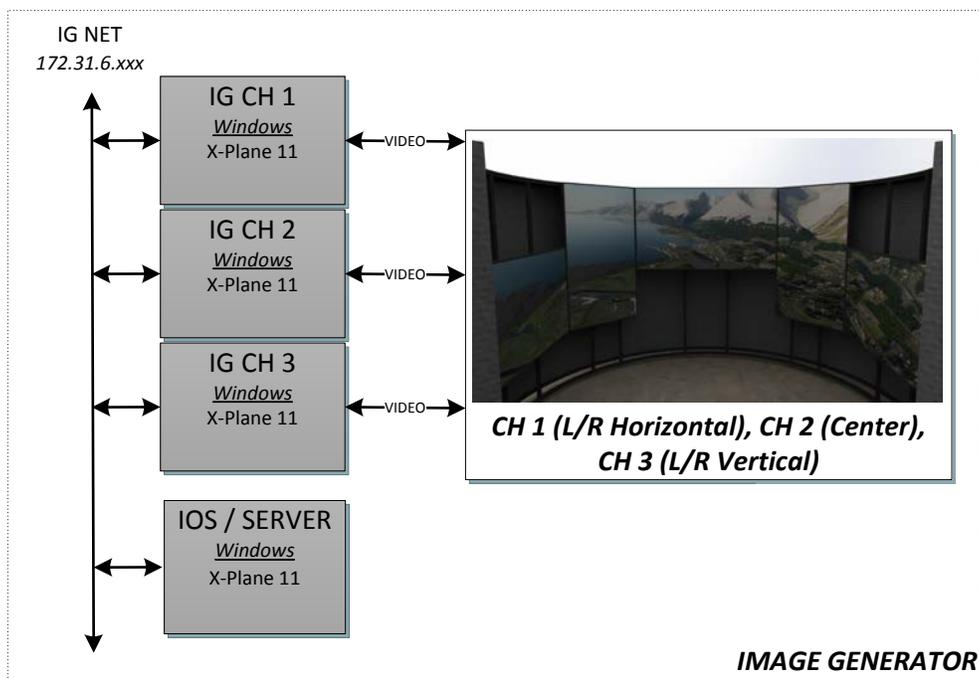


Figure 8 OTW Visual Display

3.9 Audio System

The C90 AATD audio system uses a combination of COTS and developed software for a complete audio solution. The audio solution provides environmental sound effects and a Radio System for pilot and copilot audio operation. F2Si developed a custom intercom solution for instructor and student communication. Figure 9 depicts the Audio System with X-Plane 11 running on the IOS/SERVER and IG CH 1-3 and F2Si CAN CONTROLLERS running a custom intercom solution. Sound is routed to speakers located inside and outside of the cockpit.

The IG CH 3 computer produces engine, propeller, and environmental sound effects which are routed to the left and right speaker external to the cockpit. Radio Idents and marker tones sound effects are sourced from IG CH 1 and IG CH 2 computers and mixed with the pilot/copilot intercom system through left and right cockpit speakers and pilot / copilot headsets.

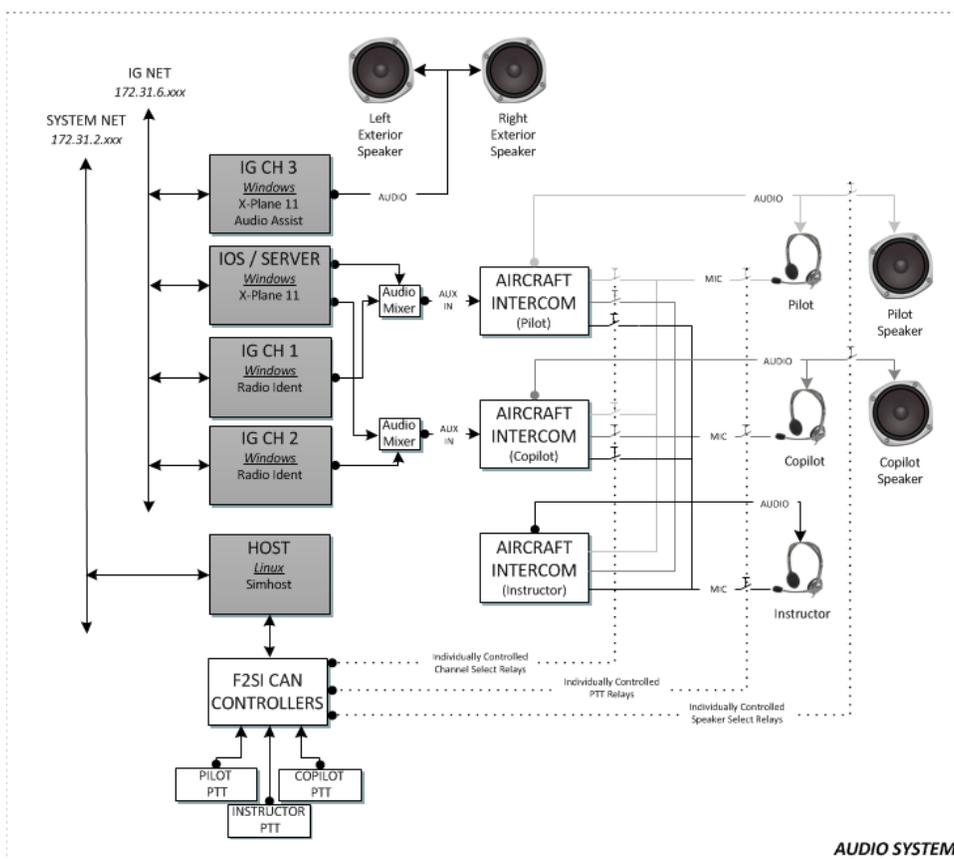


Figure 9 Audio System Diagram

3.9.1 X-Plane Audio Assist Plugin

The Audio System incorporates X-Plane 11's dynamic sound model for the C90 AATD. X-Plane 11 uses FMOD to provide a high-quality commercial sound engine and sound authoring environment. The X-Plane Audio Assist Plugin interpolates and maps data packet communication with the SimHost. The Audio Assist Plugin runs within X-Plane as a loaded Dynamically Linked Library (DLL) on the (Windows 10) computer. The plugin is used to map specific audio queue data to X-Plane data reference; interface with Flight Model via X-Plane API protocol to send/receive I/O data; and interface with SimHost via UDP protocol to send/receive I/O data.

The plugin produces system alerts sound effects which are routed to the left and right speaker external to the cockpit.

System Sound Effects include:

- Autopilot disconnects
- Gear horn
- Stall warning
- Altitude alert
- EFIS warning

3.9.2 Intercom System

The Pilot and Copilot intercoms are routed to left / right cockpit speakers, the pilot / copilot headsets and the Instructor intercom. The audio panel on the MIP controls the intercom audio output to the speakers and headsets. The Instructor intercom is connected to the Pilot and Copilot intercoms. The system includes a Push to Talk (PTT) function and Hot Mic controls. The system includes Yoke control and IOS PTT control switch to change between PTT/Hot Mic scenarios.

3.10 Instructor Operating Station (IOS)

Control functionality of the C90 AATD is managed directly from the operator station using a wireless keyboard and mouse. X-Plane's V11 has a built-in IOS Graphical User Interface (GUI) and provides the main operational control of the training device. F2Si developed Supplementary Instructor Panel (SIP) to provide control of malfunctions, circuit breaker activation, and instructor intercom. Both user-friendly applications run on the Windows 10 IOS/Server and are displayed on monitors at the IOS. The IOS monitors display the Instrumentation, OTW view, X-Plane 11 IOS, and SIP. Figure 10 provides an overview of the Instructor Operating System (IOS).

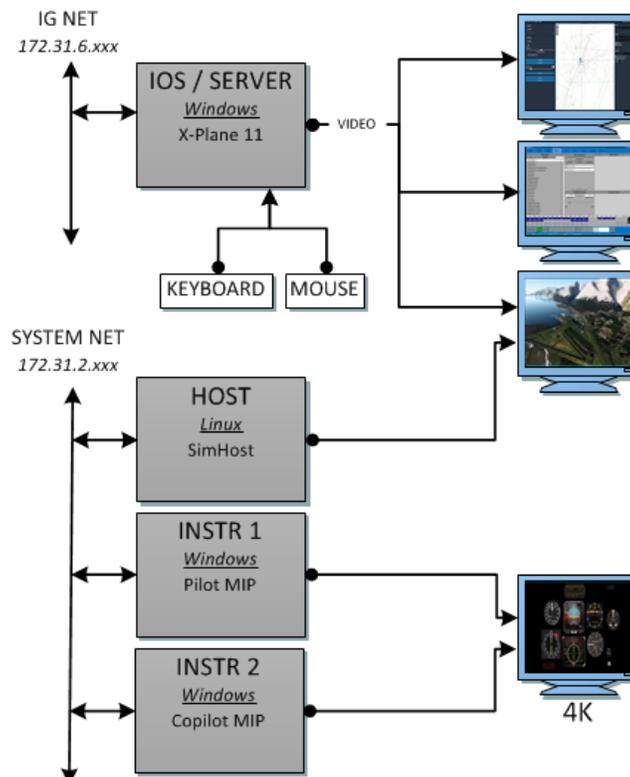


Figure 10 IOS

3.10.1 IOS

The System uses a Communication (X-Plane Data Comm Plugin) application between SimHost and IOS/Server to control X-Plane flight controls, various system switches, brakes, external lighting, malfunctions. The flight model interfaces with the IOS GUI to receive selected initial conditions including fuel and weight, position, airspeed, and malfunctions. The IOS provides the ability to control the intensity of environmental conditions. The system displays the visual effects of all environmental conditions in OTW display. Refer to the X-Plane Desktop Manual at: <https://x-plane.com/manuals/desktop/> for a full understanding of the functionality of X-Plane IOS.

