FLIGHTFX

Cessna Citation X

User Manual

For Microsoft Flight Simulator 2020 and 2024

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Special Thanks

A huge thank you to John Kluenker, our resident Citation X pilot, for not only welcoming us aboard his aircraft, but for keeping us grounded (and airborne) with invaluable insight and encouragement throughout the past year. His steady hand, sharp eye, and unwavering support have been instrumental in bringing this project to life—and we're beyond grateful to have had him in the cockpit with us.

Special thanks to our trusted advisors, tireless beta testers, skilled test pilots, loyal fans, dedicated supporters, and—once again—our amazing beta testers. Your expertise, feedback, and unwavering support have been instrumental in making our project a reality. We couldn't have done it without you!

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Preface

FOR SIMULATION USE ONLY - DESIGNED FOR SINGLE-PILOT OPERATIONS

Please note that this manual is intended solely for use within Microsoft Flight Simulator and is not applicable to real-world operations. This document may evolve and be updated as the aircraft continues to develop. Not all procedures and steps in this manual may reflect those expected in real-life operations. To ensure smooth single-pilot operation within the simulator, certain adjustments have been made.

PHOTOSENSITIVE SEIZURE WARNING

A small percentage of individuals may experience seizures when exposed to certain visual stimuli, such as flashing lights or patterns commonly found in video games. This can occur even in individuals with no prior history of epilepsy or seizures. If you experience any symptoms such as dizziness, vision changes, twitching, or loss of consciousness, stop playing immediately and consult a physician.

To minimize the risk of photosensitive seizures:

- Play in a well-lit room.
- Take regular breaks, especially if you feel tired or fatigued.
- If you or a family member has a history of seizures or epilepsy, consult a doctor before using this simulation.

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About The Citation X

FlightFX is proud to introduce the Citation X, a high-performance business jet known for its unmatched speed, sleek design, and commanding presence. As one of the fastest civilian aircraft ever built, the Citation X redefined long-range executive travel—and now brings that same spirit of power and precision to Microsoft Flight Simulator.

Jet-Class Speed Meets Executive Comfort

Equipped with twin Rolls-Royce turbofan engines and a highly swept wing optimized for high-speed cruise, the Citation X is capable of reaching Mach 0.92 and altitudes up to FL510. Its 3,000+ nautical mile range makes it ideal for coast-to-coast or transcontinental missions, offering a rare blend of speed, range, and operational efficiency. From quick climbs to smooth cruise, the aircraft's performance profile is refined and commanding.

A Cabin That Reflects Its Legacy

Step inside the Citation X and you'll find a cabin tailored for comfort, productivity, and understated luxury. Configured in an executive layout, it features customizable interior themes, rich material textures, and animated in-flight elements that enhance immersion. With engines mounted well aft of the cabin, interior noise is impressively low, creating a calm environment for passengers and pilots alike.

Designed with Real Pilots, Built for Sim Enthusiasts

Every detail of the Citation X's systems, avionics, and flight dynamics has been shaped with input from real-world pilots and a dedicated testing community. The result is a jet that not only looks and feels authentic but handles with the nuance and responsiveness expected of a true high-speed performer. Whether you're flying short hops or long-range missions, the Citation X delivers an experience that's both rewarding and true to the real thing.

Signature Features & Systems

Flight Model

The Citation X features a deeply customized flight model that captures the aircraft's unique performance envelope with precision. Real-time Engine Performance Biasing (EPB) dynamically adjusts performance across conditions, while accurate winglet and non-winglet variants ensure realistic climb, cruise, and descent behavior.

Integrated HP2000 Avionics Suite

Pilots can manage the flight using the HP2000 system, complete with dual PFDs and MFDs, Vertical Situation Display (VSD), and a fully integrated FMZ flight management system. Full VNAV support spans all flight phases, with optional VNAV-coupled autothrottle functionality controlled through the Virtual Aircraft Management System (VAMS).

Deep Systems Simulation

The Citation X simulates all major systems—including pressurization, hydraulics, environmental, electrical, fuel, and ice protection—with fidelity to the real aircraft. Functional FADEC, IRS, CAS, RTUs, and autopilot systems are modeled to ensure a fully immersive and operationally accurate experience.

Next-Gen VAMS (v2.0)

FlightFX's custom-built Virtual Aircraft Management System (VAMS) includes a redesigned interface with Navigraph and OpenStreetMap support. VAMS 2.0 handles everything from loadout and performance planning (via SimBrief integration) to ground services, cabin states, and optional autothrottle control. Cabin and cockpit configurations are easily tailored via an intuitive menu system.

Cabin & Cargo Personalization

Users can toggle a variety of interior and cargo elements including animated passengers matching load out, executive clutter, in-flight service items. These options help personalize the experience for each flight.

Immersive Audio Package

Recorded directly from the real aircraft in California, the sound set includes authentic APU whine, engine start-up, hydraulic clicks, cabin ambiance and more. An active noise reduction system reduces fatigue without sacrificing immersion or communication clarity.

High-Fidelity Visuals

From realistic and animated strobes to baked-in lighting detail and dynamic registration plates, the Citation X is visually rich inside and out. Volumetric lighting and interior bounce illumination provide added realism during dawn, dusk, and night ops. High resolution texturing and detail maps can be found throughout the aircraft.

A Commanding, Pilot-First Experience

The FlightFX Citation X is built for those who crave precision, power, and purpose in the cockpit. Every switch, dial, and flight surface has been meticulously modeled to deliver a hands-on, high-fidelity experience that empowers pilots to take full control of this legendary high-speed jet. Whether flying a complex IFR route through challenging weather or setting up for a smooth, high-performance descent into a bustling Class Bravo airspace, the Citation X is engineered to respond with confidence and clarity.

Advanced ground steering modes and responsive control logic ensure smooth taxiing and takeoff roll precision, while customizable Simplified and Advanced operating modes let you fly the way you want. Whether you're learning the ropes or operating with real-world procedural accuracy. From the moment you flip on the battery to the final engine spool-down, every phase of flight has been designed to deliver an accurate and faithful experience.

Ongoing Support and Future Updates

FlightFX is committed to sustaining a high-quality experience through ongoing updates and continuous community engagement. Regular patches will address user feedback and refine existing features, ensuring the Citation X continues to meet and exceed expectations. For direct developer interaction and real-time support, sim pilots are encouraged to join the official FlightFX Discord community.

Please note that discord is strongly preferred over email as response time can often be exponentially quicker. In addition many of your questions have often been answered in this forum already.

Preferred Methods of Contact

Discord

Email

LIST OF ACRONYMS AND ABBREVIATIONS

Below are common acronyms/abbreviations used throughout this manual:

ACARS - Aircraft Communications Addressing and Reporting System
ACFT - Aircraft
ADF - Automatic Direction Finder
AHC - Attitude Heading Computer
AHRS - Attitude and Heading Reference System
AOA - Angle-of-Attack
AP - Autopilot
AT - Autothrottle
ATC - Air Traffic Control
A/T - see AT
BAT - Battery
CAUT - Caution (alert level)
CAS - Crew Alerting System
C/B - Circuit Breaker
CDU - Control Display Unit
CG - Centre of Gravity
CRT - Cathode-Ray Tube display
DCP - Display Control Panel
EFB - Electronic Flight Bag (tablet)
EFIS - Electronic Flight-Instrument System
EICAS - Engine Indicating & Crew Alerting System
ELEC - Electrical system
ELT - Emergency Locator Transmitter
ENG - Engine
EPB - Engine Performance Biasing
EPU - Emergency Power Unit
ETA - Estimated Time of Arrival
ETE - Estimated Time En-route
FADEC - Full-Authority Digital Engine Control
FD - Flight Director
FLC - Flight Level Change
FL - Flight Level
FMC - Flight Management Computer
FMS - Flight Management System
FMZ - FMZ flight-management computer
F/O - First Officer
GS - Ground Speed
GPU - Ground Power Unit
HDG - Heading
HP2000 - avionics suite
HYD - Hydraulic system
IAS - Indicated Airspeed
ICE - Ice-protection system
ILS - Instrument Landing System
ISA - International Standard Atmosphere
IRS - Inertial Reference System
ITP - In-Trail Procedure
LCD - Liquid-Crystal Display
LFE - Landing Field Elevation
LNAV - Lateral Navigation
LRC - Long-Range Cruise
MDA - Minimum Descent Altitude
MFD - Multi-Function Display
MLW - Maximum Landing Weight
MMO - Maximum Mach Operating speed
MRW - Maximum Ramp Weight
MTOW - Maximum Take-off Weight
MZFW - Maximum Zero-Fuel Weight
NAV - Navigation (FD/FMA mode)
N1/N2 - Fan / Compressor shaft speeds
OAT - Outside-Air Temperature
PFD - Primary Flight Display
PTT - Push-to-Talk
QNH - Altimeter setting (sea-level pressure)
QOL - Quality-Of-Life
RA - Radio Altimeter
RAT - Ram-Air Turbine

RTU - Radio-Tuning Unit
SID - Standard Instrument Departure
SIMBRIEF - Online flight-planning service
STAR - Standard Terminal Arrival Route
TAS - True Airspeed
TCAS - Traffic-Collision-Avoidance System
TGT - Turbine-Gas Temperature
TOD - Top-Of-Descent
TO/GA - Take-off / Go-Around
TR - Thrust Reverser
V1 - Take-off Decision Speed
VA - Manoeuvring Speed
VAMS - Virtual Aircraft Management System
VASEL/VALT/VFLC/VPTH - VNAV altitude modes (select, hold, FLC, path)
VFE - Maximum Flap Extended Speed
VLE - Maximum Gear Extended Speed
VLO - Maximum Gear Operating Speed
VMO - Maximum Operating Speed
VNAV - Vertical Navigation
VOR - VHF Omnidirectional Range
VR - Rotation Speed
VREF - Reference Landing Speed
VSD - Vertical Situation Display
VY/VX - Best Rate / Angle of Climb
WOW - Weight-On-Wheels

Tutorial Flight

Introduction

This section serves as a hands-on introduction to operating the FlightFX Citation X, guiding users through a full flight from Sacramento International Airport (KSMF) to John Wayne Airport (KSNA). A video walkthrough will accompany this flight, covering key workflows, system usage, and real-world-inspired procedures specific to the Citation X.

This tutorial assumes a working knowledge of the aircraft's basic systems and cockpit layout. We strongly encourage all users to thoroughly review the manual particularly the **systems, performance, and avionics sections** before attempting the tutorial flight. Doing so will ensure a smoother, more immersive learning experience as you bring the Citation X to life within Microsoft Flight Simulator.

