Sim-Avionics

FTD Avionics Specification

Version 1.0 ● 11 March 2023

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B737Max

www.sim-avionics.com

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1   Key Product Features

Software

The simulation software used in all of our FTD's provides the system functionality and accuracy to ensure the high fidelity demanded from modern flight training devices.

Full Free-Play simulation environment

The virtual environment provided by our FTD's and its software allows the student to experience the functionality and operation of the avionics systems, complete with malfunctions, in a totally free-play environment.

Automated Lesson Plans

Our FTD's include a lesson plan module in the Instructor Operator Station (IOS) that supports the creation of lesson plans (snapshots), allowing for direct utilization of a particular flight phase or exercise and is completely customizable by the instructor. This reduces lesson set-up time allowing multiple lessons in a single session in a minimum amount of time.

Instructional Applications

A highlight of our FTD is the quality of training events that can be accomplished using its fully immersive free-play capabilities.

A large variety of training scenarios can be accomplished using the FTD including:

- Initial manual flight.
- Systems introduction and assimilation
- Normal procedures – introduction, practice and proficiency
- Non-normal procedures – introduction, practice and proficiency
- FMS training
- CRM training
- Remedial training

The fidelity of the simulation, coupled with the broad scope of the systems replicated, provides the flight training department with a quality training device that can supplement other FTD and/or FFS-based training.

2   Avionics

At the heart of our FTD's is the simulation software. Created using state-of-the-art development and graphics generation tools, we are able to provide several FTD options that can replicate the flight deck of a modern airliner.
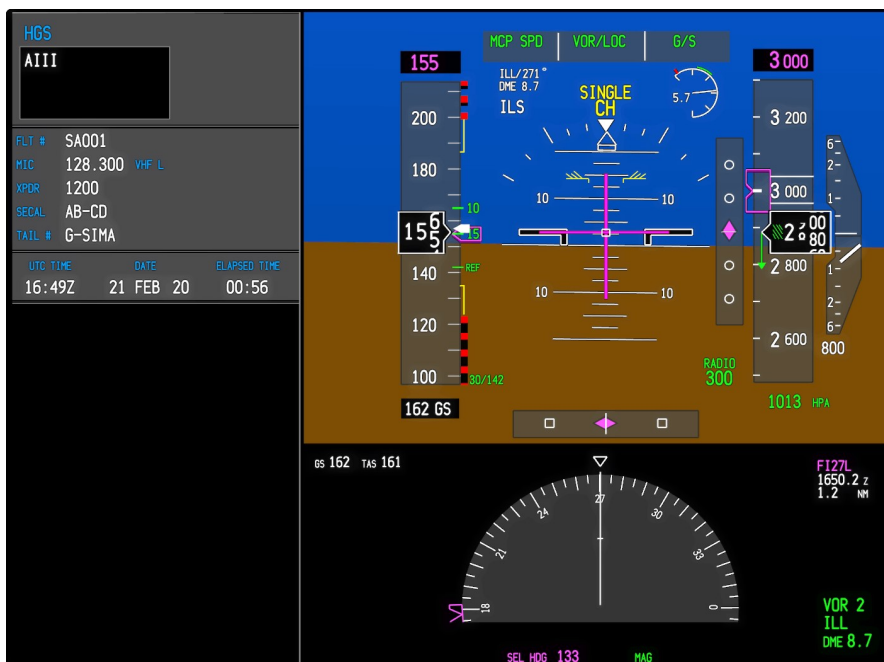
Available aircraft types include: 737NG, 737Max, 777 and 787.

The chosen software accurately simulates the operation and interaction of the various systems and sub-systems found in each aircraft.

Showing Sim-Avionics software running in a FlightDeckSolutions 737Max Flight Training Device

Outboard
Primary Flight Display

Inboard Display with
Engine instruments

Various FMC screens

The software is primarily designed to be used in a full hardware controlled flight deck, but the avionics package also comes with 2D virtual panels that accurately simulate the cockpit. Each panel component (switches, knobs etc) is fully functional via touch screen and their location matches the design of the simulated aircraft.

These can be useful monitoring tools for an Instructor or used in a classroom environment.