3.10.2 SIP

The F2Si developed utility program provides supplemental instructor interface control of malfunctions and other auxiliary functions required for training. The SIP provides additional and customizable control to the instructor which include malfunction invocation of aircrafts systems, circuit breaker, and Instructor intercom control. The SIP screen at the IOS allows the instructor to invoke and clear faults during flight training. The instructor can introduce failures from the IOS, once activated, the system will function based on actions from the crew member, with no further input from the instructor's controls. The Instructor can activate communications from SIP interface selecting to transmit on either COM 1 / COM 2 / HOT MIC, and Push-To-Talk (PTT). The Instructor intercom is routed to left and right cockpit speakers as well as pilot and copilot headsets, depending on the selections of the audio panel on the MIP. Refer to CHAPTER 5 for operating the SIP controls.

3.10.3 RemrunGUI Application

F2Si developed the RemrunGUI application as a server level, platform neutral system to work on Windows and Linux computers. RemrunGUI is designed to automate the system Startup, shutdown, power down processes, as well as serves as system status monitor. RemrunGUI uses a client/server-based architecture on the IOS/Server, with a client agent executed on each PC. The agents run in the background of each machine monitoring the state of running tasks. Remrun uses a client installed on the IOS machine to monitor agents loaded on each machine. Remrun enables remote control of programs running on a variety of network connected systems, giving the instructor control from the IOS desktop.

CHAPTER 4 Equipment Description

F2Si designed and manufactured the FTS C90 AATD to support Beechcraft King Air C90 aircraft training. The FTS C90 AATD is a fixed-base training device with a footprint of 14' X 16.5' X 7.5' and requires a minimum room size of 17' X 18' X 8' with a minimum doorway opening of 6' X 7' (WXH). The FTS C90 AATD operates on existing house power (110AC/30A). The major components of the FTS C90 AATD simulated system are identified in Figure 11, which includes:

1. Enclosed King Air C90 Cockpit replica
2. External visual display
3. Computer rack
4. IOS

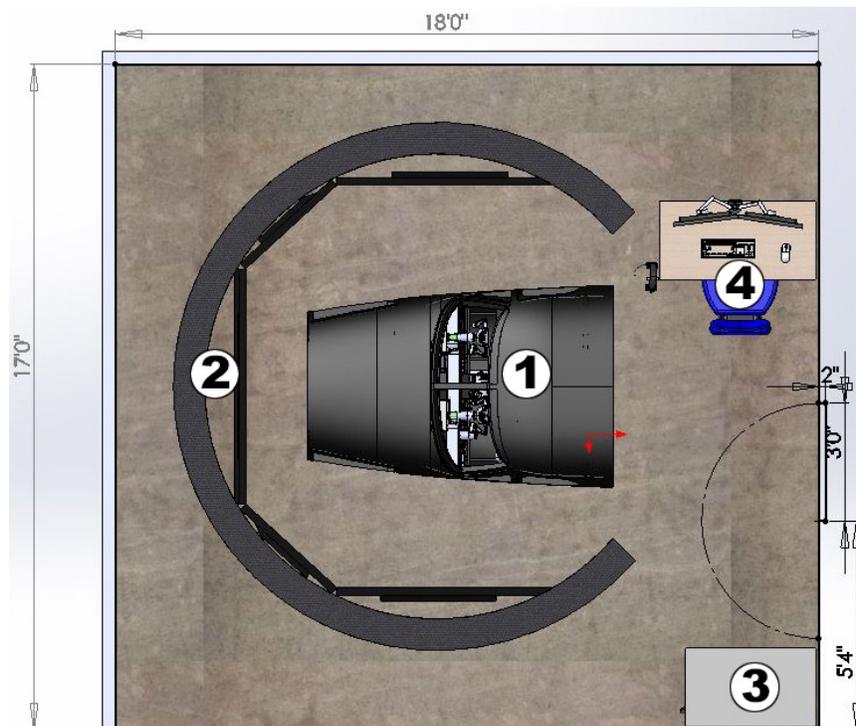


Figure 11 Simulator Training Room Minimal Size

4.1 Cockpit

The enclosed C90 cockpit replica uses an actual salvaged King Air cockpit frame for the baseline structure. The cockpit is elevated off the floor, setting on three support legs. The windshields are removed to avoid interference with the external visual display (glare/dirt/etc.) and allows better airflow through the cockpit. The cockpit layout of the King Air C90B AATD is composed of a combination of refurbished parts, new OEM parts, and mechanically/digitally replicated parts. The cockpit structure has physical and visual characteristics of the C90B aircraft to the extent necessary to supplement fidelity required and to meet or exceed FAA AATD certification.

The cockpit's pilot and copilot seats, throttle quadrant, Glareshield, and Landing Gear Handle were salvaged from the airframe and refurbished. Interior panels have been mechanically replicated including Main Instrument Panel (MIP), Knee, Fuel, Circuit Breaker Panels, Center Pedestal, and Overhead Panel. The movement, look, and tactile feel of knobs and switches replicate those in the aircraft. Flight-quality switches are used to withstand the rigorous handling typically encountered in an intensive flight training simulation environment. The location of individual panels and controls of the cockpit are called out in Figure 12. Table 2 identifies the components.

NOTE

This manual is intended to provide the end user operational instruction of the King Air C90 AATD. This manual does not provide aircraft or pilot specific tasks such as inspection or in-flight operating procedures. Refer to the aircraft's manual for all aircraft or pilot specific tasks.

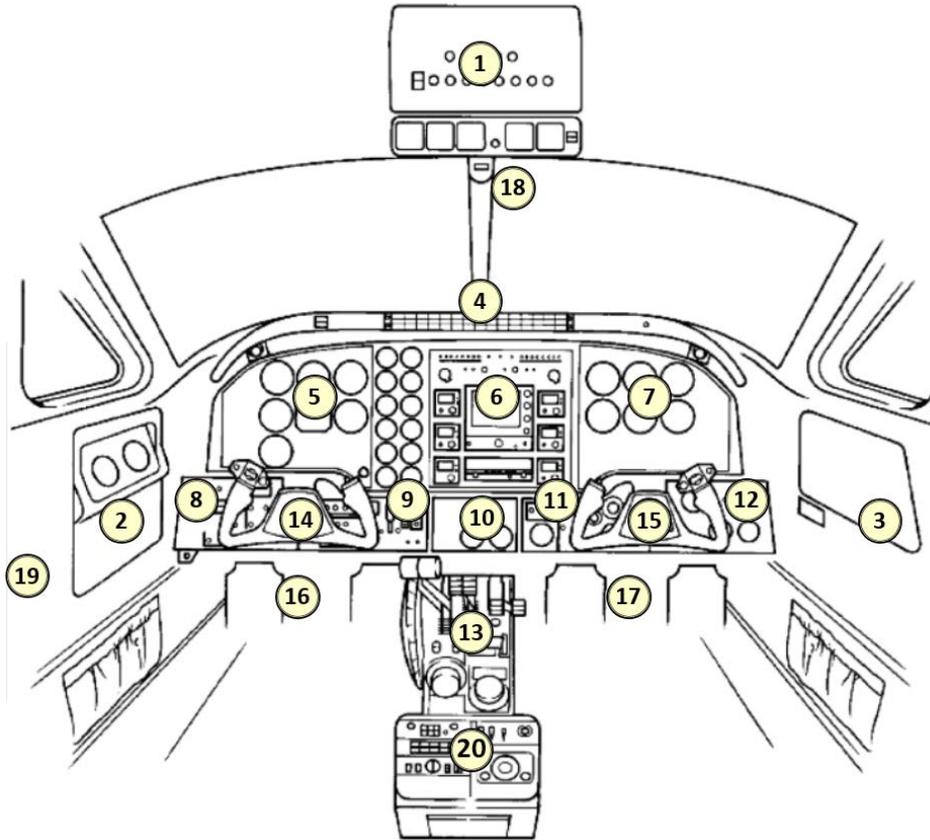


Figure 12 C90 AATD Cockpit Components

Table 2 Cockpit Components

#	Item	Type
1.	Overhead Panel	Mechanically replicated. Hinged for drop down maintenance access
2.	Fuel Management Panel/ Pilot Circuit Breaker Panel	Mechanically replicated
3.	Copilot Circuit Breaker Panel	Mechanically replicated
4.	Glareshield	Refurbished / modified to include Master Caution/Master Warning.
5.	Pilot Primary Instruments	Digitally replicated
6.	Avionics Panel	Mechanically replicated; includes an actual Comm/Nav controls, Avidyne EX500, an actual Garmin GTN 625 and an Altitude Preselect
7.	Copilot Primary Instruments	Digitally replicated
8.	Pilot Knee Panel	Mechanically replicated
9.	Landing Gear Controls	Mechanically replicated
10.	Center Knee Panel	Mechanically replicated

11.	Environmental Controls	Mechanically replicated
12.	Copilot Knee Panel	Mechanically replicated
13.	Throttle Quadrant	Refurbished
14.	Pilot Yoke	Brunner Innovations
15.	Copilot Yoke	Brunner Innovations
16.	Pilot Pedals	Brunner Innovations
17.	Copilot Pedals	Brunner Innovations
18.	Magnetic Compass	Mechanically replicated
19.	ELT/OAT	Mechanically replicated
20.	Center Pedestal Panels	Mechanically replicated

4.1.1 Main Instrument Panel (MIP)

The Main Instrument Panel (MIP) is constructed with a metal frame mechanically replicated with a King Air C90B specific cockpit configuration with CNC or 3d printed plastic Bezels. Components populating the MIP include digitally emulated gauges, manufactured or refurbished parts, and OEM parts. Digitally emulated gauges are rear projected onto the Pilot and Copilot side of the MIP and include Engine Instruments and Radios by two (2) Optoma UHD50 4K projectors. The nose of the cockpit houses the HOST computer, INSTR 1 (Pilot), and INSTR 2 (Copilot), and 2 projectors.