VIEW TUTORIAL VIDEO

Aircraft Specifications/Limitations

Engines

- Number of Engines: 2
- Engine Manufacturer: Rolls-Royce
- Engine Model: AE 3007C
- Rated Thrust:
    - AE 3007C1: ~6,700 lbf each
- Bypass Ratio: Approximately 5:1
- Compressor Type: Axial-flow, multi-stage
- Turbine Type: Dual-spool, high-efficiency
- Fan Diameter: 44 inches
- Thrust Reversers: Equipped, hydraulically actuated

Performance Characteristics

- Max Operating Mach (MMO): Mach 0.92
- Service Ceiling: 51,000 feet
- Typical Cruise Speed: Mach 0.88
- Range: ~3,100 nautical miles (standard conditions)
- Takeoff Distance (MTOW, SL, ISA): ~5,140 feet
- Landing Distance (MLW, SL, ISA): ~3,500 feet

Aircraft Limitations

Category	Limitation
Maximum Operating Altitude	51,000 ft
Minimum Flight Crew	2 (Pilot and Co-Pilot)

Engine & System Limits

Parameter	Limit
Max N1	As per FADEC control limits
Max ITT	~857°C
Generator Load Limit	400 amps per generator

Maximum Weights

Depending on configuration and equipment, the Citation X's weight limits are as follows:

- Maximum Ramp Weight (MRW): 36,400 lbs (16,510 kg)
- Maximum Takeoff Weight (MTOW): 36,100 lbs (16,374 kg)
- Maximum Landing Weight (MLW): 31,800 lbs (14,424 kg)
- Maximum Zero Fuel Weight (MZFW): 24,400 lbs (11,067 kg)

Aircraft Weights

- Typical Empty Weight: ~21,000 lbs (9,525 kg)
- Maximum Useful Load: ~15,170 lbs (7,076 kg)
- Maximum Payload: ~2,270 lbs

Note: Actual in-sim weights may vary depending on selected configuration, fuel load, and payload as set in the simulator's weight and balance menu / EFB.

Airspeeds For Normal Operations

Below are some recommended airspeeds to adhere to when using the Citation X. These figures are based on maximum take off weight and operation under normal conditions.

Speed Limits

All values approximate and may vary with aircraft configuration and weight.

Speed Description	**KIAS / Mach**
Recommended Climb Speed (Below FL300)	300 KIAS
Recommended Climb Speed (Above FL300)	Mach 0.80
Approach Speed (Flaps MID, MLW)	147 KIAS
Approach Speed (Flaps DN, MLW)	136 KIAS
Rotation Speed (Vr, typical range)	116–134 KIAS
Max Crosswind Component	25 knots
Maximum Mach (MMO)	Mach 0.92
Maximum Operating Speed (VMO) below 8,000 ft	270 KIAS
Maximum Operating Speed (VMO) above 8,000 ft	350 KIAS
Max Flap Extension Speed (Slats / Flaps 5°)	250 KIAS
Max Flap Extension Speed (Flaps FULL)	180 KIAS
Max Gear Extension Speed	210 KIAS
Max Gear Operating Speed	210 KIAS
Rough Air Penetration Speed (Below FL300)	300 KIAS
Rough Air Penetration Speed (Above FL300)	Mach 0.9

Performance Tables

All performance tables can be found here **https://bit.ly/msfsffx-c750-perf-tables**

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Airframe

The Citation X is a twin-engine, swept-wing business jet designed for high-speed, high-altitude flight. It features:

- A conventional fuselage layout with a mid-mounted main wing,
- A T-tail empennage for pitch and directional control,
- Aft-mounted turbofan engines integrated into streamlined nacelles.

The airframe is primarily constructed from aluminum alloys with selective use of composite materials for non-load-bearing panels and aerodynamic fairings. The fuselage is divided into three primary structural assemblies:

- Forward Fuselage – Includes the flight deck, avionics bay, pressurized passenger cabin, and nose gear well.
- Center/Aft Fuselage – Supports the main wing structure, engine pylons, landing gear assemblies, and pressurization bulkhead.
- Tail Cone – Houses the T-tail vertical and horizontal stabilizers and related flight control linkages.

Note: In Microsoft Flight Simulator, certain structural features may be visually represented only. Access panels, compartments, and service doors may not be fully functional or interactable.

Nose Section and Cabin

The nose section contains key avionics components and the retractable nose landing gear. The pressurized cabin is arranged in an executive layout and accessed via a single-piece airstair door on the left side of the fuselage.

Wing and Tail Surfaces

The Citation X's wing is highly swept and optimized for transonic cruise performance. It features:

- Inboard and outboard flaps for lift augmentation during takeoff and landing,
- Ailerons on the outer wing sections for roll control,
- Winglets (depending on configuration) to improve aerodynamic efficiency.

The T-tail provides pitch control via an all-moving horizontal stabilizer and elevators, and directional control via a rudder mounted on the vertical fin.

System Details and Aircraft Overview

This manual will broadly cover the following areas:

- VAMS
- Primary Controls
- Secondary Controls
- Flaps System
- Instrument Panel
- Multi Function Display
- Systems Tests
- Engine Systems
- Ice Protection
- Power Plant
- Fuel System
- Hydraulic System
- Electrical System
- Lighting System
- Pressurization System
- Static System
- Anti Ice System
- Flight Instruments
- Navigation
- Autopilot
- Flight Management System

The FlightFX Citation X's manual details its systems, mirroring the real aircraft's performance and operational depth. It covers hydraulics, electrical, fuel, environmental, HP2000 avionics, FlightFX's VAMS, and engine/autopilot management, offering a practical understanding of how the Citation X operates in Microsoft Flight Simulator.

State Saving (Persistent Settings Per Variant)

State saving in Microsoft Flight Simulator refers to recording certain configurations and conditions at the moment you exit a flight, then automatically restoring those exact parameters the next time the aircraft loads. State saving in the Citation X will capture items such as:

- Configuration options within V.A.M.S.
    - Units
    - LCD/CRT
    - Throttle Cue
    - Throttle Calibration
    - IRS Align Realism
    - Pax Visibility
    - Pause at TOD
- PFD/MFD/FMC Brightness

Note: This should not be confused with the aircraft "State." A separate option that loads the aircraft into a certain predefined configuration before a certain phase of flight.

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Virtual Aircraft Management System (V.A.M.S.)

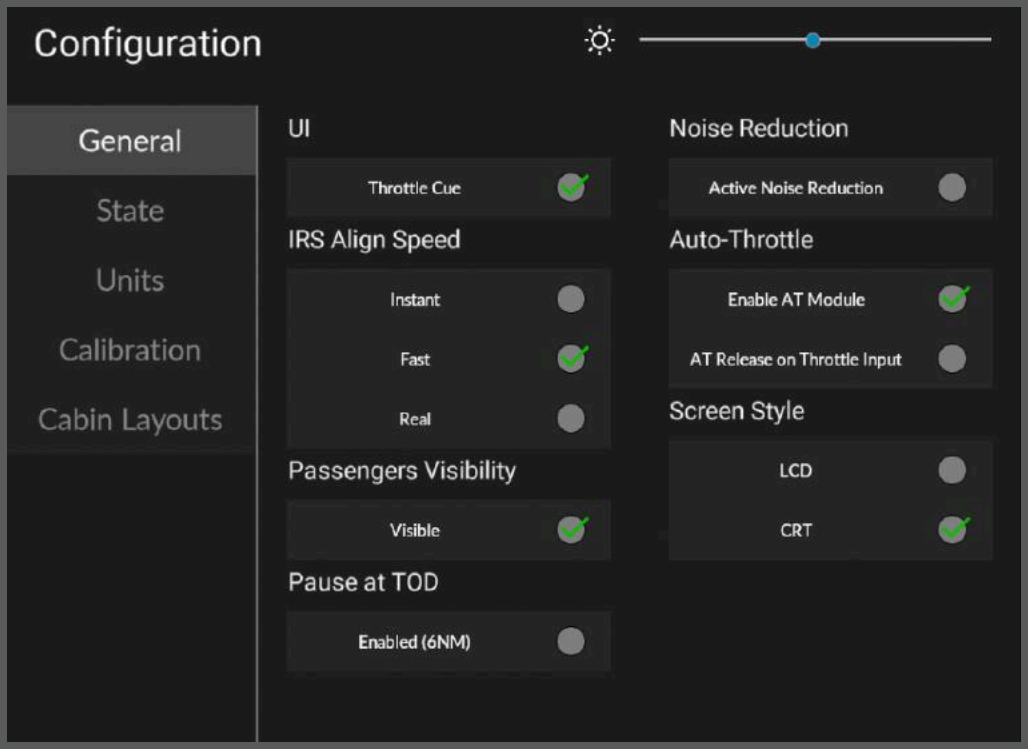
The Virtual Aircraft Management System (VAMS) is a cockpit-mounted tablet that simplifies setup and system control for the FlightFX Citation X. With this intuitive interface, pilots can adjust aircraft states, manage key systems, and activate interactive features without shifting focus from the flight deck.
A series of white icons located around the bezel, lets you manipulate the tablet as needed:

- **Swivel** – click and drag to tilt the tablet forward or backward
- **Pan** – click and drag to slide it up, down, left, or right
- **Rotate** – click and drag to spin it clockwise or counterclockwise
- **Stow** – click the pocket icon to dock the tablet in its side pocket
- **Reset Pos** – one tap returns the tablet to its default viewing angle

After clicking the stow icon, the tablet can be found in the stowage pocket just below the pilot's left knee.

Collision detection has been implemented for the Tablet. Its orientation will automatically correct to remain confined and prevent collision with its surroundings. Therefore, some movement actions will be unavailable if they would cause the tablet to collide with its environment.

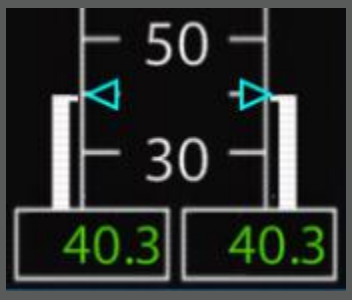
Configuration Application



General Tab

Throttle Cue

The "Throttle Cue" is a beneficial visual aid integrated into the aircraft's Engine Indicating and Crew Alerting System (EICAS). Its primary purpose is to provide pilots with a representation of the commanded N1 corresponding to the current physical position of the throttles. This feature adds a cyan visual marker directly to the N1 gauges on the EICAS display.



This simulated feature enhances your experience by offering precise engine thrust control, improving the virtual flight experience.

IRS Alignment Speed

Controls the speed the IRS system will take to align, where “Fast” will be around 15 seconds and “Real” will take from 3 ~ 15 minutes depending on the aircraft’s latitude.

Passengers Visibility

This setting controls whether three-dimensional passenger models are displayed inside the aircraft cabin during your flight simulation. For these models to become visible, the corresponding passenger weight has been input into the dedicated Weights Application in the EFB.