737Max – Virtual Overhead Panel
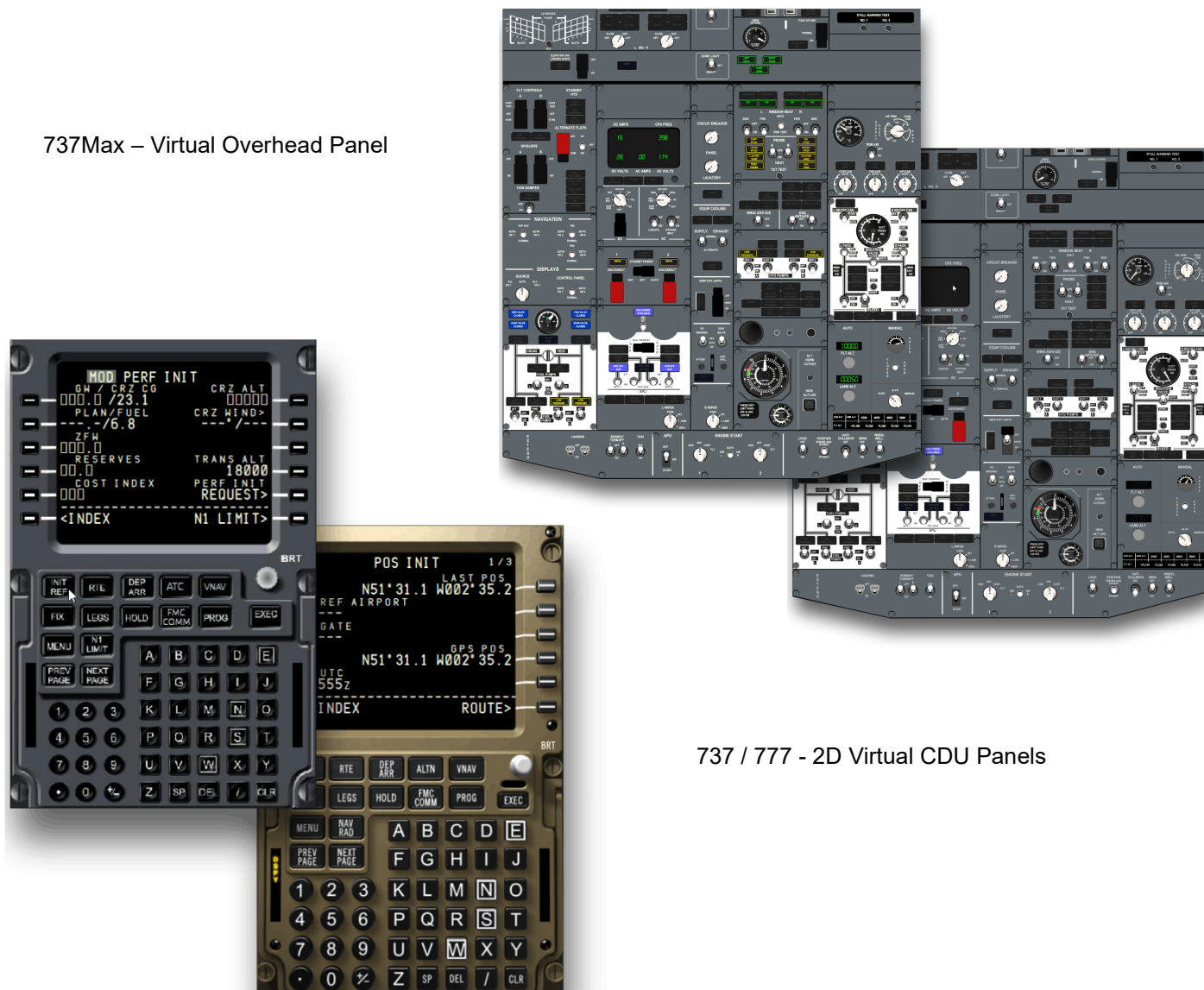
737 / 777 - 2D Virtual CDU Panels

737 – 2D Virtual Mode Control Panel

3   Avionics Overview

Fully Functional Professional FMS and EFIS System

- High resolution OpenGL full glass cockpit displays
- Realistic Prepar3D Flight model
- Simulated ADIRS including ADIRU and SADIRU
- Dual air-data computers with custom failure modes and source switching
- Display Electronic Unit simulation supporting independent DU's
- Realistic DU switching logic
- Integrated Standby Flight Display
- Custom fully integrated Flight Management Computer
- Dual FMS with dual CDU's
- Fully Integrated LNAV logic
- Full VNAV managed flight modes
- Optimum cruise performance and step climb calculations
- Two Independent NAV and ADF receivers
- Dual channel autopilot with realistic dependencies
- Fail operational / fail passive auto land with mode degradations based on system failures
- Uplink pre-generated company flight plan routes
- CPDLC Communication

Custom Systems and Failures

- Detailed simulation of almost every system in the real aircraft
- Custom Air and Pressurization system
- Electrical system with modelled AC and DC busses
- Hydraulic system modelling
- Fuel Cross feed
- Multistage custom failure system

Warning System and Radars

- Fully Functional GPWS, EGPWS and RAAS
- Fully Functional database driven Terrain Radar with Look-ahead warning system
- Integrated Weather Radar with Tilt / Gain
- TCAS Advisory and RA module

Additional Systems

- Autobrake / Antiskid
- Advanced Auto Throttle with full hardware integration
- Independent Display Dimming

Advanced Custom Sounds

- Engine sounds
- All aural flight deck warnings for full immersion
- Multiple sound sources
- Audio Control Panel

Control Loading

- Elevator, Aileron, Rudder Control Loading integration

Instructor Operating Station

- Fuel and Weight Loading
- Moving Map
- Repositioning
- Weather and Environment controls
- Takeoff / Approach / Landing Plots