Mechanical replicated gauges manufactured by F2Si include the Magnetic Compass and Free Air Temp. OEM parts include an actual Avidyne EX500 and Altitude Preselect which utilizes an actual Garmin GPS designed for simulation. The MIP is equipped with an actual Garmin GTN 625 for the GPS features. The Garmin devices require monthly database updates. The use of actual Garmin hardware allows Guardian pilots to train on the equipment found in the aircraft. Figure 13 shows the placement of the King Air C90B AATD cockpit components.



Figure 13 MIP Configuration

4.1.2 Flight Controls

The instrument panel and flight controls support both pilot and copilot crew members. Fully integrated flight controls include COTS products for the Pilot and Copilot Yoke and Pedals (Figure 14). The Yoke

and Pedals includes a 3-axes Dynamical Control Loader (DCL) system to provide force feedback based on flight parameters. DCLs are incorporated on the flight controls three main axes to provide varying forces and “feel” based on flight conditions.



Figure 14 Yoke and Pedals

4.1.3 Seats

The pilot/copilot seats are refurbished and include seat belts, forward/aft adjustment, and vertical adjustment. The visual system is installed to align with the cockpit eye position. The crew seats are placed in the original cockpit position to properly seat pilots in the flight deck environment. Pilots can adjust the seat for optimum eye position and in the correct position for access to the cockpit switches and knobs. The seats function as they do in the actual aircraft.



Figure 15 Cockpit Seats

4.2 Visual System



Figure 16 C90 AATD OTW View

The C90 AATD provides a high resolution OTW visual display for low altitude, approaches, takeoffs, environmental situations, day and night flying training (Figure 16). The OTW display consists of five (5) large LCD screens of varying sizes and orientation positioned around the cockpit. The placement of the screens maximizes the view out each window. The visual display system is comprised of:

- One (1) 82" LCD screen in front/center horizontal (landscape)
- Two (2) 75" LCD screens located at the front corners rotated in vertical (portrait)
- Two (2) 75" LCD screens flank the Pilot and Copilot in rear to achieve maximum rear view from Pilot/Copilot seats

The OTW display provides a 183 degrees x 25.6 degrees Field of View (FOV) shown in Figure 17. While not a requirement, the visual system provides a 9.8 degrees Parallax which will not require Crew Resource Mode (CRM) mode.

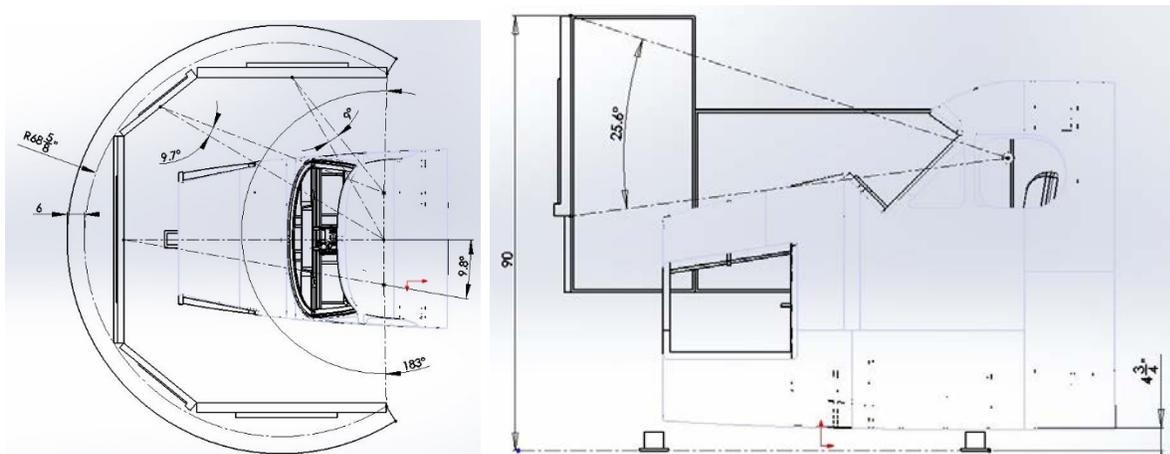


Figure 17 FOV and Parallax

4.3 Computer Rack

The computer rack contains system hardware which drives X-Plane and OTW visual display. The rack mounted computers in Figure 18 are enclosed with cover plates with an access door. The system cabling bundle extends across floor running from the rack to the Cockpit, visual system, and IOS. Table 3 lists the

computer system specifications of all computers including the items located in the computer rack and in the nose of the cockpit.

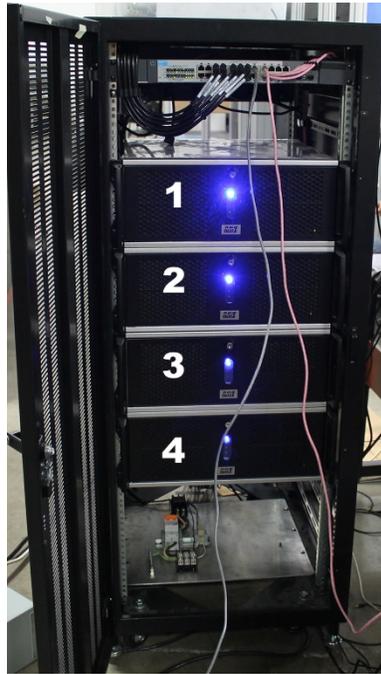


Figure 18 Computer Operating Systems

Table 3 Computer Specifications

#	Device	Description	Specification
1.	IG 1	Image generator computer for Visual 1 – 5	<ul style="list-style-type: none"> • 4U 17.5" Compact Industrial Server Chassis • 600W 80+ Titanium Modular Power Supply (Rated to support 1x GPU) • 2U ~ 4U, 26" Tool-less Kingslide Rail • 2-bay 2.5" HDD/SSD Enclosure with 6Gb/s SATA Backplane
2.	IG 2		<ul style="list-style-type: none"> • LGA 1151 (300 Series) Intel Z390 HDMI SATA 6Gb/s USB 3.1 ATX • Core i5-9600K (9M Cache, 3.7 to 4.60 GHz) 6C/6T 95W • 92mm CPU Heatsink • (2) 8GB DDR4-2666 Hyper X Memory (16GB Total)
3.	IG 3		<ul style="list-style-type: none"> • DCT-883 480GB Enterprise SSD Drive 2.5in (Removable) • GTX 1080Ti 11GB Graphics Card (EOL, only available while quantities last) • OEM WIN PRO 10 64BIT ENGLISH 1PK KIT SKU • 3-year warranty from date of purchase (2/19/19)
4.	IOS/SERVER	IOS and X-Plane server computer	<ul style="list-style-type: none"> • 4U 17.5" Compact Industrial Server Chassis • 600W 80+ Titanium Modular Power Supply (Rated to support 1x GPU) • 2U ~ 4U, 26" Tool-less Kingslide Rail

			<ul style="list-style-type: none"> • 2-bay 2.5" HDD/SSD Enclosure with 6Gb/s SATA Backplane • LGA 1151 (300 Series) Intel Z390 HDMI SATA 6Gb/s USB 3.1 ATX • Core i5-9600K (9M Cache, 3.7 to 4.60 GHz) 6C/6T 95W • 92mm CPU Heatsink • (2) 8GB DDR4-2666 Hyper X Memory (16GB Total) • DCT-883 480GB Enterprise SSD Drive 2.5in (Removable) • GTX 1080Ti 11GB Graphics Card (EOL, only available while quantities last) • OEM WIN PRO 10 64BIT ENGLISH 1PK KIT SKU • 3-year warranty from date of purchase (2/19/19)
The following components are not in Figure 17. The components are in the nose of the cockpit.			
5.	HOST	Host computer for SimHost	<ul style="list-style-type: none"> • Ubuntu (Linux) • 6th Generation Intel Core-i7-6822EQ Processor (2.0/2.8GHz, 8MB Cache) • 16GB SO-DIMM DDR4 2400 (1x 8GB) 1.2V SAM • 256GB SSD420 SATAIII MLC (Set up as Mirrored RAID) • (2) mPCIe x2; (1) USMI; (1) mSATA Expansion Slots
6.	INSTR 1	Instrument computer for pilot MIP	<ul style="list-style-type: none"> • Windows 10 • Intel NUC • Intel Core i3-7100U 2.4GHz • 8GB DDR4 • 240GB SSD • 4k Support
7.	INSTR 2	Instrument computer for copilot MIP	

4.4 Instructor Operation Station (IOS)

The Instructor monitors and controls the training session from the 48 x 23" IOS desk located directly behind the opening to the cockpit. The station is equipped with four (4) 24-inch monitors, keyboard and mouse, chair, and intercom jack for instructor headset. Used to monitor and control the training session, the 4 IOS Monitors identified in Figure 19 include (1) cockpit instrumentation, (2) OTW Monitor, (3) IOS GUI, and (4) Supplemental Instructor Panel (SIP).



Figure 19 IOS Monitor Identification

4.4.1 Cockpit Instrumentation Monitor

The instructor can view the Pilot/Copilot instrumentation on the instrumentation monitor. Item 1 in Figure 19 is displaying the Pilots instrumentation. The screens can be switched between Pilot/Copilot instrumentation screens. Refer to Section 5.4 for the process to switch between screens.

4.4.2 OTW Monitor

The instructor monitors the flight crew's external OTW view (Figure 20) from the IOS.



Figure 20 OTW Monitor

4.4.3 IOS Monitor

The IOS monitor at the instructor station runs the X-Plane's V11 built in IOS GUI and RemrunGUI to provide operational control of the system.

4.4.3.1 IOS GUI

X-Plane's GUI operates on the IOS/Server and displayed on the IOS monitor (Figure 21). The flight model interfaces with the IOS GUI to receive selected initial conditions including fuel and weight, position, airspeed, and malfunctions. The Laminar Research X-Plane Application is a COTS product. Refer to the X-Plane Desktop Manual at <https://x-plane.com/manuals/desktop/> for a full understanding of the operating procedures and functionality of X-Plane IOS to monitor and control training.