Pause at TOD

This function is designed to halt the simulation when your aircraft reaches 6 nautical miles prior to the VNAV (Vertical Navigation) calculated top of descent (TOD) point.

Note: This feature is disabled by default.

Active Noise Reduction

This feature simulates the audio experience of a pilot wearing a noise-canceling headset within the cockpit. When activated, the system effectively suppresses ambient cockpit noises, such as engine hum, air conditioning, and other background sounds, creating a more focused and immersive environment.
The goal is to replicate the acoustic isolation and clarity that a real-world noise-canceling headset provides.

Enable AT Module

Equips the aircraft with an integrated AT (Autothrottle) unit . This unit replicates a real-life upgrade that is installed on some Citation X aircraft.

AT Release On Throttle Input

This option allows the auto-throttle to be disconnected by moving your hardware throttle. It should be disabled if your throttle axis is "noisy," as it could lead to accidental disconnects.

Screen Style

The system offers a flexible display mode, allowing users to transition between modern LCD (Liquid Crystal Display) and classic CRT (Cathode Ray Tube) visual styles. This toggle function applies comprehensively across all primary flight and engine information displays, including the Primary Flight Display (PFD), Engine Indication and Crew Alerting System (EICAS), Multi-Function Display (MFD), and Flight Management Computer (FMC) screens. This versatility caters to pilot preference and does not have any other affect on aircraft operations.

State Tab

The aircraft offers several preset configurations to quickly set it to various operational states.

- **Cold and Dark:** This configuration represents the aircraft in a completely shut-down state. All systems, including engines, avionics, and electrical power, are off. This preset is used for starting a flight from scratch, allowing the pilot to experience a full pre-flight checklist and system startup procedure. It mimics the aircraft as it would be found after a long period of inactivity or maintenance.
- **Ready To Taxi:** In this configuration, the aircraft is prepared for ground movement. The engines are started and stabilized, essential avionics are powered on, and the aircraft's systems are configured for taxiing to the runway. This preset bypasses the full startup sequence, making it suitable for pilots who want to begin their flight directly from the ramp without going through the complete cold and dark startup procedure.
- **Ready For Take-off:** This preset configures the aircraft to be immediately prepared for departure. Beyond the "Ready To Taxi" state, the flaps are set for takeoff, trim is adjusted, and all necessary flight controls and avionics are configured for an imminent takeoff. This option is for pilots who wish to jump straight into the takeoff phase, perhaps for practicing takeoffs and landings.

Units Tab

This setting allows pilots to configure the units that their weight, temperature, and altimeter is displayed in.

Weight Units: Pilots can select their desired units for displaying aircraft weight, which includes parameters such as gross weight, fuel weight, and payload. Options include:

- **Pounds (lbs)**
- **Kilograms (kg)**

Temperature Units: The display of outside air temperature (OAT) and other relevant temperature readouts can also be configured. Available choices encompass:

- **Degrees Celsius (°C)**.
- **Degrees Fahrenheit (°F)**.

Barometric Altimeter Units: pilots can choose the units in which barometric pressure is displayed for the altimeters. The primary options are:

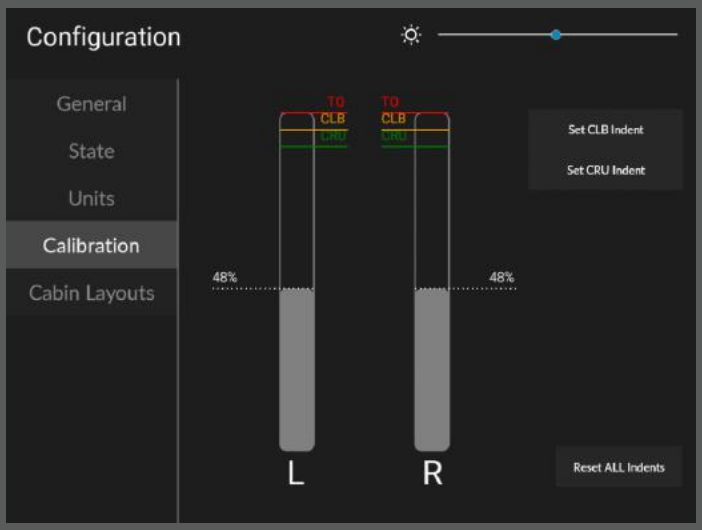
- **Inches of Mercury (inHg)**: Predominantly used in North America for aviation altimeter settings.
- **Hectopascals (hPa) / Millibars (mb)**: The international standard for atmospheric pressure, used extensively in most parts of the world. (Note: Hectopascals and millibars are numerically equivalent).

Calibration Tab

The Citation X features a FADEC-driven throttle system that incorporates detents to simplify normal operations for pilots. This page enables users to customize the positions of the CRU/CLB detents on their external throttle hardware.

Throttle Calibration

V.A.M.S Calibration Tool



1. Move your physical throttle to the desire CRU detent location and press “Set CRU Indent”
2. Move your physical throttle to the desired CLB detent location and press “Set CLB Indent”

NOTE : There are some restrictions put in place where the CLB detent must be higher than the CRU detent by at least 4% , Additionally the CRU detent cannot be lower than 24%. The UI will show an error message if an invalid detent position is chosen.

In simulator recommendations:

External hardware throttles typically fall into two categories based on their design and functionality, each offering a distinct experience for the virtual pilot: those with an on-axis reverser, and those without. See the use cases below to determine which type of throttle you have and follow the directions for the relevant one. Once you know your throttles are configured correctly please then proceed to the calibration tool in the EFB.

Setting a "Reverser Not On Axis" Throttle

(Examples: Thrustmaster TCA Quadrant Boeing Edition, Honeycomb Bravo, Logitech Flight Throttle Quadrant, etc.)

In this case joystick button 10 and joystick button 11 are the reverser handles illustrated in the picture below.

(Example screenshots are for the Honeycomb Bravo throttle quadrant in MSFS2020)

To configure your throttle, first bind "Throttle 1 Decrease" and "Throttle 2 Decrease" to indicate action type "on press" when you pull up on the reverser handle. Then, bind "Throttle 1 Cut" and "Throttle 2 Cut" to indicate action type "on release" when you pull up on the reverser handle.

Note: You may need to save the action type twice to ensure it registers. Button names may also vary based on your hardware.

This setup will command maximum reverse thrust when you pull the handle and idle thrust when you release it.

Reverser On Axis Throttles (Thrustmaster TCA Quadrant Airbus Edition, etc)

(Example screenshot is for the TCA Quadrant Airbus Edition in MSFS2020)

Configure your joystick by assigning the L-AXIS X and Y to throttle one and two. Adjust sensitivity curves, ensuring the white dot moves positively for the reverser range and negatively for the normal range. Precisely fine-tune deadzone and neutral settings to synchronize your physical detents with the flight simulator's sensitivity curve.

ThrustmasterTCA Quadrant Airbus Edition Users

When using the Citation X, some users may find the limited range of motion on the TCA Airbus Throttle Quadrant detracts from their experience. FlightFX suggests the following simple adjustments to address this.

- Disable Physical Detents
  Watch this simple to follow video to disable the detents for your TCA Aibus Throttle Quadrant
  https://www.youtube.com/watch?v=KLn_JwsUJx0

- Adjust your sensitivity curves to match the image above, particularly by straightening the throttle portion of the curve in both the X and Y axes. Failure to do so will result in an overly sensitive throttle response to inputs.

Cabin Layouts

Allows the user to display visuals in the cabin of the food items listed.

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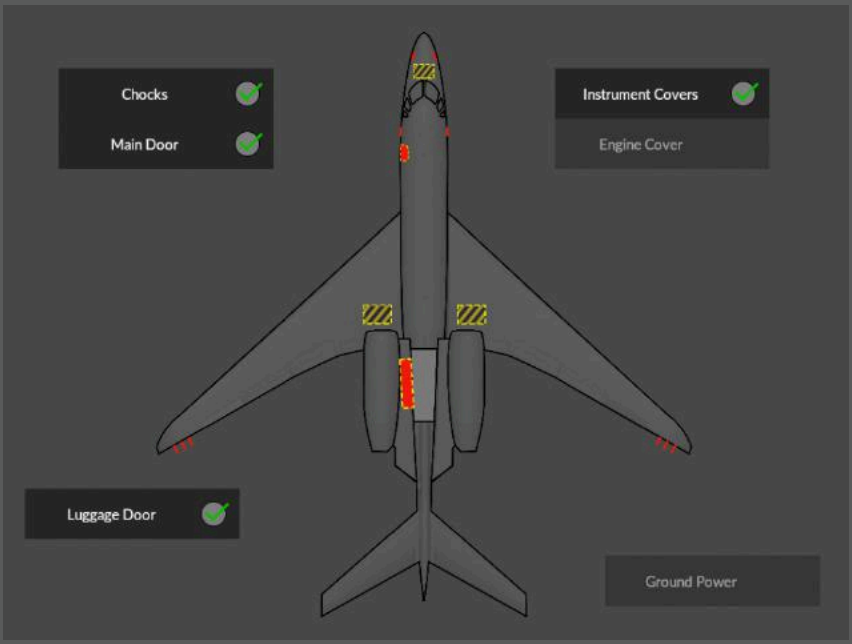
Ground Services Application



This application serves as the central control hub for managing exterior visual and functional elements of the aircraft. This includes the luggage door, main door, chocks, instrument and engine covers and the ground power unit.

Chocks

Will hold the aircraft in place without the need for a parking brake .
Aircraft must be stationary for the option to be available.

Main Door / Luggage Door

Opens and closes the main and luggage doors.
Aircraft must be stationary for the option to be available.

Instrument Covers

Toggles covers for various probes on the fuselage.