- TCAS Training
- ACARS
- Flight Analysis "Blackbox" Recording
- Multi Screen Map Operation
- Failures and Malfunctions
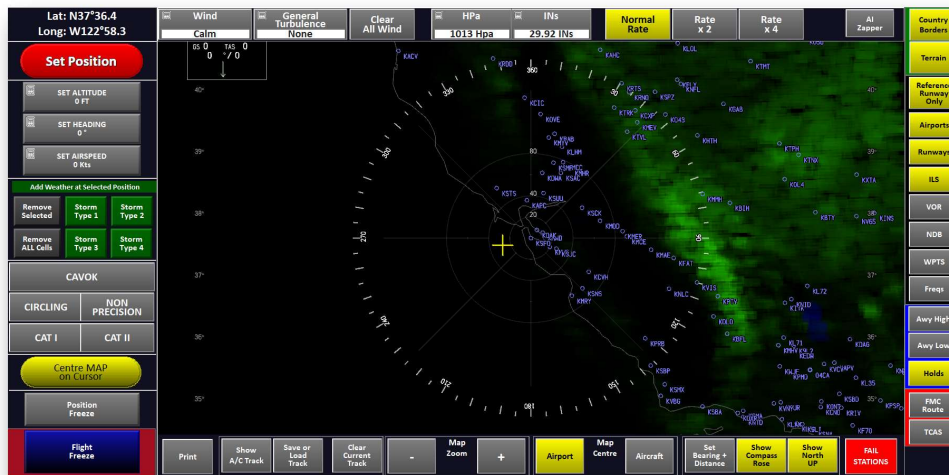
Moving Map Views
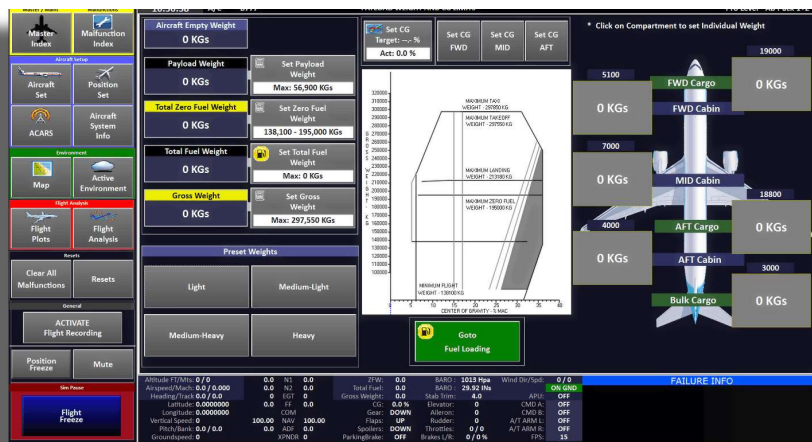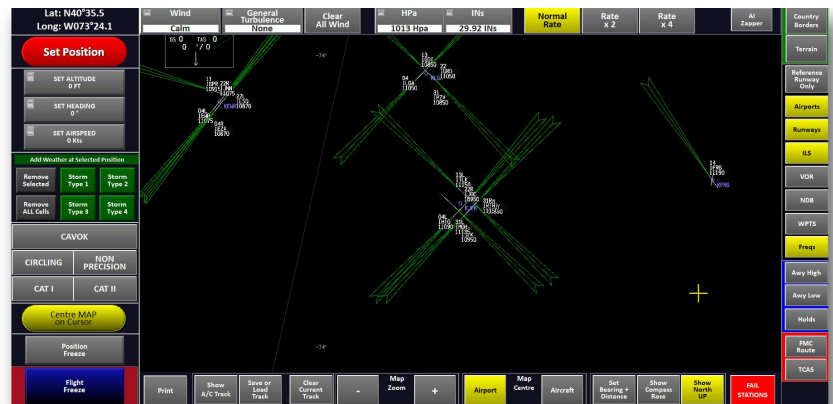
Weight and Balance
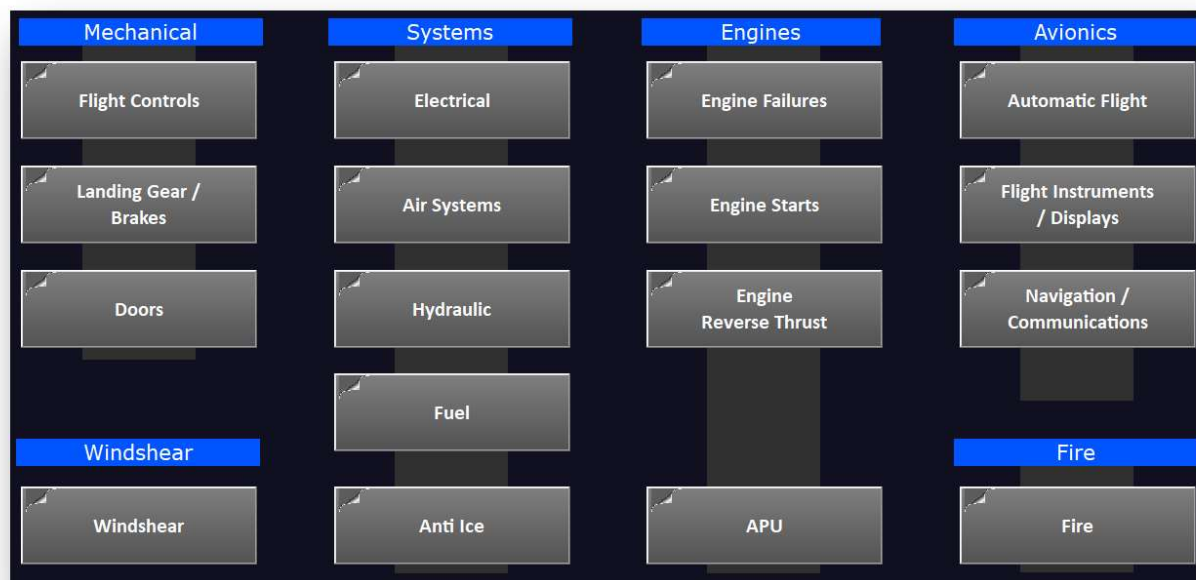
Malfunction Categories
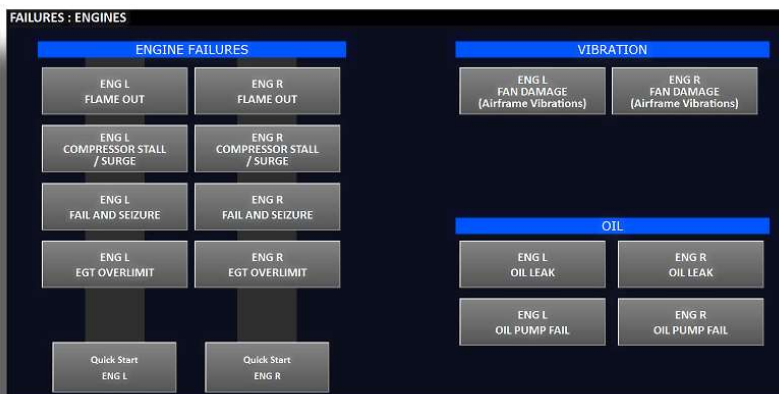
Engine Malfunctions