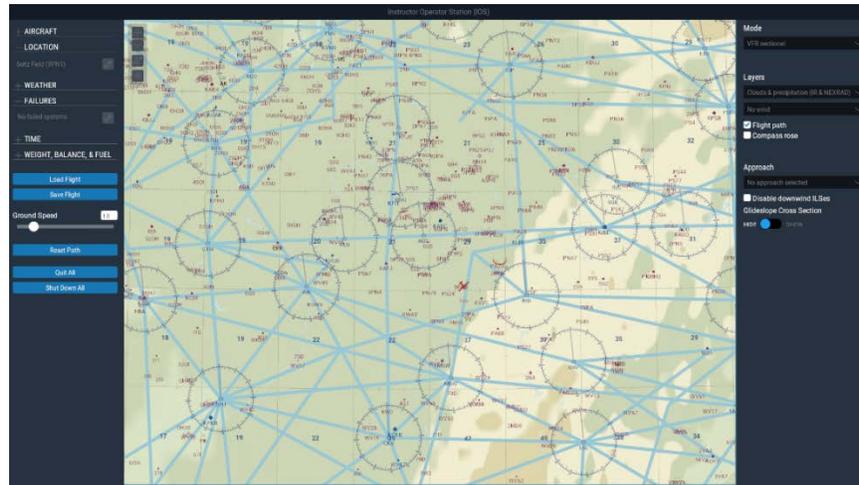


Figure 21 X-Plane's IOS GUI

4.4.3.2 RemrunGUI

The RemrunGUI application automates the system Startup, shutdown, and power down processes. All systems must be in the stopped state for the remote startup or shutdown. Remrun is designed to monitor the state of each server from the IOS and to start and stop the programs necessary for the operation of the simulator. The system uses a client/server-based architecture on the IOS/Server, with a client agent executed on each server which allows the instructor to observe the state of the system; and query the status of each subsystem agent loaded on the system.

Functions of RemrunGUI include:

- **Startup:** initial start of the simulator from a powered down state.
- **Reset:** indicates a software fault or lockup.
- **Shutdown:** applies to resetting the individual server applications.
- **Powerdown:** powers off the entire system.

The Remrun interface includes Server and Control Buttons with a log file description window to monitor the state of the servers. The Remrun's interface displays the server's status by color shown in Figure 22. The server button color indicates the state of the server described in Table 4. The following describes the Remrun interface.



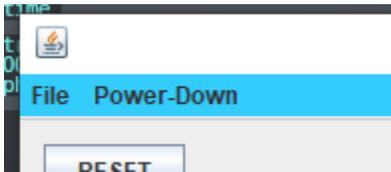
Figure 22 RemRunGUI

Table 4 Remrun Server Status Indicator

Status Color	Description
No Software Running	Initiating stage
Running	Indicates the system has been successfully accessed and computers are communicating.
Undetermined	Indicates the system is not in a running state. A reset is needed.
Stopped	Indicates the computers are not communicating, system cannot be reached.

4.4.3.2.1 Command Tabs

The following describes the command tabs in blue (Figure 23) at the upper left corner of the screen.

**Figure 23 Command Tabs**

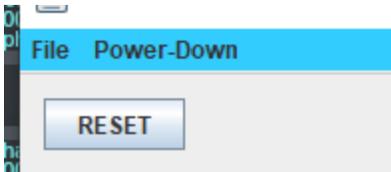
- **File**

File opens a menu option to Exit RemrunGUI. The program can also be closed using the keyboard shortcut “Ctrl + F4”.

- **Power Down**

Power Down located next to the File command tab opens a power down dropdown. Selecting Power Down launches a global shut down of the system. When selected several safeguards such as the power down dialog box, are activated to avoid an inadvertent shutdown. Selecting the Power Down option from the dropdown begins the Power Down process. This action will open a dialog box asking if a power down is required. The Power Down process safely shuts down the system terminating all running processes of each machine. The Remrun Power Down process tells the system to wait before moving onto the next machine. Refer to Section 5.10 for the full Power Down process.

4.4.3.2.2 Control Button

**Figure 24 Control Button**

There is only one Remrun Control Button (labelled “Reset” in Figure 24) located on the top left of the Remrun interface. When RemrunGUI is launched, the servers are running in an initializing state. Once the system is fully booted up, the control button will display one of the following: Start, Reset, or Stop. The control button indicates if the system is communicating properly and provides the ability to manage the servers’ state. Dependent on the state of the simulator determines what is displayed on the button. The RemRun Control Button provide will display as one of the following:

- **Start**

The control button displays “Start” to indicate all systems are in the stopped state and are ready for remote startup or shutdown. Pressing start will launch a system startup, the Control button will display “Abort Start”. Pressing “Abort Start” will end the system startup.

- **Reset Button**

In the event all systems did not initialize in the Running (green) state. When one or more server buttons display as yellow (Undetermined) and/or red (Stopped) this indicates the software running on those servers failed to start or there is an issue and a reset is required. Pressing the reset button will reinitialize the system by restarting the software.

- If the reset initializes the system and “Start” is displayed, select to launch the startup process.
- If the reset results in Undetermined after several attempts, troubleshoot the undetermined subsystem(s).

- **Stop**

When all servers are running (green) the control button will display “Stop”. Pressing Stop will put the software running on the servers in a Stopped state.

- If all systems are Stopped, the control button will display “Start”.
- If a portion of systems cannot be reached, the system is placed in an undetermined state with the control button displaying “Reset”.

4.4.3.2.3 Update Log Checkbox

The Update Log Checkbox is located above the Server Buttons and opens or closes the Log window below the Server Buttons.

- When checked the log file is populated in the window providing data that pertains to the state of the system.
- Deselecting the checkbox will close the Log window.

4.4.3.2.4 Log Level Selector

Log Level Selector controls the amount of information displayed in the Log window located below the server buttons. The Log Level Selector allows the user to select levels from 1-9 to display the amount of information. Lower Log levels provide less information and gradually provide more verbose information as the numbers increase. Level 1 provides the minimum information: basic log timestamp including the system state. Log Level 5 displays all RemRun information. Log Levels 6 begins to include system responses and increases as the numbers increase. Log Level 9 displays a verbose log file.

4.4.3.2.5 Sever Buttons

Each server is represented by a large rectangular button displayed across the middle of the screen. The buttons function as indicators and provide server information and controls. The state of each server is represented a color. Server information is provided by hovering over the server button or clicking the server button (Figure 25).

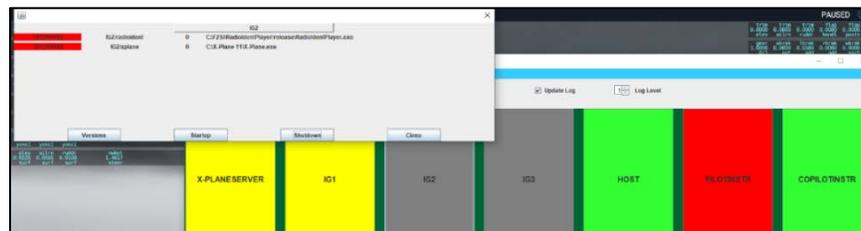


Figure 25 IG2 Server Software Information Status

4.4.3.2.6 Log File Window

The Log file window provides read-only information, viewable with the Update Log checked. The information displayed in the Log window is controlled with the Log Level selector.

4.4.3.2.7 Status Bar

The Status Bar at the bottom of the RemrunGUI displays read-only data, displaying the date, time, and state of the system.

4.4.4 Supplemental Instructor Panel (SIP)

F2Si developed the utility program interface, Supplemental Instructor Panel (SIP), to provide the instructor additional and customizable control of training. The SIP provides additional simulation control that X-Plane does not provide and control of auxiliary functions required for training. The instructor can implement SIP utility program failures at the SIP monitor. The SIP offers two tabs Malfunctions (default) and Circuit Breakers. The intercom system controls remain constant at the bottom of the SIP interface in either tab. The SIP default screen displays the Systems Malfunctions Tab interface (Figure 26). The following sections describe the SIP interface, refer to Section 5.6 for SIP operations.

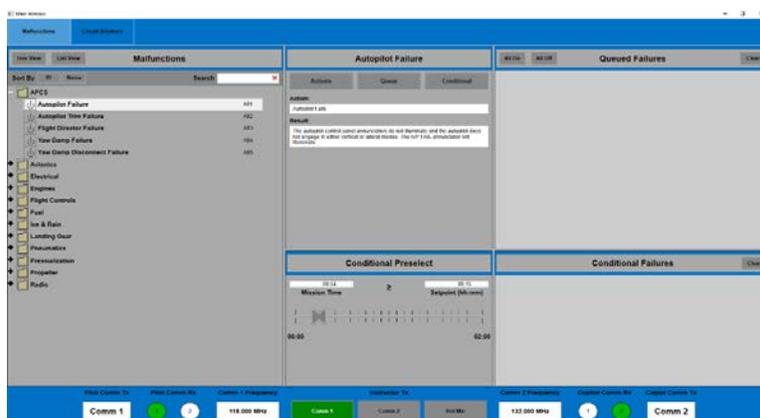


Figure 26 Systems Malfunctions

4.4.4.1 Malfunctions Tab

The SIP interface opens to the default Malfunctions screen which provides the instructor the ability to sort through and insert training malfunctions into the training session. Each training session can include multiple malfunctions. Figure 27 identifies the components of the Malfunctions Tab and correlate with Table 5. The following provides an overview of the malfunction components.