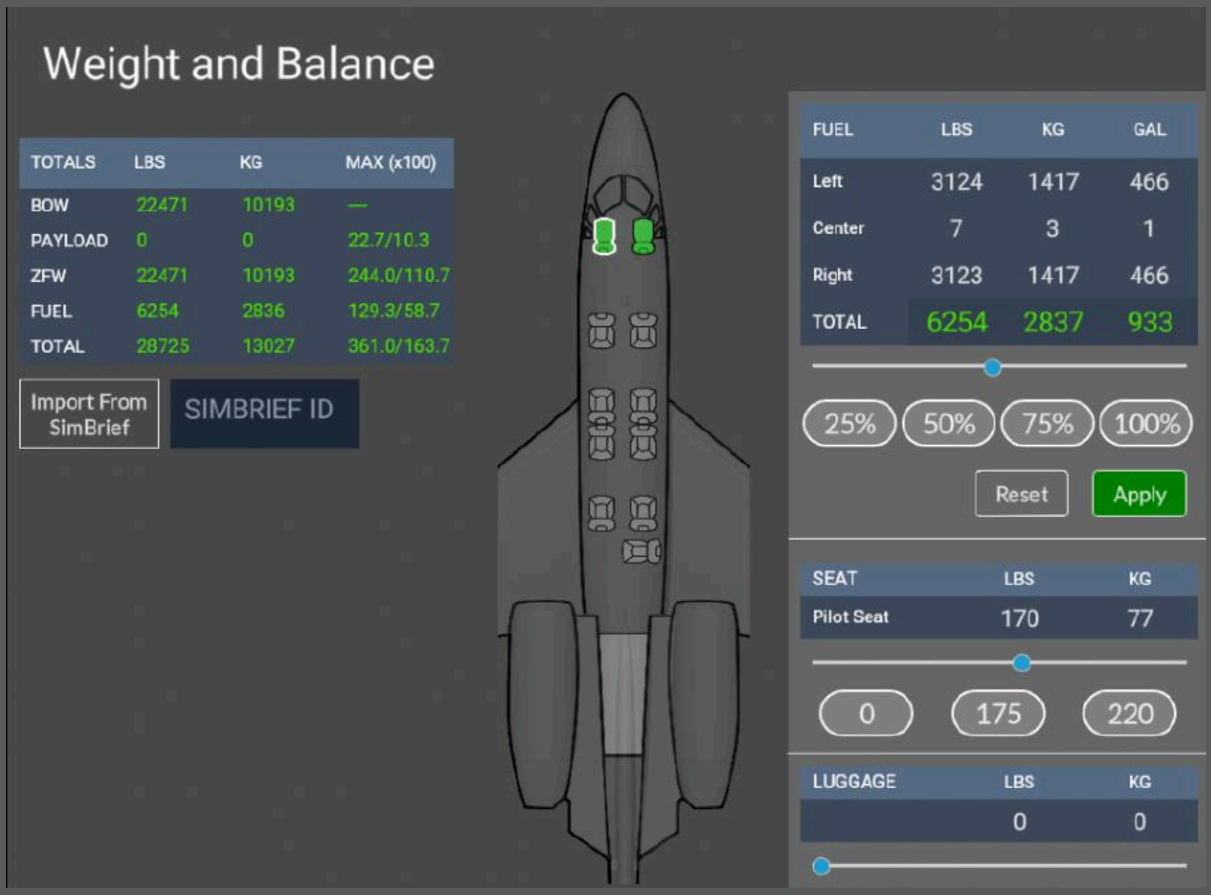
Engine Cover

Applies protection covers for the engines.
Engines must be shutdown for this option to be available.

Ground Power

Spawns a GPU and connects it to the aircraft.
Aircraft must be at an airport apron/parking spot for this option to be completed.

Weights Application



This app is used to set the weight and balance of the Citation X. Crew weights are preloaded at 170 lbs x2 (for each pilot.)

Note: 2024 Users will only be able to visibly see one pilot when in the exterior view. This is due to a bug within MSFS 2024 at the time of this manual's creation.

Fuel

Fuel can be loaded by either using the fuel slider, or by selecting a preset percentage, then clicking Apply. If you have made a mistake you can return to the previously applied value or the original value from load in. Another method of entry is clicking on the green coloured TOTAL amount and entering an exact value using the pop up keyboard.

Passengers

To set a passenger weight, click and choose a passenger seat, then either set this particular passenger weight via the slider or by clicking on the preset values 0/175/220 lbs. Passenger weights are applied immediately with no need to click “Apply.” To remove a passenger added in error. Simply click on the seat and zero out the weight using either the slider or the preset.

Luggage

Similar to the passenger section, luggage weight is set using the slider.
Luggage weight is applied immediately in real time.

Simbrief Import

Alternatively, all weights (including fuel) can be synchronized with your most recently generated SimBrief flight plan.

1. Enter your Simbrief ID in the labeled text field (the 6 digit number not the username)
2. Click import from SimBrief
3. If successful, the message “SimBrief data imported successfully” will be displayed.

Navigraph

Navigraph Charts subscribers can access their Charts and other information through the Navigraph app. (Navigraph Subscription required)

1. Scan the QR code or visit navigraph.com/code and enter the code displayed in V.A.M.S.
2. Login to your navigraph account.
3. Click approve when asked to allow the aircraft to connect to your navigraph account.

Note: You must use the virtual keyboard in the Navigraph app to type in any inputs, such as the Airport ICAO code.

Systems

Cockpit Lighting System

Primary cockpit lighting consists of backlit panels, internal instrument lighting, and floodlights. These illuminate all instruments on the cockpit instrument panel, side consoles, and center pedestal. The backlit panels specifically illuminate the position functions of switches and controls. This primary lighting is designed to be dimmed for night operation.

Auxiliary Panel Light

The AUX PANEL LIGHT knob controls the brightness of the auxiliary panel lighting, located underneath the glareshield. Turning the knob allows for dimming or brightening the lights.

Map Light Controls

The overhead spotlight's intensity is controlled by the MAP LIGHT, which can be adjusted by rotating the knob left or right. A separate map light control is also available on the copilot's side.

Emerg Lt Arm

This switch toggles the emergency lighting in the cabin. When armed, emergency lighting activates of no power is supplied to the DC bus.

Flood Lts

Turning this knob left or right controls the intensity of the overhead cockpit flood lighting.

LH/RH

Independent control of left or right side integrated panel lighting. Co pilot RH switch is located on the right hand side of the cockpit underneath the bleed air panel.

Day/Nite Dim

Global switch to control the dimming of integrated panel lighting and glass display brightness for night operations , where ON = dim , and OFF = normal daytime operation.

EL

Controls the intensity of all integrated panel lighting and will override the LH knob.

CTR

Offers Independent control of center pedestal integrated lighting and RMU brightness.

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Cabin Systems

Lighting controls for the passenger compartment are located at the top of the cabinet fixture, adjacent to the cockpit door. These switches manage all cabin lighting, including overhead service lights, indirect lighting, and specific lighting for the main entry door and cabin escape hatch. The shade controls operate all window shades simultaneously.

CABIN ENTRY

Controls entry lights atop of the main door and access light on the main door stairs.

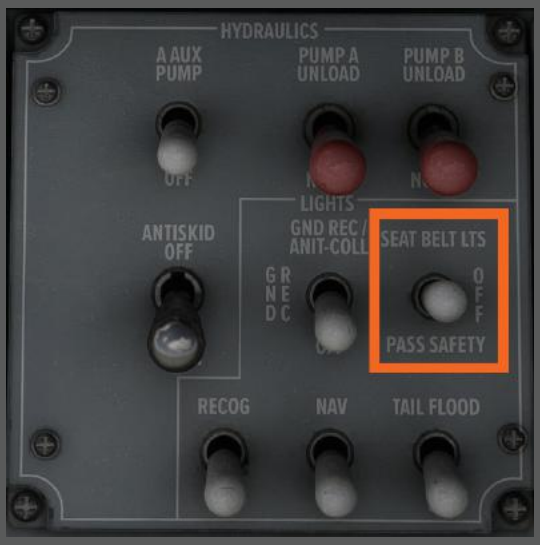
CABIN OVERHEAD

Turns cabin lighting ON/OFF.

DIM / BRT

Controls the brightness of the cabin lighting.

Passenger Advisory Lighting



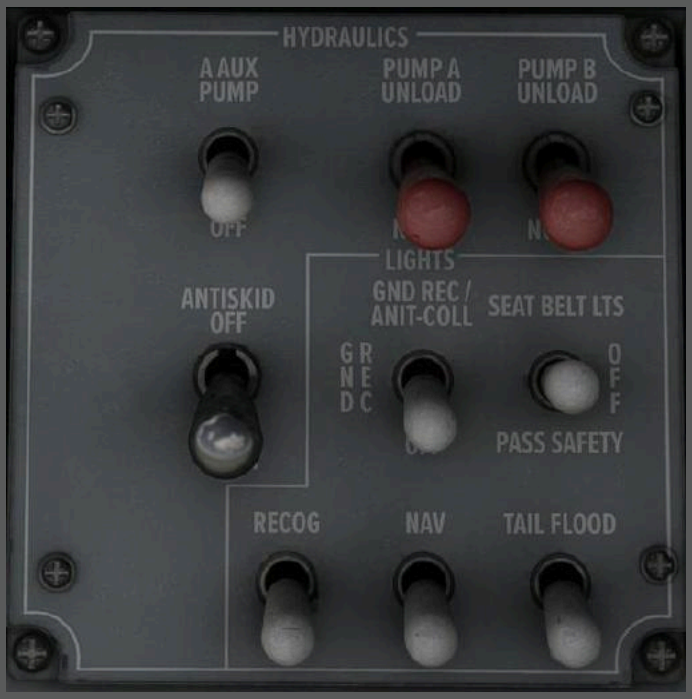
Passenger advisory lights are controlled by a three-position switch in the cockpit. When set to the "SEAT BELT" position, the "FASTEN SEAT BELT" signs in the cabin illuminate. In the "PASS SAFE" position, "NO SMOKING," "FASTEN SEAT BELT," and "EXIT" signs are illuminated, along with a "RETURN TO SEAT" sign located in the aft area. All signs are extinguished when the switch is in the "OFF" position. If installed, safety chimes operate in conjunction with the "NO SMOKING" and "FASTEN SEAT BELT" signs.
Cabin lighting can be controlled from the master control box atop of the pantry cabinets:

Exterior Lighting Controls

Exterior lighting consists of navigation lights, anti-collision (strobe) lights, wing inspection lights, ground recognition lights (fuselage and tail mounted strobe lights), tail floodlights, landing lights, and taxi lights. Lighting switches can be found in two independent locations within the cockpit.

The landing and taxi lights are controlled by switches located near the throttles on the center pedestal.

All other exterior lights are controlled by switches located on the light panels (LIGHTS) located low on the right and left instrument panels.



The GND REC/ANTI-COLL switch controls ground recognition lights. The GND position activates tail anti-collision lights (Beacons), while GND REC/ANTI-COLL controls both wing (STROBES) and tail anti-collision lights.
Landing lights serve as in-flight recognition lights via the RECOG/OFF switch, reducing intensity and extending bulb life.

Navigation lights include colored wingtip lights (red-left, green-right) and a white tail light.
Wingtip anti-collision lights are separate, high-intensity, and should only be used just before takeoff and after landing. Wing inspection lights illuminate wings for ice detection.
Ground recognition lights are on the lower aft fuselage and bullet fairing for high-density ground areas.
Tail floodlights illuminate aircraft surfaces for night identification.
Landing lights, one on each wing, have separate switches.
Twin taxi lights on the nose gear strut are ground-only, controlled by a single ON/OFF switch, and steer with the nose gear. Weight-on-wheels switches prevent in-flight taxi light illumination.