All malfunctions can be "Pre-Armed" to activate under specific conditions

Flight Analysis
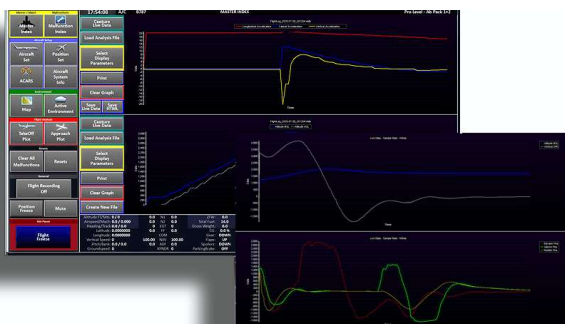
737Max Malfunction List

Flight Controls
CPT / FO Stab Trim Fail
Aileron Trim Fail
Rudder Trim Fail
Horizontal Stabilizer Fail
Runaway Stabilizer UP / DOWN
Flap Primary Drive Fail
Flap Drive Fail
Slat Primary Drive Fail
Auto Slat Fail
TE Disagree
TE Asymmetry
Auto Speed brake Fail

Landing Gear / Brakes
Anti Skid Fail
Auto brake Fail
Brake Fail
Dragging Brake OVHT
Alternate Brake Valve Fail
Gear L / N / R:
  Jammed Down - Temp
  Jammed Down – ALTN OP
  Jammed Down – ALTN INOP
Main Gear Downlock Disagree

Doors
Cargo Door FWD / AFT Open
Passenger Door Entry:
  Door L1 / R1 Open
  Door L4 / R4 Open

Air Systems
Rapid Decompression
Slow Decompression
Cabin Pres Sensor Auto / Dual : Fail
Outflow Valve: Fail
Pack L / R: Fail
Pack L / R: Overheat
Trim Air : PRSOV Fail
ISLN Valve PRSOV Fail Closed
EQUIP Cooling Supply OVRD
EQUIP Cooling Exhaust OVRD
Zone Temp Fail
Wing Body Overheat L / R

APU
AUTO Shutdown
Overspeed
Low Oil Pressure / Qty
Starter Fail

Electrical
IDG L/ R
  Drive Disconnect
  Drive Oil Leak
  Generator Fail
Battery Relay Fail Open
AC Bus Fail
DC Standby Power Fail
Hot Battery Bus Short
ELEC Fail
APU Generator CB Trip
TRU 1 / 2 / 3 Fail
Maintenance

Hydraulic
HYD ELEC 1 / 2 : Pump OVHT
HYD Eng L / R: Pump Fail
HYD Elec 1 / 2: Pump Fail
HYD QTY L / C / R: Low
HYD L / C / R: System Leak
HYD L / C / R: Low Pressure

Fuel
Individual Pump: Fail
Cross feed Fail in Position
Fuel L / R: Imbalance
Tank L / C / R: Leak

Anti Ice
Pitot Heat L / R / Aux: Fail
AOA Vane L / R: Fail
TAT Probe Fail
Window Heat: Individual Fail
Window Overheat
ENG Anti-Ice L / R: Fail Closed
Wing Anti-Ice Fail Closed
ENG L / R: Duct Leak / Loss

Reverse Thrust
Reverse Thrust Fail
Reverser Stuck Open

Engine Failures
ENG L / R:
Flame Out
Compressor Stall
Fail and Seizure
EGT Over limit
Fan Damage / Vibrations
Oil Leak / Pump Fail
EEC L / R: ALTN

Engine Starts
ENG L / R:
Hot Start   Hung Start
No N1 Rise   No N2 Rise
No Oil Pressure Rise