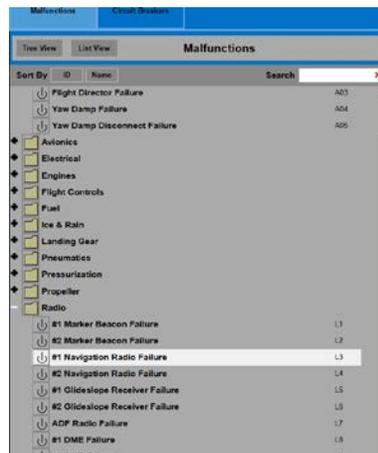
Figure 27 SIP Default Interface

Table 5 Malfunctions UI Identification

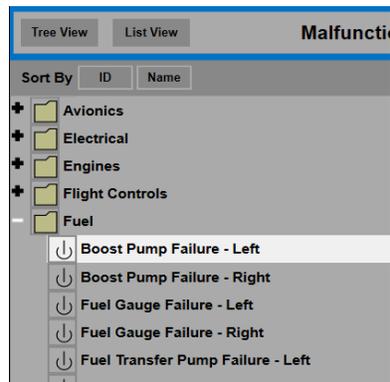
Item	Malfunctions Sections	Item	Function
A.	Malfunction List	Listed Malfunctions	Select malfunctions from the list
B.	Selected Malfunction Display	Displays the Malfunction	Displays the Cause
			Displays the Effect
C.	Conditional Pre-select Setting	Mission Time Slider	Set a moment on the slider to trigger a malfunction
D.	Queued Failures	Lists Queued Failures	Manage the selected failures
E.	Conditional Failures	Lists Conditional Failures	Manage the set conditional failures

A. Malfunctions Column

The Malfunctions column lists the failures by default in a tree view (Figure 28). The following provides an overview of the Malfunctions tab. The list may extend beyond the window use the scroll bar to the right of the list or the mouse scroll wheel.

**Figure 28 Malfunctions List**

- View
 - Tree View: Buttons on the left of the column allows the instructor to change how the list is displayed. Tree View lists malfunctions in folders by type.
 - List View provides malfunctions in a list.
- Sort By buttons shown in Figure 29

**Figure 29 Sort by Buttons**

- ID lists the malfunctions in numerical order
- Name lists the malfunctions alphabetically

- In the Search Field the instructor can begin to type the specific malfunction. A list will populate with each keystroke

B. Selected Malfunction Panel

The selected malfunction's title is listed at the top of the center column and in the Action field (Figure 30). Integration mode control buttons provides three options to integrate the selected failure into the training. Dependent on which mode is selected determines the state of the malfunction.

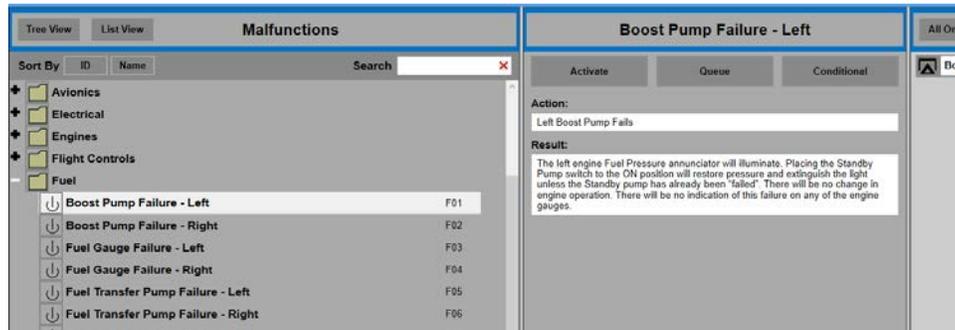


Figure 30 Selected Malfunctions

• Mode options:

By default, when selected the malfunction is displayed in the center column with the result displayed below. The selected malfunction is highlighted in white in the malfunctions list.

- Activate:
 - The malfunction becomes instantly active during training.
 - If selected prior to training, the selected failure becomes activated once training begins.
 - Appears in red (Figure 31)
 - In the Malfunction Sort By column
 - In the Queued Failures column

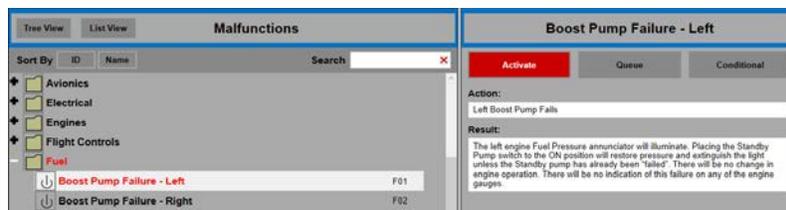


Figure 31 Activated Malfunction

- Queue:
 - Adds selected failures to the list in an inactive state. During the training session the failure can be activated by clicking on the queued item in the list at any moment in the training.
 - Appears in White in both the Malfunction Sort By column and in the Queued Failures list.
 - Displayed in white when inactive
 - Displayed in red when activated
- Conditional: a failure can be activated based on meeting preset conditions set in Conditional Preselect located below the selected malfunction (see Section C below).

- Action: identifies what will cause the failure.
- Result: provides a brief description of what is affected and the result of the failure.

C. Conditional Pre-select

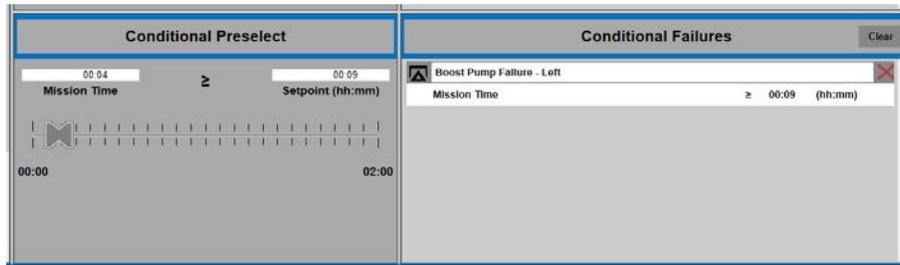


Figure 32 Conditional Settings

Malfunctions can be scheduled to trigger at a specific moment in the mission time. The Conditional Preselect provides a mission time slider which allows for up to 2 hours to introduce the set point marker. When the training reaches the set time, the failure will be initiated.

D. Queued Failures Column

Queued Failures is located on the upper right-hand column of the Malfunctions tab. By default, it is unpopulated (gray) and is divided in two sections, Queued Failures and Conditional Failures. When failures are either activated or queued in the Selected Malfunction Panel, the malfunction will be listed in the queued failures list (Figure 33). Control buttons provide the instructor with options to control the failure list.

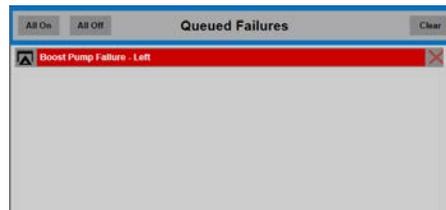


Figure 33 Queued Failures

- Activated (red)
- Queued (white)
- Control buttons:
 - All On: activates all the queued failures
 - All Off: deactivates all the queued failures
 - Clear:
 - The Clear button removes all the failures in the Queue list.
 - Click the red “X” on the right of the listed failure to clear individual failures

E. Conditional Failures

Located on the lower right-hand section lists the Conditional Failures (Figure 32) set in the Conditional Preselect. The failures are indicated as inactive (white) and triggered (red). The items in the list can be removed by clicking the red “X” to clear individual items or the clear button to remove all items in the queue.

4.4.4.2 Circuit Breakers (CB) Tab

The Circuit Breaker (CB) tab on the SIP interface displays both pilot and copilot CB on one screen (Figure 34) and corresponds with each functional CB in the cockpit. The instructor can view the status and induce faults in the cockpit. From the SIP the instructor can control the CB remotely by clicking on the breaker. From the SIP monitor the instructor can induce faults, view the status, and monitor the pilots' reaction in the cockpit.

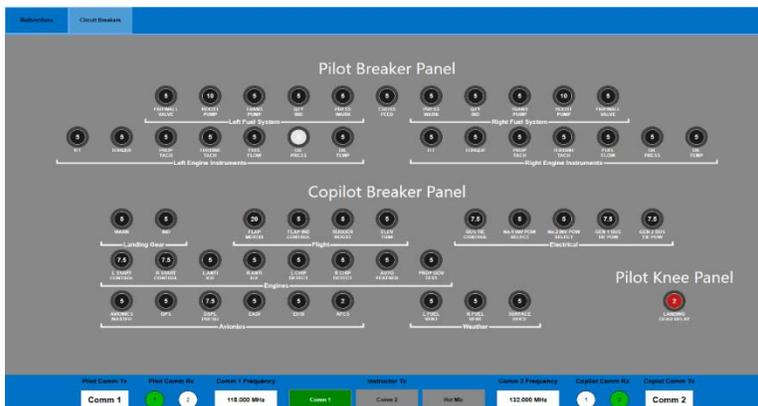


Figure 34 Circuit Breaker Screen Placeholder

When the instructor clicks on a CB on the SIP interface the induced fault is set to fail. The CBs are simulated and do not require the same current as the aircraft. When the circuit breaker pops, the appropriate reaction will take place inside the cockpit. The instructor can monitor the pilots' reaction by viewing the state of the CB. There are four (4) states of the CBs represented by a color on the SIP interface. Table 6 provides a description of the states of the CB.

Table 6 Circuit Breaker States

Circuit Breaker State Graphical Depictions			
	Black	Default state	Inactive or not tripped
	Orange	Activated to fail	Invoked by Instructor but not yet physically tripped
	Red	Tripped	Invoked by Instructor and physically tripped
	White	Cleared	Pilot corrected

4.4.4.3 Communications Panel

The SIP Communications (Comm) panel (Figure 35) is a custom solution which provides the instructor the ability to control and monitor pilots' communications. The Communications panel remains constant on the bottom of the SIP interface. The instructor has access to the panel in both the Malfunctions and CB tabs. The instructor can select transmission on the COM 1 / COM 2 / HOT MIC or any combination of

the three options. The instructor intercom is routed to left/right cockpit speakers and pilot/copilot headsets. The custom Intercomm system includes Yoke control PTT which the pilots must use to communicate back to the instructor.