Fuel System

The **Citation X's fuel system** includes two wing tanks with hopper tanks and a center wing tank that includes a forward fairing fuel tank. Each wing tank holds 521 gallons (3518 lbs), and the center wing tank holds 888 gallons (5594 lbs), with 207 gallons (1397 lbs) in the forward fairing tank, totaling 1930 gallons (13,031 lbs at 6.75 lbs/gal). System operation is fully automatic during normal flight. Manual control and monitoring are provided through boost pump switches, the wing gravity transfer (GRVTY XFLOW) switch, fuel CROSSFEED switch, CTR WING XFER O'RIDE switch, fuel quantity and flow indicators, and EICAS messages that indicate abnormal operation. A low fuel level warning system operates independently of the normal fuel quantity indicating system.

Fuel System Control Panel

The Citation X supports multiple functions including engine feed, crossfeed, wing-to-hopper scavenging, center-to-wing transfer, and gravity crossflow. Under normal conditions with crossfeed off, each engine is supplied by its respective hopper tank via a motive flow ejector pump, driven by engine-generated pressure. Electric boost pumps in each hopper serve as backups and activate automatically during engine start, crossfeed, low pressure, or APU operation (left side only), or can be manually controlled via cockpit switches. Boost pump status appears on the EICAS: white when manually on, amber with MASTER CAUTION when triggered by low pressure.
Boost pump controls feature ON, OFF, and NORM positions. In OFF, the pump remains inactive unless needed for start or transfer. In NORM, it engages automatically during critical operations but is inhibited when the throttle is in cut-off to avoid false activation during shutdown. ON mode runs the pump continuously.
Fuel transfer from the center to wing tanks maintains center-of-gravity by keeping wing fuel levels stable until the center tank is depleted. Transfer ejector pumps move fuel as needed, regulated by float valves in each wing tank that modulate flow based on tank level.

Fuel transfer from the center wing is typically automatic, but manual control is possible using the LH and RH CENTER WING XFER O'RIDE OFF/ON/NORM switches located on the fuel control panel. These switches operate shutoff valves that regulate fuel flow to the ejector pumps.

- **OFF:** Stops fuel transfer.
- **NORM:** Enables automatic transfer. However, if the corresponding wing tank's fuel level falls below 500 lbs, the valve closes to prevent motive flow fuel from being trapped.

- **ON:** Allows continuous fuel transfer, regardless of the 500 lb threshold, ensuring all center tank fuel is pumped out.

Normal position is NORM for automatic operation.

Engine Crossfeed System:

The Citation X's crossfeed system allows the left engine to be supplied from the right tank or the right engine from the left tank. When crossfeed is selected (LH TANK - RH ENG or RH TANK - LH ENG), the selected engine draws fuel from the opposite tank, which continues to feed its own engine. No wing-to-wing fuel transfer occurs. On crossfeed selection, the boost pump in the selected hopper tank activates, the crossfeed valve opens to supply fuel to the opposite engine, and the opposite engine's motive flow shutoff valve closes to disable its primary ejector pump. Crossfeed can operate without the boost pump, but the pump should always be on.
A white EICAS message FUEL XFEED OPEN confirms the crossfeed valve has opened. The pilot must verify the selected tank shows FUEL BOOST ON and that the opposite boost pump is off, since opposite pump operation stops crossfeed.

Gravity Crossflow System

The gravity crossflow system permits gravity flow between the left and right hand wing tanks for backup to the crossfeed system, and to equalize wing tank levels during conditions which could occur if a center-to-wing tank transfer pump were to fail on one side. Control of gravity crossflow is by the GRAVITY CROSSFLOW L WING - R WING/OFF switch on the fuel control panel. The L WING - R WING position causes the gravity crossflow valve in a line between the two wing tanks to open. A white EICAS message (FUEL XFLOW OPEN) will appear to remind the pilot that the valve is open. If the fuel quantity differential is small, gravity leveling will be slow. The process can be accelerated by sideslipping the airplane. If a cyan EICAS message (FUEL GRV XFLW XSIT) appears it means that the gravity crossflow valve did not fully open or close. To preclude fuel vent spills, the gravity crossflow valve must be closed whenever the airplane is parked on uneven ground.

Hydraulic System

The Citation X's main hydraulic system consists of two independent systems, A and B. Hydraulic power operates the primary flight controls (rudder, elevators, ailerons, roll spoilers), landing gear, leading edge slats, speed brakes, nose wheel steering, and main wheel brakes. A rudder standby subsystem, located in the right pylon, powers the system B lower rudder PCU via an electric motor/pump supplying 3000 PSI. This unit runs automatically when accumulator pressure drops below 2300 PSI and cycles periodically to maintain charge.
Each engine drives a hydraulic pump: the left powers system A, the right powers system B.
System A operates the landing gear, nose wheel steering, main brakes, outboard speed brakes, and outboard roll spoilers.

Hydraulic System Control Panel

Located right of the landing gear control handle on the lower copilot's instrument panel, this panel contains UNLOAD A/NORM and UNLOAD B/NORM switches to depressurize systems A and B, and an A AUX PUMP/OFF switch for the A system electric auxiliary pump. When loading valves are closed (UNLOAD), fluid flows from pumps into distribution lines. When open, fluid still flows but returns to pump inlets at under 100 PSI through unloading pressure relief valves.

Hydraulic System Indicators

Selecting FUEL HYD on the MFD/EICAS displays hydraulic A and B system pressures and fluid quantities. Normal pressure (2600–3200 PSI) and quantity (16%–100%) are green. Abnormal pressures (outside range) or quantities (below 16%) are amber. Fluid temperatures up to 82°C are green; 82°C and above are amber. If engines run and both systems are < 2600 PSI, pressures are red.

Landing Gear

The Citation X features electrically controlled, hydraulically actuated landing gear. It cycles in under six seconds, operable up to 210 KIAS. The control panel includes a gear handle, three green "gear safe" lights, and a red "unlocked" light. An audible warning sounds if gear is not down and locked when throttles are retarded.

Parking Brake

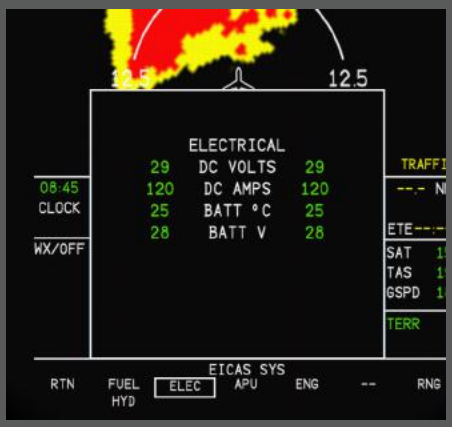
The parking brake is engaged by pulling the handle at the aft center pedestal. When set, with electrical power on EICAS, a cyan PARK BRAKE ON message appears, activated by a 1200–1500 PSI switch in the right brake line and a position switch on the brake valve lever. If the handle is pulled in flight, an amber PARK BRAKE ON message and a chime will occur. The Parking brake is engaged when the lever is in the up position, and disengaged when the lever is pushed down.

Electrical System

The Citation X Electrical system includes two main batteries, two generators (which supply less power above 41,000 feet), and two engine-driven alternators for backup power.
In the cockpit, you'll find switches and controls for managing power. Such as battery switches, generator controls, avionics power, and an emergency LOAD SHED switch. There's also a switch and port for external ground power, plus a display (DC ammeter) to monitor APU power usage.
An APU is available for ground and in-flight use up to 31,000 ft. The AC system solely powers windshield anti-ice.

Indications

The EICAS display's CAS section provides power indicators. Pressing the ELEC bezel button reveals engine-driven generator voltage, amperage, and both battery temperatures. Abnormal electrical conditions trigger eight digital EICAS messages, and pressing the ELEC button again provides detailed system status. A separate ammeter for the APU is located on the copilot's meter panel.



Routine electrical data is not displayed without pressing the ELEC button. However, any abnormal state generates a color-coded EICAS message:

- Red (Warnings): Also flashes on the MFD with the master warning until acknowledged. Examples include GEN OFF L-R.
- Amber (Cautions): Accompanied by a steady master caution and flashing until acknowledged. Examples include GEN OFF L-R, and LOAD SHED.
- Cyan (Advisories): Flashes for five seconds, then steadies. An example is LOAD SHED OVERRIDE.

Generators

Each generator is controlled by a three-position switch (LH or RH GEN, OFF, RESET) on the DC power panel to the left of the pedestal.

To bring a generator online: place the switch to GEN with the engine running. This removes the amber GEN OFF L-R EICAS message and connects the generator to the bus if voltage and amperage are within GCU limits.

To take a generator offline: place the switch to OFF. This disconnects the generator from the bus and triggers the amber GEN OFF L-R annunciation.
To reset a tripped generator: move the switch momentarily to RESET. This briefly connects the armature to the field to build voltage to 28.5 V, then the switch returns to OFF. Manually set it back to GEN to reconnect.
If both generators trip or fault, the MASTER WARNING flashes, a red GEN OFF L-R EICAS message appears flashing, and an attention tone sounds.

Batteries

Each of the two 44 amp-hour batteries is controlled by a BATT 1/OFF or BATT 2/OFF switch on the panel left of the center pedestal. Set OFF to isolate that battery.
External power is connected by plugging in the GPU and placing the EXT PWR switch to EXT PWR (ON). This powers the airplane via the crossfeed bus. Starting a generator automatically disconnects external power.

Batteries charge from the GPU when connected and at least one BATT switch is ON.
Pressing the ELEC bezel on EICAS shows battery temps, generator voltages, battery voltages, and DC amps.

With either battery switch in OFF, some systems still receive power from the hot battery bus.
These include BATT 1 and BATT 2 sensing, selected forward and aft compartment lights, EICAS emergency power, and emergency exit lights.

Standby Power

The STBY PWR switch (ON/OFF/TEST) on the AVIONICS POWER panel controls power to standby equipment via the standby battery in the left nose avionics bay. In ON, standby equipment receives power from normal sources. If normal power is lost (batteries, generators, external), it automatically switches to the standby battery.

An amber light indicates the standby battery is supplying power to the standby altimeter/airspeed vibrator, standby attitude indicator, and standby engine indicators. This lasts at least 30 minutes.
In OFF, the standby equipment bus is unpowered.

Holding to TEST checks the standby battery and circuits; a green light confirms a satisfactory test and adequate charge.

Load Shed Override

The LOAD SHED switch is used to manage the jet's electrical bus circuits in case of emergencies to save power for critical subsystems.

APU System

The APU is installed in the tail (stinger) and powers a DC generator rated at 200 A in flight, 300 A on ground, and can be operated up to 31,000 ft.
It supplies electrical power, engine starting air, auxiliary bleed air for air conditioning, and door seal inflation.