Fire
APU Extinguishable
APU Non-Extinguishable
Cargo FWD / AFT
ENG L / R: 1 / 2 Bottle
                    Non-Extinguishable
Wheel Well Fire / Detector Fail
Overheat (Idle Required)
Overheat (Shutdown Required)
Cargo FWD/AFT Fire / Detector Fail

Displays
Outboard / Inboard - Fail
CPT / FO
Attitude Fail / Unreliable
Altimeter Fail / Unreliable
Airspeed Fail / Unreliable
Radio Alt Fail / Unreliable
AOA Fail / Unreliable
EFIS Control Panel Fail
Overspeed Warning Fail
Stall Warning Ch 1 / 2 Fail

Automatic Flight
Autopilot Fail
Flight Directors Fail
FCC Downgrade /   LAND 2
No Autoland
Auto throttle Motor L / R: Fail

Nav / Communications
IRS L / R: Fail
FMC L / R: Fail
COM 1 / 2: Fail
VOR 1 / 2: Fail
ADF 1 / 2: Fail
DME 1 / 2: Fail
ILS LOC / G/S Antenna SW: Fail
Individual Station: Fail
Individual LOC or GS: Fail
Marker Receiver Fail
Weather Radar Fail
Altitude Callouts Fail
TCAS Fail
GND PROX SYS / GPWS Fail

4   Simulated Systems Overview

4.1   Forward Overhead Panel

Description	Mode
Flight Control Panel	Fully Functional
Source Panel	Fully Functional
Fuel Panel	Fully Functional
Electrical Panel	Fully Functional
APU Panel	Fully Functional
Hydraulic Panel	Fully Functional
Window Heat Panel	Fully Functional
Anti Ice Panel	Fully Functional
Passenger Signs	Fully Functional
Air Conditioning Panel	Fully Functional
Bleed Air Panel	Fully Functional
Pressurization Panel	Fully Functional
IRS Panel	Fully Functional
EEC / Engine Panel	Fully Functional
LE Devices Panel	Fully Functional
Stall / Overspeed Panel	Fully Functional
Wiper Panel	Functional (Sound Only)
Landing Lights	Fully Functional
Runway Turn Off / Taxi	Fully Functional

4.2   Main Instrument Panel

Description	Mode
Left Inboard Display Unit	Fully Functional
Left Outboard Display Unit	Fully Functional
Right Inboard Display Unit	Fully Functional
Right Outboard Display Unit	Fully Functional
Standby Gauge ISFD	Fully Functional
GND Prox	Fully Functional
Gear	Fully Functional
Display Brightness	Fully Functional
Brake Pressure	Fully Functional
Display Selectors	Fully Functional
HDG Ref	Fully Functional
AFDS Panel	Fully Functional
Clock	Fully Functional
EFIS Panels	Fully Functional
Mode Control Panel	Fully Functional
Master Caution	Fully Functional
Recall	Fully Functional

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4.3   Pedestal Forward Panel

Description	Mode
Autobrake / TFR Panel	Fully Functional
CPT / FO – CDU	Fully Functional
Throttles + Reversers	Fully Functional
Speed brake Lever	Fully Functional
Flap Lever	Fully Functional
Parking Brake Lever	Fully Functional
Fuel Control Switches	Fully Functional
TOGA, A/T Disconnect, Horn Cutout	Fully Functional
Stab Trim Indicators / Manual Stab Trim	Fully Functional
Stab Trim Override Switches	Fully Functional
Cursor Control Selectors	Fully Functional

4.4   Pedestal Aft Panel

Description	Mode
Fire Handles	Fully Functional
VHF Radio Control Panels	Fully Functional
NAV Radio Control Panels	Fully Functional
Audio Control Panels	Fully Functional
Rudder / Aileron Trim Panel	Fully Functional
EVAC Panel	Fully Functional
ADF Radio Control Panels	Fully Functional
Transponder	Fully Functional
Weather Radar Control Panel	Mostly Functional

5   Aero Model

Our FTD Aero models are built around a Lockheed Martin Prepar3D (P3D) Simulation Environment.

Prepar3D allows the FTD to simulate:

- Aero modelling
- Engine Modelling
- Ground Dynamics
- Out the Window View / Terrain
- Environmental settings (Dawn / Day / Dusk / Night)
- Weather settings

Unlike a conventional touch panel simulator, our fully hardware integrated FTD's <u>can</u> be flown manually.

Elevator, Aileron, Rudder, Brakes and Steering Tiller are available.

P3D doesn't use a manufacturer's data pack, but the simulation is realistic and can produce a flight model that is extremely close to real world values.

The 'feel' of the flight controls is dictated by the selected hardware package.
(Hydraulic Damping or Full Control Loading)

The simulator will not replace the manual flight accuracy of a Full Flight Simulator, but does provide a realistic simulation to allow training of complete flights.

Details:

- The aircraft is affected by the selected Wind and weather conditions.
- Airframe mechanical malfunctions are limited to :

    Gear / Flap / Brake / Speed brake and Trim

- Real world Elevation and Terrain is simulated
- Icing effects are not currently simulated

6   Simulated Systems

6.1   Air Conditioning and Pressurization

The air conditioning system is simulated and fully interactive to the extent that the system interacts with the bleed air system.

Both Air Conditioning Packs, Trim Air, Recirc Fans, Isolation Valve and Equipment Cooling are simulated.