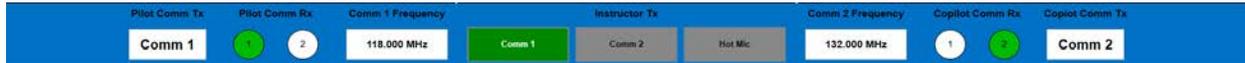


Figure 35 Communications Panel

The instructor can monitor the channel the communication is transferred on. The colors on the Comm panel indicate if the channel is ON (green) or off (white/gray). The following provides an overview of the communications panel.

- Pilot and Copilot Communication Transfer (Tx) shows which Comm channel the Pilot (on the left) and Copilot (on the right) are communicating on:
 - Comm 1
 - Comm 2
 - Cabin
- Pilot and Copilot Comm Receiving (Rx) 1 and 2: indicators show the state of the communication each pilot is receiving communication.
- Comm 1 and 2 Frequency indicates the frequency of the radios.
- Instructor Tx: indicates which channel the instructor's communication is transferred on.
 - Comm 1
 - Comm 2
 - Hot Mic

CHAPTER 5 System Operating Procedures

The procedures described in the following section provide instructions to power up, remote startup and shutdown, simulator operation and control. This section will also include of the SIP and Remrun application operation. Operation instructions of X-Plane IOS and all the COTS products can be found in their respective operator manuals located on the IOS/Server user desktop in the “Manuals” folder.

5.1 System Power up

1. Turn on the AATD power.
 - a. Locate the AATD power switch shown in Figure 36 (on the back of the computer cabinet).
 - i. Open the power cabinet’s back panel to access the switch.
 - ii. Turn the switch to the ON position to auto-boot the computers.

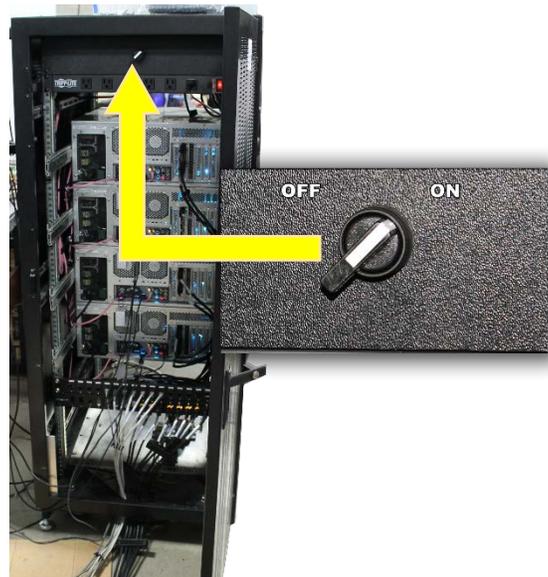


Figure 36 Device Power Button

2. Wait for the system to fully boot up, the F2Si screen will be displayed on the monitors while booting up. Once system has fully booted, the system icons will appear on left side of the IOS screen.
3. The OTW Visual Display Monitors will turn on automatically when the System Powers up.
 - a. In the event the monitors do not turn on automatically at start up, power on the OTW Visual Display Monitors using the remote Power button (Figure 37).



Figure 37 OTW Monitors Remote Control

- i. Each monitor has its own remote control. However, the monitors are synced together, and one remote will power ON all the OTW monitors.
 - ii. Should one or more monitors not power on, manually press the Monitor Power button.
 - 1). Horizontal Monitors power button location:
 - a). center monitor power = bottom right
 - b). side monitors = bottom center
 - 2). Vertical Monitors button location:
 - a). middle left = right side, center
 - b). middle right = left side, center
4. Power on the Projectors using the projector remote control (Figure 38).



Figure 38 Projector Remote Control Options

- a. Press User1
 - b. Press the ON button 2 times.
 - c. The projectors will turn on, the cockpit visuals will be displayed.
5. **Continue to Section 5.2 Remote Startup**

5.2 Remote Startup

1. Open the RemRun Interface: from the IOS desktop, double click the RemRunGUI icon.
2. When launched, RemrunGUI begins initializing, wait up to 30 seconds for the RemrunGUI to launch, the Servers will change to all gray during startup (Figure 39).

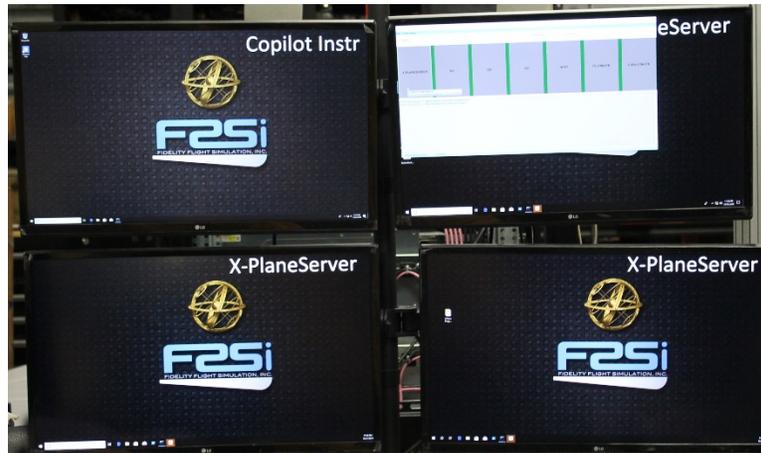


Figure 39 RemRunGUI Launched Successfully

3. Select “Start” to begin all tasks, the Control Button will display “Abort Start”.
 - a. Wait up to 30 seconds, the RemRun servers display yellow and change to green
 - b. The IOS monitors will display as shown in Figure 40
 - i. Cockpit Display
 - ii. RemRun interface will display on the OTW monitor
 - iii. IOS will be displayed
 - iv. SIP visuals will be displayed



Figure 40 Ready for Training

- v. The visuals will display OTW scene (Figure 41).



Figure 41 OTW Visual Display

- c. If Remrun displays as screen similar to Figure 42, this indicates not all the servers have been reached. Should this occur:



Figure 42 Start Button Available RemRun Not Ready

- i. Wait 30 more seconds for the button(s) to turn green.
 - ii. If the servers do not change to all green refer to Section 5.3.1.
- 4. All tasked will be launched; the screen will appear as shown in Figure 43, the system is ready for training.

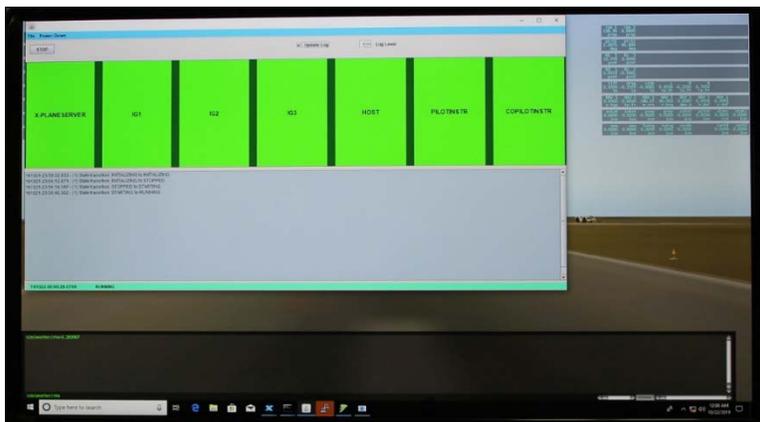


Figure 43 Tasked Launched

- 5. Minimize the RemRun Box. **NOTE: Do not close the RemRun window** as it will be needed for system shutdown.

- a. Double Click on the screen background to minimize the RemRun window (RemRun window will remain visible until X-Plane fully loads)
 - b. X-Plane will be brought to the foreground.
6. From the X-Plane monitor set up training. (refer to the X-Plane manual for all operation instruction.)
- a. Setup Flight by setting the Location, Weather (Wx), Failures, Time, and Weight and Balance (W&B) located on the left of the screen (Figure 44).

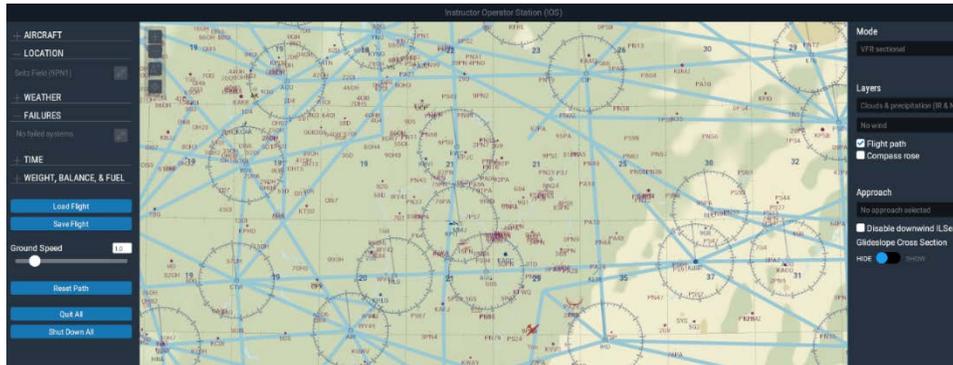


Figure 44 Flight Control Settings

- b. Refer to the X-Plane manual for all operation instruction.
- c. Optional: The Flight Parameters Box, highlighted in RED in Figure 45, can be opened to display and control the aircraft's Heading, Altitude, Speed, and Pitch on screen. **To open**, click on Aircraft Icon on Map Display on Instructor's Station.