- APU control panel functions:
    - MASTER ON/OFF: powers the APU system.
    - TEST/PUSH: initiates APU internal self-tests.
    - APU START/NORM/STOP: starts or shuts down APU (spring-loaded to NORM).
    - APU STARTER DISENGAGE/NORMAL: manually disengages starter if it fails to disengage automatically (spring-loaded to NORMAL).
    - BLEED AIR MAX COOL/ON/OFF: controls APU bleed air. ON is normal for cooling/environmental air; MAX COOL bypasses flow control valves (not approved for engine start).
- Indications:
    - READY TO LOAD light illuminates when APU is ready to supply generator power.
    - APU RELAY ENGAGED and APU FAIL lights on the right meter panel.
- During startup, the APU automatically sequences fuel, ignition, surge valve, starter cutout, and temperature control.

External power

- The EXT PWR/OFF switch on the DC power control panel connects or disconnects GPU power.
- In EXT PWR, external power is applied to the aircraft busses with overvoltage and undervoltage protection active.
- Batteries will only charge if their respective BATT switches are also turned ON.
- In sim , the GPU must first be connected to the aircraft through the EFB for external power to function. Being in a parking spot at the airport is a prerequisite.

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Ice Protection System

The anti-ice systems prevent ice buildup on the pitot tubes, static ports, AOA probes, RAT probes, engines, wings, wing roots, horizontal stabilizer leading edges, windshields, and drain lines; the vertical stabilizer does not require anti-icing. These systems use either electrical heating elements or hot engine bleed air, controlled by switches and knobs on the instrument panels. Various EICAS messages indicate anti-ice system status or faults, with some covered here and others detailed in the EICAS section.

Pitot-Static and Angle-Of-Attack (AOA) Probe Anti-Ice

Use the LH/OFF and RH/OFF PITOT/STATIC switches on the ANTI-ICE panel (right of pedestal) to control electric heating. If pitot/static or RAT heaters are off:

- Cyan P/S RAT HEAT OFF: indicates switches are off.
- Amber P/S RAT HEAT OFF with chime: throttle lever angle >60° and switches are off.

Engine Anti-Ice

Use the ENGINE LH/OFF and RH/OFF switches on the ANTI-ICE panel to control engine nacelle and wing root anti-ice.

- ON: Removes power, valves open, bleed air flows for anti-icing.
- OFF: Powers valves closed, anti-ice off regardless of throttle.

Monitor system by observing N1 decrease when anti-ice is on.

Related CAS messages:

- ENG A/I COLD L-R (cyan): warming up, no power increase required.

Wing leading edges:

- WING A/I COLD L-R: warming up, no power increase required.

The system should be turned on before entering into visible moisture due to lower power settings.
Note reduced maximum power from engines when the system is activated.

Wing And Slat Anti-Ice

Bleed air from high and low pressure engine stages heats the wings leading edges and inside each slat.
Landing lights are also tied into the bleed air system as well.

Turn on wing anti-ice using the ANTI-ICE panel switches whenever flying in or about to enter icing conditions.

Monitor CAS:

- WING A/I COLD or SLAT A/I COLD (amber): indicates low exhaust temp, usually from low power. Increase N1 slightly above idle to clear.

Keep anti-ice systems active in icing conditions and adjust power to make up for the thrust penalty on the engines.

Horizontal Stabilizer Anti-Ice

Bleed air from the engines is sprayed inside the horizontal stabilizer leading edges, controlled by separate LH and RH valves.

Valves open when **STABILIZER LH and RH/OFF switches** on the ANTI-ICE panel are set to LH and RH.
The system is independent of the wing crossover valve; each side draws from the bleed air duct system.

Turn on STABILIZER LH and RH switches whenever icing conditions may be present.

At low power (below 48% N1), expect **STAB A/I COLD CAS**; clear by increasing power.

Pressurization/Environmental Systems

In the Citation X, engine bleed air (hot, high-pressure air from the engine) is used for cabin pressurization, air conditioning, and anti-ice systems. Before reaching the cabin, this air is cooled and conditioned by Environmental Control Units (ECUs). Cabin pressure is controlled by adjusting how much air is let out, and a separate valve heats and pressurizes the baggage compartment. On the ground, the system uses high-pressure air for strong cooling. Once you advance the throttles past about 30° TLA, it switches to low-pressure air (from the 8th stage of the engine). In flight, it usually stays in low-pressure mode unless throttle settings or anti-ice demands require high pressure again.

The system automatically switches between different bleed air sources depending on throttle position, anti-ice use, and whether you're in the air or on approach.

On the ground, the APU can supply bleed air too. It's used for engine starts, pressurizing the cabin door seal, vacuum systems, and cooling the cabin and cockpit.

Control

The system uses engine bleed air, cooled and regulated by the environmental control units (PACs), to pressurize the cabin and cockpit. Cabin pressure is controlled by valves that release air to maintain the desired cabin altitude. In automatic modes (NORM or ALT SEL), a digital controller modulates the outflow valves based on aircraft altitude or pilot-selected cabin settings. The system maintains cabin altitude up to 8,000 ft at maximum aircraft altitude (51,000 ft).

Alt Sel/Norm Switch

- NORM:
    - Fully automatic schedule: cabin altitude follows a programmed curve vs airplane altitude.
    - Uses landing field elevation and baro input to adjust for descent.
    - Rate knob sets *maximum* climb/descent rate; system may use slower rates.
- ALT SEL:
    - Pilot selects exact target cabin altitude and cabin rate-of-change.
    - Useful for nonstandard descents or when optimizing passenger comfort.
    - Requires setting cabin altitude to field elevation before landing.

Cabin Altitude Selector Knob (ALTITUDE SELECT)

- Sets the desired cabin altitude when ALT SEL mode is active.
- Typically set to match landing field elevation before descent.

RATE Knob (Rate of Change)

- Sets climb ~500 fpm and descent ~300 fpm at the “pip” mark.
- Limits the cabin rate in NORM mode and directly sets rate in ALT SEL.

Manual/Norm Switch

- NORM:
    - The system runs automatically under digital controller logic.
- MANUAL:
    - Electrical control is bypassed.
    - The pilot manually operates outflow valves via manual control valve.
    - Used if auto mode fails (indicated by persistent FAULT).

Cabin Dump Switch

    - Guarded Switch
    - When lifted and pressed to DUMP, commands both outflow valves fully open.

    - Rapidly depressurizes the cabin to ambient altitude (up to ~13,000 ft).

Indications

- CAS/EICAS messages:
    - CABIN ALT (amber): cabin altitude above ~8,500 ft, chime sounds.
    - CABIN ALT (red): above ~10,000 ft, dual chime sounds.

Notes on automatic operation

- The system maintains cabin pressure at or below 8,000 feet, even when the aircraft reaches altitudes of up to 51,000 feet.

Operation

- Before flight:
    - Set landing field elevation and verify pressurization in NORM or ALT SEL.
- In flight:
    - Use NORM for fully automatic control.
    - Use ALT SEL to target a specific cabin altitude with controlled rate.

Air Conditioning System

The system uses two PACs (Environmental Control Unit Packages) — one for the cockpit and one for the cabin.

- Each PAC has a switch on the environmental control panel with OFF, ON, and HIGH positions:
    - ON is normal operation.
    - HIGH increases airflow, mainly for ground cooling.
    - When the APU is running, only one PAC (cabin or cockpit) may be set to HIGH at a time.

Temperature controls labeled CKPT TEMP SEL and CAB TEMP SEL each have:

- AUTO for automatic temperature regulation, changing the value of this knob changes the selected target zone temperature.
- MANUAL COLD or HOT for direct temperature override where either cold or hot air will be pushed without regulation for a target temperature, air temperature is manually controlled by moving the knob towards COLD or HOT positions.

TEMP DISPLAY SEL control allows selection of cockpit or cabin zone temperatures on a digital readout.

- In SEL, it shows the selected zone temperature.
- In SUPPLY, it shows the temperature of supply air in feeder ducts.
- CKPT/CAB : shows current temperature in the specific zone.

SOL VALVE switch (OPEN/CLSD) controls a duct valve between cockpit and cabin bleed air systems.

- In OPEN, either engine can run both PACs if one engine shuts down.
- In CLSD, right engine supplies cabin PAC, left engine supplies cockpit PAC.

If the cockpit PAC is OFF but the cabin PAC is ON or HIGH, a crossover valve automatically opens to route heated cabin air to the cockpit duct system.

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System Tests

The rotary test selector switch, located on the right side of the center pedestal, is used to test the aircraft's visual and aural warning systems. The system operates only if at least one battery switch is set to BATT. Whenever the selector is turned to any position other than OFF, a red indicator light above the switch illuminates.

Below is the expected action for each test position:

SWITCH POSITION	TEST FUNCTION	CAS MESSAGE	AURAL	LIGHTS
SMOKE/DET	Tests smoke detector and its aural/visual warning interface.	BAGGAGE SMOKE	CHIME1	Master Warning
LDG GR	Tests landing gear warning system and landing gear indicator lights.	—	LANDING GEAR WARNING	Landing gear module lights
FIRE WARN	Tests engine fire detection system and aural/visual warning interface.	ENGINE FIRE L-R	CHIME1	Master Warning, APU Fire, Engine FW Lights
THRUST REV	Checks thrust reverser indicator lights.	—	—	All TR lights
FLAP	Tests flap controller.	FLAPS FAIL , FLAPS ICON AMBER	—	Master Caution
W/S TEMP	Tests windshield heat system and RAT heat (CAS msg if fail).	WSHLD HEAT INOP L, WSHLD HEAT INOP R, WSHLD O'TEMP L-R,	CHIME	Master Caution

OVERSPEED	Tests overspeed warning horn.	—	—	—
AOA	Tests AOA computers, stick shakers, auto slats, optional AOA display & indexer.	AOA PROBE FAIL L-R, AUTO SLATS FAIL, STALL WARN L-R	—	—
ANNUN	Lamp test of discrete annunciators.	—	—	—
OFF	Disables all test functions. Red light off.	—	—	—

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Instrumentation and Avionics

The HP2000 integrated avionics suite combines the electronic flight instrument system, flight director, coupled autopilot with yaw damper, attitude and heading reference, and the flight management computer into one digital package that controls all flight guidance and primary displays.

Five interchangeable cathode-ray-tube displays present all data . The left and right units show each pilot's primary flight display with attitude and horizontal situation information. Each pilot also has a multifunction display that can mirror the primary data or switch to optional maps, or systems synoptics. The center display is dedicated to engine indications and crew alerts. Any display can replace another because each unit is identical and its lower control section is removable.