Duct Pressure, Cabin Differential Pressure, Cabin Altitude, Cabin Rate of Change and Outflow Valve are simulated and displayed on operational gauges in the Overhead Panel

Cabin temperature zones are simulated and can be individually displayed on an operation gauge in the Overhead panel.

The pressurization system is simulated to the extent that simulated faults can be replicated and cleared per standard operating procedure.

Limitations

Rates of temperature change are approximate.

Simulated Faults / Malfunctions

System	Type
Pack L / R	FAIL
Pack L / R	OVERHEAT
Cabin Press Sensor AUTO	FAIL
Outflow Valve FWD / AFT	FAIL
Trim Air L / R	FAIL
Trim Air PRSOV	FAIL
Equip Cooling	OVRD
Bleed ISLN	FAIL CLOSED
Depressurization	RAPID
Depressurization	SLOW

6.2   Autoflight

The autoflight system including the yaw damper, automatic stabilizer trim, and autopilot flight director system is simulated.

The simulation supports all normal Roll, Pitch and Auto Throttle modes.

The simulation responds to all normal vertical and lateral command requests provided by the Flight Management System or Mode Control Panel.

Autoflight modes include:

HDG SEL, V/S, FLCH, ALT HOLD, SPD INTV, ALT INTV, LOC, APP and Auto Landing Modes.
LNAV and VNAV

Automatic Flight is simulated through all phases of flight: Takeoff, Climb, Cruise, Descent, Landing and Go Around.

If the Autopilot is disconnected the aircraft reverts to Manual Flight Control.

Simulated Faults

System	Type
FCC L / R	FAIL
Flight Directors	FAIL
FCC Downgrade	LAND 2
AutoLand	FAIL
Auto throttle Motor L / R	FAIL

6.3   Electrical

Electrical Power system is simulated including: AC Power generation and distribution, Alternate AC power (Ground Power), DC Power, Standby Power, and the electrical system control panel.

External power can be enabled via the IOS and connected to the electrical system.

The APU generator is simulated and can be used as a power source for the electrical system.

All AC and DC busses are simulated.

Limitations

Current is not fully simulated. Basic general values are displayed.

Automatic load shedding is not currently simulated

Simulated Faults / Malfunctions

System	Type
Main Battery Relay	FAILS OPEN
AC Bus	FAIL
DC Standby Bus	FAIL
IDG L / R	DRIVE DISCONNECT
IDG L / R	DRIVE OIL LEAK
IDG L / R	GENERATOR FAIL

6.4   Fire Protection

The following fire protection systems are simulated:

- Engine fire and overheat detection
- Engine fire extinguishing
- APU Fire detection and extinguishing
- Cargo compartment fire/smoke detection and extinguishing
- Wheel well fire detection
- Wing leading edge and body duct leak overheat detection

Limitations

Lavatory smoke detection and extinguishing is not simulated

Crew rest smoke detection is not simulated

Simulated Faults / Malfunctions

System	Type
APU	EXTINGUISHABLE
APU	NON-EXTINGUISHABLE
Cargo FWD / AFT	DETECTOR FAIL
Cargo FWD / AFT	FIRE
Wheel Well	DETECTOR FAIL
Wheel Well	FIRE
ENG L / R	1 BOTTLE
ENG L / R	2 BOTTLE
ENG L / R	NON-EXTINGUISHABLE
ENG L / R	OVERHEAT (IDLE REQUIRED)
ENG L / R	OVERHEAT (SHUTDOWN REQUIRED)
ENG L / R	DETECTOR FAIL

6.5   Flight Controls

Flaps / Slats and Speed brakes are simulated.

Proportional Pitch, Roll and Yaw are provided by the selected flight control hardware.

The control input is either sent to the aero model control surfaces directly, or via the Flight Control Computers depending on the selected flight control mode.

Control sensitivity curves can be applied to any of the primary controls

The Yaw axis has a selectable Yaw Damper.

With the Control Loading option, control force is adjusted based on the hydraulic system status.

Horizontal Stab Trim is controlled primarily via the yoke trim switches, or by manually turning the Trim Wheels

Rudder trim is functional and the position indicated via the trim indicator needle.

Aileron trim is functional. (Although not recommended on non control loading system)

Limitations

Simulated Faults / Malfunctions

System	Type
CPT / FO Stab Trim	FAIL
Aileron Trim	FAIL
Rudder Trim	FAIL
Flaps Primary Drive	FAIL
Flaps Drive	FAIL
Slats Primary Drive	FAIL
Auto Slats	FAIL
Trailing Edge	DISAGREE
Trailing Edge	ASYMMETRY
Auto Speed brake	FAIL
Thrust Asym Compensation	FAIL
Stabilizer / Stabilizer C / R	FAIL

6.6   Fuel System

The Fuel Quantity Indication System, fuel management system, fuel cross feed system are simulated consistent with the functional system.

Centre Fuel Pump logic is integrated and configurable with or without an NGS system.

Fuel Temperature is simulated and displayed on an operational gauge in the Overhead Panel

Limitations

Fuel tank venting is not simulated

Simulated Faults / Malfunctions

System	Type
Fuel Quantity	LOW
Fuel Configuration	CONFIG
Fuel	IMBALANCE
Fuel Pumps : MAIN	FAIL
Fuel Pumps : CTR	FAIL
Cross feed	FAIL IN POSITION
Fuel Imbalance	LEFT / RIGHT
Fuel Tank : L / C / R	LEAK
Fuel Filer L / R	BYPASS

6.7   Hydraulic System

The Hydraulic System is fully simulated except for the limitations noted below.