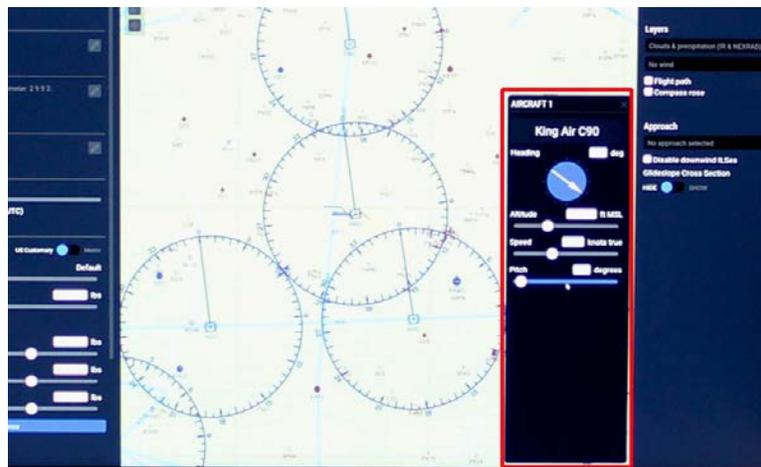


Figure 45 Flight Parameter Box Display

7. End of Startup procedure.
- a. Refer to the X-Plane Desktop Manual at <https://x-plane.com/manuals/desktop/> for a full understanding of the operating procedures and functionality of X-Plane IOS to monitor and control training.
 - b. Proceed to Section 5.6 SIP Operations for adding Malfunctions to training.
 - c. Continue to Section 5.9 System Shut down when training is completed.

5.3 RemRun Functions

RemRun functions include power up/down, startup/shutdown, start/close programs, and monitor programs status. In the event the system is not functioning properly, RemrunGUI can be used to identify system errors and restart the server in a warm start.

5.3.1 Identify System Errors

If the system is not functioning properly check the RemrunGUI for system errors. If the servers are displaying in yellow or red this indicates the machines are not communicating properly. The following describes how to use Remrun to identify system errors.

1. Open RemrunGUI.
 - a. Double click the RemRun icon on the IOS Main desktop.
 - b. If already running, pull up the RemRun main window from the taskbar (Figure 46).

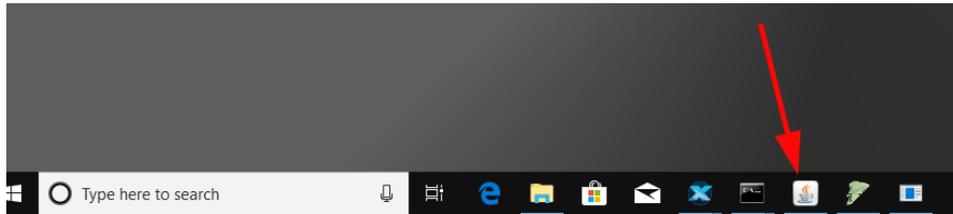


Figure 46 Remrun Taskbar Icon

2. In the RemRun screen, identify the state of the servers:
 - a. Green: Initialized and running machines. No action is needed.
 - b. Yellow: Unitialized machines indicating the machine is not communicating. If communication is lost, a warm start (reset) of the server(s) is needed.
 - c. Red: Machines are unreachable by the Remrun system. If unreachable, warm start (reset) of the applications is needed.
3. Check the server status:
 - a. **Hover over a red or yellow server button.** Hovering over a server button activates a hover state in Remrun. An identifier line displays information which includes the device current status response identifying the device and listing currently running tasks.
 - b. **Open the Server Window:** click on the server button opens a server window to troubleshoot possible issues with the server. The Server Window lists all registered tasks on the machine and offers device controls. Note: when the server window is open, access to the main RemRunGUI window is blocked.
 - i. The state of the tasks will display a RUN state or a STOPPED state.
 - ii. Individual Server Control Buttons located on the bottom of the server window allow for:
 - 1). Versions
 - 2). Startup: restarts the server
 - 3). Shutdown: kills all running programs on the machine
 - 4). Close: closes the server window and returns to the main RemRunGUI.
 - c. If a system error is identified in the RemrunGUI interface with server buttons displaying yellow or red, the I/O should attempt a warm start.

5.3.2 Warm Start

A Warm Start of the entire system may be required if the server(s) are not communicating and the Remrun control button reads “Reset”.

1. Select the Reset Button
2. Wait up to 90 seconds for Remrun to initialize.
 - a. If the reset is successful, continue with training.
 - b. If the system did not launch successfully, notify F2Si.

5.4 Cockpit Instrumentation



Figure 47 Copilot Instrumentation Screen

The Instrumentation monitor will display the Pilot and Copilot’s instrumentation individually. Figure 47 shows the Copilot instrumentation. The instructor can switch the display to view either pilot’s instrumentation by doing the following process.

1. Locate the joystick button located under the bottom center of the Cockpit Instrumentation monitor.
2. Push the joystick button in to display the menu as shown in Figure 48.



Figure 48 Monitor Joystick Menu

3. Select the Input option to open the Input menu (Figure 49).



Figure 49 Input Menu

4. On the Input menu, select one of the HDMI options:
 - a. HDMI1 for pilot
 - b. HDMI2 for copilot.

5.5 IOS GUI

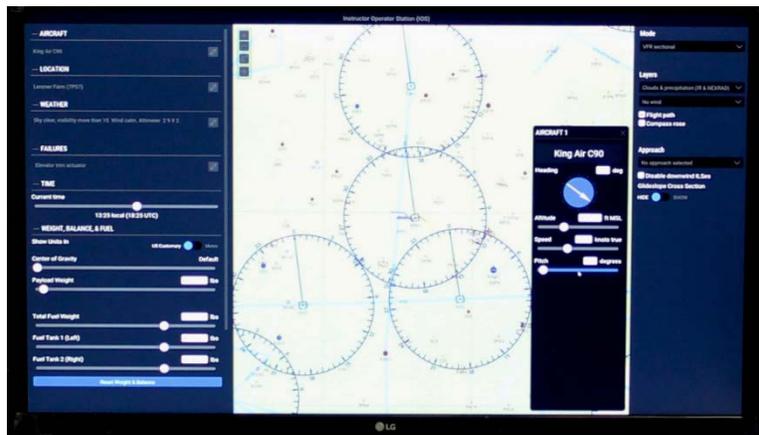


Figure 50 IOS Settings

X-Plane's V11 IOS GUI application (Figure 50) provides flight instructors the main simulation control for training. The following provides a brief description of the available functions of the X-Plane IOS. However, the application is a COTS product, this section does not include functions, operations, or configuration settings of X-Plane flight simulation software. Refer to the X-Plane Desktop Manual at <https://x-plane.com/manuals/desktop/> for a full understanding of the operating procedures and functionality of X-Plane IOS to monitor and control training.

- Environmental/Atmospheric Conditions
- Visibility, temperature, pressure, clouds, precipitation, wind, turbulence, icing
- Weight and Balance
- Fuel Quantity

- (Re) Position
- 2D Map, Airports, Approaches
- Airspeed/Altitude/Attitude/Pitch/Location
- Time of Day and Date
- Vertical and Horizontal Track
- Replay, Scenario Loading
- Pause/Un-pause

The flight instructor monitors and controls the location, heading, airspeed, and altitude of the simulated aircraft on a 2D Map. The IOS allows for control of the weather, failures, time, weight, balance, fuel, and a moving map. The horizontal and vertical track of aircraft movement can be recorded and played back for review during the entire training session. The IOS GUI displays all the training scenario conditions including:

- Ownship (own aircraft) Geographic Location
- Malfunction invocation
- Time of Day
- Visibility/RVR
- Wind
- Cloud levels, control height of top and bottom
- Precipitation with levels of intensity
- Temperature and Barometric Pressure

The intensity of all environmental conditions is controlled at the IOS. Visual effects are displayed on OTW display and monitor. The flight instructor can introduce malfunctions, failures, and alerts into the simulation without pausing the simulation. The X-Plane software package includes the following failures:

- Oversee tracks along published airways, holding entries and patterns, along with LOC and GS alignment/deviation.
- Function as air traffic control (ATC) in providing vectors.
- Monitor and control light/moderate/severe turbulence as well as icing conditions.

5.6 SIP Operations

The SIP monitor allows the instructor to invoke and clear faults, trip circuit breakers, and control communications during flight training. The following describes setting the malfunctions and the CB in the SIP interface.

5.6.1 Setting Malfunctions

The following provides the steps to set malfunctions in SIP.

1. Navigate to the Malfunctions tab on the SIP monitor (Figure 51).

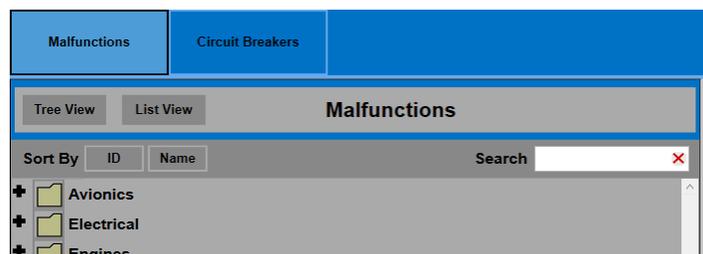
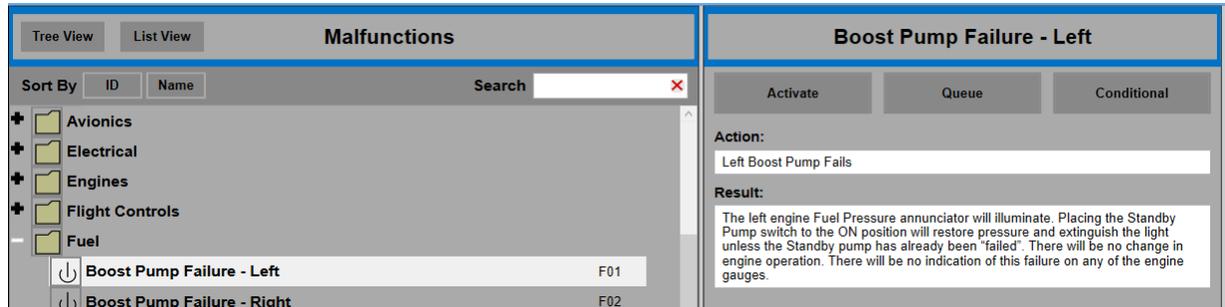


Figure 51 Malfunction Tab

2. Select a malfunction from the malfunctions list located on the left of the screen.
3. In the center of the screen, the selected malfunction will be displayed listing the action and result (Figure 52).