Traffic advisories and resolution commands from the integrated TCAS appear on the primary displays when the Mode S transponder is powered.

Two independent pitot-static systems feed the left and right electronic instruments, and a separate third system serves the standby gauges. Three electrically heated pitot probes and six heated static ports supply reliable pressure data and automatic ice protection.

Flight crew interaction in the simulator centers on the glareshield control panel for flight director and autopilot engagement, the bezel controls on each display for page selection or reversion, and continuous monitoring of crew alerts on the center engine indicating and crew alerting display.

Note: Using the V.A.M.S. tablet, the displays can be switched between Cathode Ray Tube to Liquid Crystal Display.

Primary Flight Display (PFD)

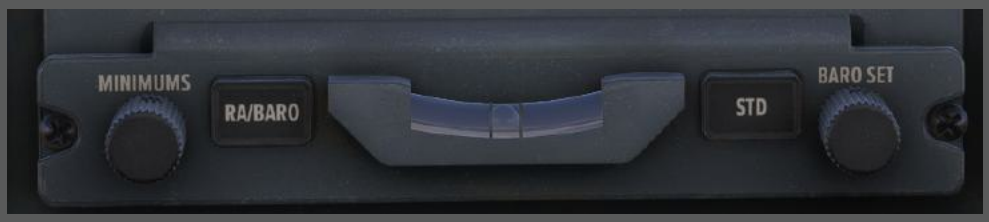
The primary flight display merges attitude, heading, air data, flight director command bars, weather radar overlay and navigation cues on one screen so you can keep your eyes in one place. The multifunction display sits beside it and shows a moving map, weather radar, and TCAS symbols. Engine data, system status and all caution or advisory messages appear on the center EICAS panel.

All three screens have a row of bezel buttons along the lower edge. On the PFD these buttons are joined by a slip–skid indicator. PFD altitude bugs are managed with two dedicated bezel controls. Press RA / BARO to toggle the MINIMUMS knob between controlling decision-height or radio-altitude bugs. Press STD to snap the barometric setting to 29.92 in Hg or 1013 hPa if metric units are active. The BARO knob below the display lets you set a custom pressure.

On the MFD a rotary knob at the lower right corner changes map or plan range through preset steps. Certain menu keys can repurpose this knob for flight-parameter entry, and if the weather radar page is active the radar controller takes ownership of range control.

For routine simulator flying: use the bezel buttons to bring up the page you need, twist the BARO knob to match the local altimeter setting, tap RA / BARO and the MINIMUMS knob to set decision height or minimums, twist the MFD rotary to zoom in or out on the map, and let the radar controller handle range when weather is displayed.

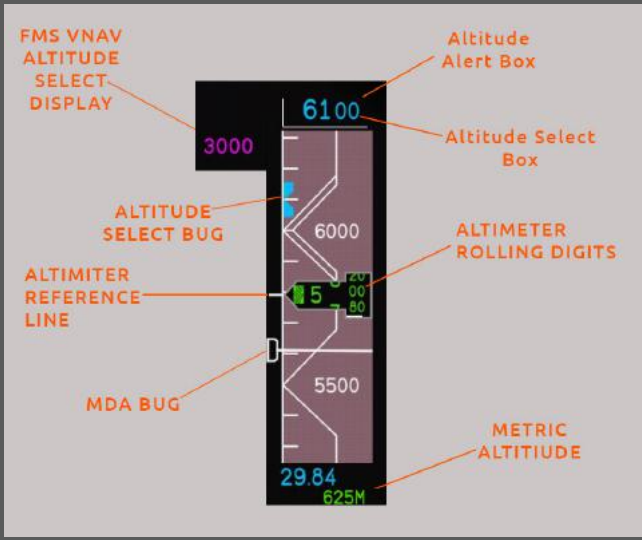
Primary Flight Display Controller



A small bezel panel under each primary flight display carries the controls for minimums and altimeter settings. Press the RA / BARO button to decide whether the MINIMUMS knob governs a radio-altitude warning or a barometric decision height. With RA selected the knob sets a cyan digital value that appears just below the altitude tape; this value defines an aural or visual callout as the aircraft descends and can be adjusted from twenty to two thousand five hundred feet. With BARO selected the knob drives a cyan bug on the altitude

tape and an accompanying readout, allowing you to mark a minimum descent altitude or decision height anywhere between twenty and sixteen thousand feet. Only one mode can be active at a time. The BARO SET knob beside it adjusts the reference pressure shown on the electronic Kollsman dial. Turn clockwise to raise the setting or counter-clockwise to lower it. The units, inches of mercury or hectopascals, are chosen in the PFD setup menu accessed from the multifunction display bezel. If the display controller fails the barometric setting knob still works but the minimums selection is lost. When the opposite-side air-data source is displayed on a PFD the BARO SET knob on that side is locked out, so change the setting from the controller that owns the data.

Altitude Display

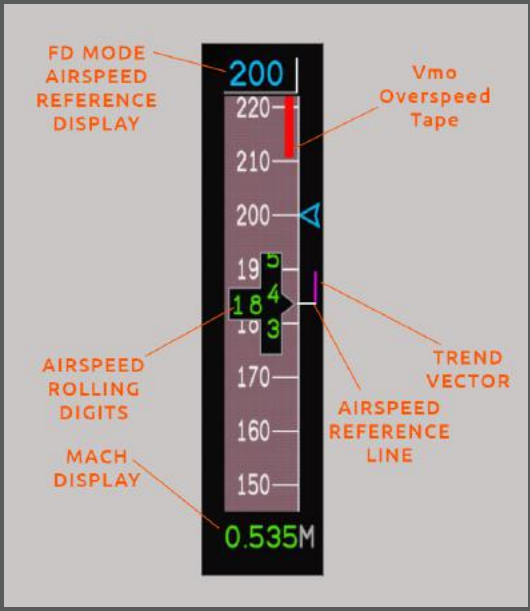


The altitude presentation occupies the upper right of each primary flight display and combines two synchronized readouts. A white moving tape with a fixed pointer provides the analog view while a rolling digital window centered on the tape shows the exact altitude with twenty-foot resolution. Below ten thousand feet a boxed cross-hatch replaces the ten-thousands digit to highlight low-level flight.

Barometric reference is controlled by three bezel inputs. Press the BARO / IN HPA button on the associated multifunction display to toggle between inches of mercury and hectopascals. Rotate the BARO knob at the bottom of the primary display to set the pressure; the value shows in cyan. Press the adjacent STD button to load the standard twenty-nine point ninety-two reference.

The minimums system uses the MINIMUMS knob on the lower left of the bezel. Turning the knob sets either a decision height or a minimum descent altitude bug which appears on the left side of the tape with a horizontal line and brown shading below it.

Airspeed Display



The airspeed tape occupies the upper left corner of each primary flight display. A white moving scale with fixed pointer provides the analog view while a rolling digital window centeredd on the pointer shows airspeed to one knot. If the aircraft exceeds VMO or MMO the digits in the window change to red; when the trend vector exceeds VMO by one knot the digits turn amber unless the red overspeed indication is already active. A red VMO bar appears on the right edge of the tape once the corresponding speed value scrolls into view.

A magenta trend vector on the right side of the tape projects the speed expected in ten seconds at the current rate of change. Directly below the tape a digital Mach readout appears whenever Mach climbs above 0.45 and disappears when it drops below 0.40; its colour follows the airspeed digits above it.

Low speed awareness is given by a thermometer style bar inside the lower right of the tape, coloured white, yellow and red according to angle of attack. The red segment reaches the pointer when the stick-shaker activates. This bar is not displayed on the ground.
When the flight director is in Flight Level Change mode a cyan airspeed or Mach target appears above the tape with a matching bug on the right side.

Six blue VSPEED bugs (V1, VR, V2, Vref, Venr and an additional climb reference) can be entered through the V SPEEDS menu on the multifunction display. The bugs travel along the right side of the tape and remove themselves when the indicated speed moves fifty knots beyond the set value, except Vref, which remains until speed drops fifty knots below it. With weight on wheels and airspeed below thirty knots the bottom half of the tape is replaced by a column listing the selected VSPEED values for easy review.

Note: VSPEED for TO appears when flaps are set to 5 or higher. VSPEED for APPR appears when <200 KIAS and within 50 NM of the destination *airport.*

The rotary knob on the flight director control panel adjusts the FLC target airspeed or Mach, and the V SPEEDS menu on the multifunction display sets or edits each VSPEED bug. All other indicators on the tape respond automatically to the aircraft state.

Vertical Speed Display

The vertical speed indicator sits at the lower right of each primary flight display. A fixed white arc scaled from plus three thousand five hundred to minus three thousand five hundred feet per minute carries a moving pointer, while a boxed digital readout on the zero line shows exact rate with fifty foot resolution when the rate is within one thousand feet per minute. Between plus and minus one thousand feet per minute a plus or minus sign precedes the number; beyond three thousand five hundred feet per minute the pointer parks at the scale limit and the digital box continues to show the true rate up to nine thousand nine hundred ninety nine. Engaging Vertical Speed mode prompts a cyan bug that travels the left edge of the scale and aligns with the value set on the flight guidance controller. The selected rate also appears as a digital target with an up or down arrow above the scale.

Display Controller

The display controller lets you cycle through the available layouts on the primary flight, multifunction and engine alerting displays. Use it to switch between navigation formats, bring weather radar or TCAS imagery onto either the PFD or MFD, and clone the EICAS page onto an MFD when needed.

Navigation

The bezel keys below the displays provide quick control of several common viewing options..

- ET shows or hides the elapsed-time clock on the multifunction display. A brief press starts or stops timing. Hold for about two seconds to reset. If no activity occurs for ten minutes the clock disappears. To count down, enter a preset value through MAIN 1, then press ET to start.
- TCAS (when installed) places traffic data in the MFD map window. Pressing the button while the map page is active leaves the map in place; the window can then be cycled between systems and TCAS.
- ACFT SYS cycles the center display through system pages in the sequence: Normal, Fuel / Hydraulic, Electrical, Control-position, Engine standard, De-ice / Climate, back to Normal. If an EICAS menu has been chosen, the currently displayed page is boxed. The EICAS menu keys may also be used to jump directly to any page.
- MFD MAP switches the multifunction display between heading-up Map view and north-up Plan view. Map is the default. Weather overlay is retained if active.
- MFD WX toggles the weather radar overlay on the map display. When weather is selected it replaces Plan view but does not affect TCAS. Radar range is controlled by the weather controller.

The lower block of buttons and the joystick on the display controller serve two roles. With the flight management system active they move the on-screen position designator for data entry.