Logic includes:

Engine and Electrical Driven pumps

Quantity variations with Gear retraction and Speed brake deployment

Control forces change appropriately

Flaps, Gear and Braking fail and react with appropriate system failure

Limitations

Load is not simulated

Simulated Faults / Malfunctions

System	Type
HYD Pump ELEC 1 / 2	FAIL
HYD Pump ENG 1 / 2	FAIL
HYD QTY A / B	LOW
HYD QTY A / B	SYSTEM LEAK
HYD Press A / B	LOW PRESSURE

6.8   Ice & Rain Protection

The Ice and Rain protection system is fully simulated except for the limitations noted below.

Logic Includes:

Wing Anti-Ice switch auto shutoff logic

Wing Anti-Ice Stall Speed adjustments

Limitations

Water and Waste Heat are not simulated

Rain repellent system is not simulated

Simulated Faults / Malfunctions

System	Type
Pitot Heat L / R	FAIL
Pitot Heat AUX	FAIL
AOA / ALPHA Van L / R	FAIL
TAT / TEMP Probe	FAIL
ENG L / R Anti Ice	FAIL CLOSED
ENG L / R Anti Ice	DUCT LEAK
ENG L / R Anti Ice	DUCT LOSS
Wing Anti Ice	FAIL CLOSED
Window Heat SIDE / FWD / L / R	FAIL
Window	OVERHEAT

6.9   Flight Instruments

The instrument simulation includes:

- EFIS, PFD, ND systems and sub-systems consistent with the general limitations of the FTD

- Integrated Warning Lights (Six Pack) with Recall function

- Hydraulic, Flight Controls, Tyre Pressure and Brake Temp Synoptic Displays

- Flight Mode Annunciators integrated with the FMC

- All software displays utilize graphical motion smoothing for fluid display movement

Limitations

The Airplane Condition Monitoring System (ACMS) is not simulated

Basic MAINT screens displaying live flight/system data are implemented for visual presentation only

Simulated Faults / Malfunctions

System	Type
CPT / FO Inboard DU	FAIL
CPT / FO Outboard DU	FAIL
Upper / Lower DU	FAIL
Attitude, Altimeter, Airspeed, Radio Altimeter, AOA	FAIL / UNRELIABLE
CPT / FO EFIS Control Panel	FAIL
DEU 1 / 2	FAIL

6.10   Landing Gear and Brakes

The Landing Gear annunciation, Landing Gear Lever, and Landing Gear Configuration warnings (Visual and Aural) are simulated.

The Parking Brake is simulated with automatic Lever and Pedal locking solenoids

The aircraft braking system is simulated to include Auto braking and Antiskid.

Brake pressure is displayed on an operational gauge in the Fwd pedestal.

Limitations

Antiskid simulation is limited due to the available ground handling properties

Simulated Faults / Malfunctions

System	Type
Antiskid Valve	FAIL CLOSED
Autobrake	FAIL
Brake	FAIL
Dragging Brake	OVERHEAT
Gear L / N / R	JAMMED DOWN
Gear L / N / R	JAMMED UP (ALTN OP)
Gear L / N / R	JAMMED UP (ALTN INOP)
Main Gear Downlock	DISAGREE
Gear Doors	FAIL OPEN

6.11   Lighting

The simulation includes the visible aircraft exterior lights including:

- Individual Landing Lights
- Individual Runway Turnoff Lights
- Taxi Light

These lights illuminate the runway and taxiways.

Beacon, Nav and Strobe lights are functional, but not visible from within the aircraft.

Limitations

Simulated Faults / Malfunctions

None

6.12   Navigation

The avionics FMS simulation is _based_ on load U14.0 and contains the majority of features.

(This is not a 100% replication and some features are not implemented)

FMS Source select switch is simulated and is fully interactive.

Captain and F/O Flight Management Computers and Control Display Units are simulated and fully interactive.

All normal flight functions are available, including:

- Route entry and modification. (Airways and LEGS)
- Company route entry
- Manual route entry
- Adding and deleting waypoints
- Creating Custom Waypoints
- Insertion of procedures, SID's, STAR's, Approaches, Holds
- Secondary route information
- Route Offsets
- Performance information (Entry of Weights, Fuel, CRZ Altitude, VNAV Speeds, etc),
- Thrust Limit Page
- Takeoff Page
- Flight Data (Progress, ETA, Fuel Usage, Phases, Predicted speeds, pseudo waypoint data, steps and optimum altitude calculations)
- Nav Radio page
- Alternate destination page
- RTA

Numerous CDU Messages and indications are simulated

Flight Management functions are simulated, including route and performance predictions, leg sequencing and database access.

IRS and GPS position information is available from the CDU

Winds can be entered and used for predictions.

<u>Limitations</u>

No maintenance pages are simulated

Up to date FMC Navigation Database to be provided by the customer. Details can be provided.