**Figure 52 Malfunction Tab**

4. Select how the malfunction is integrated during training by selecting one of the control buttons.
 - a. Activate: the malfunction becomes instantly active during training.
 - i. If selected prior to training, the selected failure becomes activated once training begins.
 - ii. The malfunction will be listed in the Queued Failures column in red.
 - b. Queue:
 - i. Added to the Queued Failures column in white (inactive state) in the Malfunction Sort By column and in the Queued Failures list.
 - ii. During the training session the failure can be activated by:
 - 1). Clicking on the queued item in the list at any moment in the training.
 - 2). Click “All On” button, Activates all items in the list.
 - c. Conditional, the following provides steps to set the conditions.
 - i. Navigate to the Conditional Preselect at the bottom of the column.
 - ii. Adjust the mission time on the timeline to add the set point
 - iii. When the Conditional Preselect has been set, the malfunction will be listed in white under the Conditional Failures.
5. Repeat Steps 2-4 to set each malfunction to be included in the training exercise.
6. When training is started, the malfunction will be triggered when the moment set in the timeline has been reached. The malfunction will appear as red when triggered.

5.6.2 Set and Reset Circuit Breakers

The following describes the process to set and reset the CB during training at the IOS.

5.6.2.1 Set CB to Fail

1. At the SIP monitor navigate to the CB screen shown in Figure 53.

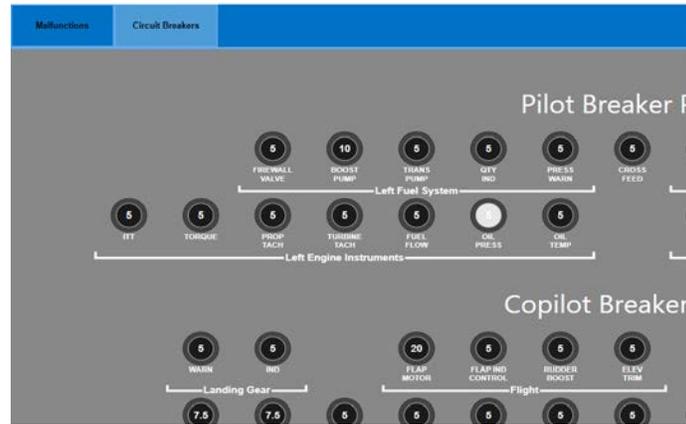


Figure 53 CB Tab

2. Select the appropriate CBs for the Pilot and/or Copilot.
3. Click on the CB(s) to activate the fault(s).
 - a. At the IOS, the selected CB will:
 - i. Turn orange indicating it is set to trip.
 - ii. The selected CB will turn red at the IOS when popped.
 - b. Inside the cockpit:
 - i. The circuit will pop out.
 - ii. An audible click will be heard.
 - iii. The popped CB will remain active until the crew takes the appropriate actions to clear the fault. The tripped CB will not reset when pushed in the overhead panel.
4. Once the Pilot corrects the fault the CB will change to White indicating the fault has been cleared.

5.6.2.2 Reset CB

The CB can be manually reset by the instructor on the SIP interface.

1. When the fault is cleared, the instructor can remove the fault.
 - a. At the IOS click on the red (tripped) CB to deactivate the fault.
 - b. The CB turns white indicating it is ready for reset.
2. Repeat Step 1a and 1b for all tripped CB.
3. In the cockpit the flight crew must push the CBs in to reset it.

5.6.3 Audio Control



Figure 54 SIP Audio Control Panel

The audio control panel shown in Figure 54 on the IOS SIP allows the instructor to monitor and control communications. The instructor can monitor the channels the Pilot and Copilot are transmitting (Tx) and receiving (Rx) on. The instructor can also monitor the frequencies of the transmission. The Instructor Tx control buttons selection operates how the instructor communicates. Students must use the Yoke PTT control button to communicate. The instructor can select to transmit on either COM 1, COM 2, or HOT MIC, or any combination of the buttons. Selecting the Instructor Tx buttons will do the following;

- Comm 1: communicate with the Pilot
- Comm 2: communicate with the Copilot activated from control yoke
- Comm 1 and 2: communicate with the Pilot and Copilot
- HOT MIC communicates over the cockpit speakers.

5.7 Sound

The dynamic sound model produces various sound effects which are routed to speakers located inside and outside of the cockpit. The sound is controlled using the speaker's control knobs. Main volume control uses the volume knob to:

- Turn the speaker on and off
- Adjusts the overall system volume.
- Tone control– The tone knob adjusts the treble and bass output levels of the speakers.

5.8 Computer Access

Should access to any computer become necessary, there are two (2) ways to access the system's computers, manually and Virtual Network Computing (VNC).

Note: VNC access wont work if PC doesn't fully boot into windows. In that case manual access will be necessary.

5.8.1 Manual Access

By default, the IOS the keyboard and mouse are connected to the IOS/ Server computer in the computer rack. Should access to the IG computers become necessary, unplug the mouse and keyboard from the IOS/Server computer and plug into the desired IG computer.

5.8.2 VNC

Access to all computers is done using a Virtual Network Computing (VNC) process. VNC is a platform-independent graphical desktop sharing system that uses the Remote Frame Buffer protocol (RFB) to remotely view and control another computer over a network connection. The system utilizes a VNC software package to transmit graphics from the Host computer to the Client computer (IOS/Server). The system is designed to provide the ability for the system operator to monitor and manipulate the computers directly from the IOS/Server. The following steps are provided for accessing the VNC displays in the event maintenance is needed.

5.8.2.1 Access VNC Display

NOTE

The VNC Viewer window is displayed in a lower quality color mode and will not look exactly like the display on the visual screen being accessed. The VNC Viewer display is in 256 color mode.

1. Start the VNC Viewer application
 - a. Double-click on the "Tight VNC Viewer" icon on the IOS/Server Screen

- b. The VNC Viewer dialog will open
2. Type or Select the name of the PC from the dropdown list:
 - a. host
 - b. ig1
 - c. ig2
 - d. ig3
 - e. pilotinstr
 - f. copilotinstr
3. Click Connect, the host desktop will open in a new window

5.9 System Shut down

1. Shutdown Aircraft per the normal King Air C90 Procedures.

NOTE

This procedure is intended to provide the end user operational instruction of the FTS C90 AATD. This process does not provide aircraft or pilot specific tasks such as inspection or in-flight operating procedures. Refer to the aircraft's manuals for all aircraft or pilot specific tasks.

2. Open RemrunGUI.
 - a. Double click the RemRun icon on the IOS Main desktop.
 - b. If already running, bring the RemRun Status Board to the foreground, this can be done by doing one of the following:
 - i. Select windows key on the keyboard
 - ii. Select the RemRun icon in the bottom Taskbar on the monitor.
3. Select "Shutdown" on the RemRun Status Board, all programs will shut down.
4. An exit confirmation window will open, **Select OK.**
5. Wait a few moments. The server buttons will switch from green to gray as the applications are shutdown. When the applications are fully shutdown, the Remrun interface will display all servers as gray.
6. From this point the user can restart RemRun by clicking the Startup button, or Powerdown the system (continue to Section 5.10 Powerdown).

5.10 Powerdown

1. Navigate to Remrun's top toolbar; select Powerdown option (Figure 55).



Figure 55 Powerdown Button

2. Select the Powerdown option from the dropdown.
3. Allow 6 - 9 seconds for all screens, including instrument panel and Instructors Station, to go blank.
4. Turn Power Switch to the OFF position once the simulator has been fully powered down.
 - a. Open the power cabinet's back panel to access the switch.
 - b. Turn the switch to the OFF position.
5. Shutdown Complete.

CHAPTER 6 Maintenance and Troubleshooting

6.1 Maintenance

It is important to perform regular maintenance to ensure the equipment is always running safely and efficiently. With daily inspections and after use cleaning, minor problems can be detected and corrected before becoming a major problem. Factors such as frequency of use and climate can affect the equipment. Refer to the COTS manuals for the maintenance of the COTS products used in the C90 AATD.

6.2 Troubleshooting

Refer to the COTS manual for COTS products troubleshooting. The following provides basic troubleshooting steps. If the solutions provided do not remedy the problem or if an unusual event occurs that is not provided in the section below, contact:

F2Si Customer Support

Phone: (412) 592-0110

Or dial the main number (412-321-3280) and press 2.

Email: customerservice@f2si.net

Table 7 Troubleshooting

#	Symptom	Test, Check, Remedy
Power		
1	Device No Power	<ul style="list-style-type: none"> • Check plug is plugged in • Check and verify facility power. If facility power is not present, contact facility manager.
Computers		
2	All Computers Any One Computer Does Not Startup During Remote Run	<ol style="list-style-type: none"> 1. Perform system shutdown (see section 5.1). 2. Perform system startup (see section 5.9).
3	Flight Model Computer (Windows) Stops Responding	Restart Windows from the Start menu. <ul style="list-style-type: none"> • If Windows will not restart from the Start menu, power cycle the computer that has stopped responding. <ul style="list-style-type: none"> ○ Once the computer has restarted, double click the executable icon on the desktop for that computer. ○ If Windows has failed to start, contact F2Si Customer Service to investigate a possible computer/hard drive failure.
4.	SimHost Computer (Linux) Stops Responding During a Simulation	
Monitors		
	Fails To Power On During Startup	Confirm that the monitor's: <ul style="list-style-type: none"> • Power button is ON • Power cable is plugged in.