<u>Simulated Faults / Malfunctions</u>

System	Type
CDU L / R	FAIL
FMC L / R	FAIL
ADIRU	FAIL
GPS L / R	FAIL

6.13   Oxygen System

Crew Oxygen is simulated and displayed on an operational gauge in the Aft Overhead panel

Crew Oxygen mask test is simulated and will reduce crew oxygen level.

Passenger Oxygen Mask Auto / Manual deploy is simulated.

<u>Limitations</u>

A physical oxygen mask system is not provided.

<u>Simulated Faults / Malfunctions</u>

None

6.14   Pneumatics

The pneumatic system is simulated to the extent required by the interaction with other simulated systems on the FTD.

Limitations

Load is not simulated

Subject to general limitations

Simulated Faults / Malfunctions

System	Type
Wind Body L / R	OVERHEAT
Over Pressure L / R	FAIL
Over Temperature L / R	FAIL

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6.15   APU

The APU is simulated to the extent necessary for operation of other aircraft systems and sub-systems simulated in the FTD

Limitations

APU lubrication system is not simulated

The APU automatic load shedding is not simulated

Simulated Faults / Malfunctions

System	Type
APU Fire	EXTINGUISHABLE
APU Fire	NON-EXTINGUISHABLE
APU	AUTO SHUTDOWN
APU	OVERSPEED
APU	LOW OIL PRESSURE
APU	LOW OIL QTY
APU	STARTER FAIL

6.16   Doors

The Door warning indications are simulated and fully interactive.

Door status is controlled via the Instructor Station

Doors can be opened individually.

Limitations

Simulated Faults / Malfunctions

6.17   Power Plant

The FTD engine model simulates:

LEAP-1B 29k

The aircraft engine system is simulated to allow all ground and in-flight operations of the engine system to be trained. The simulation allows the pilot to shutdown and restart engines on the ground and in-flight.

The aircraft engine control, fuel, air, indicating, starting, ignition, and oil systems are simulated consistent with the interaction with other aircraft systems within the simulation.

Thrust reversers are simulated.

Limitations

Simulated Faults / Malfunctions

Start Failures	Type
ENG L / R	HOT START
ENG L / R	HUNG START
ENG L / R	NO N1 RISE
ENG L / R	NO N2 RISE
ENG L / R	NO OIL PRESS RISE
ENG L / R	START VALVE FAILS OPEN
ENG L / R	START VALVE FAILS CLOSED
ENG L / R	IGNITION 1 / 2 FAIL

General Failures	Type
ENG L / R	FLAME OUT
ENG L / R	COMPRESSOR STALL
ENG L / R	FAIL AND SEIZURE
ENG L / R	EGT OVERLIMIT
ENG L / R	FAN DAMAGE (VIBRATIONS)
ENG L / R	OIL LEAK
ENG L / R	OIL PUMP FAIL
ENG L / R	EEC ALTN

Reversers	Type
Reverser L / R	FAIL
Reverser L / R	STUCK OPEN

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6.18   Warning System

The Warning System is fully integrated into the core systems simulation

Takeoff configuration warnings for the Flaps, Gear, Parking Brakes, Spoilers, Doors and stabilizer are fully simulated.

Aural sounds, Master Warning and Caution lights are simulated consistent with the system simulated in the FTD.

All warnings and malfunctions are appropriately displayed on the Warning System with the associated aural sounds.

Limitations

Simulated Faults / Malfunctions

None

System	Type
Overspeed Warning	FAIL
Stall Warning	FAIL

6.19   Circuit Breakers

A selection of the more commonly used Circuit Breakers are integrated into the system logic.

These include :

SYSTEM	PANEL	SYSTEM	PANEL
Generator Disc 1	P6-4:F8	Mach Warn SYS 1	P18-2:E3
Generator Disc 2	P6-4:F9	Mach Warn SYS 2	P6-1:B7
Fuel Crossfeed INOP	P6-3:B7	LG Air Gnd SYS 1	P6-3:C16
Takeoff Warning Cutout	P6-3:C18	LG Air Gnd SYS 1	P6-3:C15
Aural Warning	P6-3:D18	LG Air Gnd Relay	P6-3:D15
Flt Ctrl Auto Speedbrake	P6-2:B9	Eng 1 Ignition Left	P18-2:A3
FMC 1	P18-2:A6	Eng 1 Ignition Right	P18-2:A1
FMC 2	P6-1:D16	Eng 2 Ignition Left	P6-2:D6
MCDU 1	P18-2:A7	Eng 2 Ignition Right	P6-2:D4
MCDU 2	P6-1:D15	Capt EFIS CTRL	P18-2:D1
CAPT OUTBD	P18-2:D4	FO EFIS CTRL	P6-1:E13
FO OUTBD	P6-1:E10	ADIRU Left DC	P18-1:E5
Flap Skew SNSR Left	P6-2:A12	ADIRU Left AC	P18-1:E7
Flap Ckew SNSR Right	P6-2:A11	ADIRU Right DC	P6-1:C17
Stall Warning	P18-2:E7	ADIRU Right AC	P6-1:C14
Stick Shaker CPT	P18-2:E4	RCCB Battery	P6:A4
Stick Shaker FO	P6-1:B6	RCCB Inverter	P6:A5

Depending on the installed hardware each circuit breaker can be manually pulled or automatically tripped via the Instructor Station.