Designator Control

- SKP Button
  - Press once to move the designator from its home position to the next waypoint shown on the display.
  - If the designator is already at the last waypoint, another press returns it to the aircraft symbol.
- RCL Button
  - In MAP view it snaps the designator back to its referenced waypoint, or to the aircraft's current position when the aircraft is the reference.
  - In PLAN view it always returns the designator to the referenced waypoint.
- ENT Button INOP
- Joystick INOP

Source Controller

Functions

The source controller mounted beside each pilot lets you decide what each bearing pointer shows and which navigation sensor drives the primary course on the PFD and MFD. Any choice you make is sent straight to the on-side display controller so the change appears immediately.

- Bearing Pointer Knobs
  - The left knob marked BRG O cycles OFF, VOR 1, ADF 1 and FMS 1.
  - The right knob marked BRG ~ cycles OFF, VOR 2 and ADF 2.
    Each selection is labelled in the lower-left corner of the PFD in the same colour as the corresponding pointer.
- NAV Button
  - Switches the primary course between the on-side and cross-side VOR or ILS receiver. The system powers up using the on-side receiver.

- FMS Button
    - Alternates the primary course between Flight Management System 1 and Flight Management System 2. Neither system is selected until this button is pressed.
- PRE Button
    - When either FMS is providing course guidance a press of PRE overlays a white preview CDI from the tuned VOR or localizer so you can compare raw-data guidance with the flight plan. Press again to remove the preview or toggle to the opposite side's NAV source.

Instrument Controller

Each pilot has a remote controller that feeds course and heading commands to the displays and flight director. The copilot's unit adds an altitude-select knob that sets the pre-selected level shown at the top of both PFDs.

- CRS Button
    - In VOR or ILS mode turn the knob to choose the inbound or outbound course; press PUSH DCT to center the pointer for a direct track to the tuned station. No action is required in FMS or MLS modes because the course is set automatically.
- HDG button
    - Shows and moves either the heading bug or, when selected on the guidance panel, the inertial track bug; pressing PUSH SYNC aligns the chosen bug with the current aircraft heading or track.
- ALT SEL Knob (Copilot side only)
    - Rotate to set the altitude pre-select value. One detent changes the setting in small steps; a brisk twist makes larger jumps. Clockwise raises the target altitude and counter-clockwise lowers it.

Standby Altimeter

A combined standby airspeed indicator and altimeter is installed above the pilot's multifunction display. It draws pitot and static pressure from its own electrically heated probe set so it remains available if the main pitot-static system is lost. The unit needs no aircraft power except the emergency DC supply that drives the altimeter vibrator.

Standby Attitude Indicator

Positioned directly above the pilot's multifunction display, a critical standby attitude indicator serves as an essential backup system. This instrument provides an independent and reliable source of attitude information. Its strategic placement ensures immediate visibility and accessibility for the pilot, allowing for seamless transition and continued safe operation during unexpected anomalies.

Standby Horizontal Situation Indicator

A mechanical standby horizontal situation indicator is installed above the engine indicating and crew alerting display, immediately right of the standby attitude indicator. A CRS knob on the lower left bezel selects the desired course and rotates both the course cursor and the inner course deviation bar together with the compass card. The instrument shows magnetic heading, VOR radial tracking, localizer deviation and ILS glide slope. The compass card is marked every five degrees with larger azimuth marks at forty-five degree intervals and a fixed lubber line aligns with the aircraft symbol at the center. When tuned to a VOR the outer dot on the deviation scale equals ten degrees; on an ILS localizer it equals two and a half degrees. White TO and FROM arrows indicate station orientation during VOR use. A red NAV flag appears if the receiver loses valid navigation data, and a red VERT flag appears if the glide slope signal becomes invalid. The HSI draws only from NAV 1.

Standby Engine Instruments

A dedicated standby engine instrument panel sits above the EICAS display and remains active whenever the aircraft has electrical power. Six LCD readouts give independent backup indications for both engines: N1 fan speed, N2 core speed and inter-turbine temperature.

Stall and Angle Of Attack System

The angle of attack system uses sensors for flaps, slats and speedbrakes, allowing it to calculate a normalised angle of attack for any configuration and weight.
During normal flight the system feeds low speed awareness cues to the PFD and drives the coloured AOA bar on the airspeed tape. The indicator on the pilot's side shows a scale from zero to one where one is the maximum angle of attack for a stall. Stick shakers activate at an indicated value of about 0.83 and continue until the angle of attack is reduced.

Radio Transmitting Unit (RTU)

The aircraft's integrated communications system covers 118.00 to 137.95 MHz. Both communication radios are managed through two identical radio management units (RMUs) mounted on either side of the center pedestal just forward of the throttles. The left RMU handles COM 1, NAV 1 and ADF 1, while the right RMU controls COM 2, NAV 2 and ADF 2. Each RMU shows the controlled radio on its display, and the four primary radio functions—COM, NAV, ATC transponder and ADF—share the main frequency selection page. Select the desired function by pressing the line-select key beside it, then use the tuning controls to set a standby frequency, which can be swapped into the active window as needed.

Operation

The communication radios are managed from a pair of radio management units (RMUs) mounted on either side of the pedestal just ahead of the throttles. The left RMU handles COM 1, NAV 1 and ADF 1 while the right unit controls the number-two radios. All tuning and status information is shown on the upper left corner of each RMU display.

Basic Tuning

- Press the line-select key beside the standby frequency line to place an amber box around it, then use the large and small concentric knobs to set the desired standby frequency.
- Press the transfer key with vertical arrows to swap standby and active values.

VHF Nav

The integrated VHF navigation receivers cover 108.00 to 117.95 MHz and provide VOR, localizer, glideslope, marker beacon, DME and ADF capability in one package. Both NAV 1 and NAV 2 are tuned from the radio management units on the pedestal.

To enter a standby VOR or ILS frequency press the line-select key beside the NAV standby field, turn the large and small concentric knobs to the desired value, then press the transfer key to swap it with the active line.
NAV 1 can also be tuned from the standby radio control head that operates on battery power alone.
Source selection for display and guidance is done from the source controllers adjacent to each electronic HSI. Rotate the BRG O knob to show NAV 1 bearing information on the HSI or the BRG ~ knob for NAV 2. Press the NAV button to choose which receiver feeds the flight director; each press toggles between NAV 1 and NAV 2.

Key Controls and Indicators

- Line-select keys: move the cursor to the standby field or memory slots.
- Large / small knobs: tune frequencies or scroll memory entries.
- Transfer key (vertical arrows): swap standby and active frequencies.
- NAV pushbutton on each source controller: selects the receiver that drives the flight director.
- BRG O and BRG ~ knobs: choose which NAV bearing source is displayed on each HSI.

Markers

The marker beacon receiver is built into each NAV radio so it runs automatically whenever a VOR or ILS frequency is active. Indications appear on the right side of the electronic attitude director indicator, just below the glide-slope scale. As each beacon is crossed the boxed identifier flashes once then stays steady: a blue O for the outer marker, an amber M for the middle marker and a white I for the inner marker. Corresponding tones can be heard.

ADF

The automatic direction finder is integrated with each NAV receiver and tunes from 100.0 to 1799.5 kHz in half-kilohertz steps.
All interaction is through the ADF window on the radio management unit.

To tune a frequency press the line-select key next to the ADF frequency field so the cursor moves to it. Turn the small knob for 0.5 kHz increments and the large knob for 10 kHz increments; turning either knob rapidly accelerates the step size.
Bearing needles are selected on the source controllers. Rotate the BRG O knob to place ADF 1 on the O pointer of either electronic HSI, and use the BRG ~ knob for ADF 2 on the tilde pointer.

Transponder

The aircraft carries two independent transponder channels, one active at a time and the other held in standby for instant changeover. Both channels are controlled from the ATC window on each radio management unit. The upper line in this window holds the four-digit code; press the adjacent line key to highlight it, then use the large knob for the first two digits and the small knob for the last two.
The lower line in the window selects operating mode. Press its line key once to move the cursor, then rotate either tuning knob to cycle through STANDBY (no replies) and TA RA (TCAS traffic and resolution advisories). An IDENT reply can be triggered at any time by pressing the ID button on the RMU bezel or the inboard push-button on either control wheel. IDENT remains active for roughly eighteen seconds and an amber ID label is shown at the top of the ATC window during that period.

Distance Measuring Equipment (DME)

Each navigation receiver includes an internal DME transmitter and receiver that normally channels to the VOR or ILS frequency selected on the radio management unit. Distance readout appears on the electronic HSI, with the tuned source name shown in the upper left of the attitude display and range in the upper right. Selecting a VOR on one side has no effect on the opposite display unless both sides happen to use the same DME source, in which case the source label turns amber to highlight the cross-selection.
To capture a DME station and keep it while tuning a different VOR press the DME push-button at the bottom of the radio management unit.

Audio Control Unit

Each cockpit audio panel controls receiver monitoring and transmitter selection through a simple set of push-knob switches and volume controls located on the pilot and copilot instrument panels.
Three rows of small round push-knobs serve a dual function: pressing a knob toggles its associated receiver audio ON or OFF, and rotating the same knob sets that receiver's individual volume. Two larger knobs below them act as master volume controls for the speaker and

headset output on each side; they work in series with the smaller knobs so you can fine-tune a single radio, then raise or lower the overall level.

Along the top edge a row of illuminated microphone selector buttons routes the pilot or copilot microphone to the chosen transmitter. Selecting a transmitter automatically opens that radio's receiver audio even if its push-knob is OFF. A light in the button confirms the active channel at night.

Marker beacon controls occupy the bottom row. The MKR push-knob turns beacon audio on or off and its rotation sets volume, though a minimum level is always retained.

In normal simulator use you will:

- press a receiver's push-knob to monitor it and set its level with the knob itself,
- choose the transmitter by pressing its lit button on the top row,
- use SPEAKER/HEADSET knobs for overall volume,
- manage marker beacon audio with MKR when flying an ILS approach.

Traffic Avoidance (TCAS)

TCAS monitors every transponder within the selected range, builds tracks and classifies each aircraft as non-threat, proximity, traffic advisory or resolution advisory. Multiple targets can be processed at once, thirty can be shown on the screen and the computer can issue coordinated resolution advice for three intruders simultaneously. Traffic symbols and any TA or RA banners appear on the selected map page of the multifunction display.

Primary Controls

Operating Modes

- STANDBY silences the transponder and disables TCAS.
- TA ONLY shows and voices advisories without issuing climb or descent commands.

Mode selection is performed with the lower line key on the main RMU page after moving the cursor to the mode field.

Autopilot

The panel at the top of the glareshield lets you engage or disengage the autopilot and yaw damper, pick flight director modes, choose which air-data computer and horizontal situation source feed the system, and adjust

pitch trim when no automatic pitch mode is active. A second pitch trim wheel near the throttles gives the pilot the same manual control.

Flight Guidance Controller

Key Functions

- Autopilot and yaw damper switches toggle each function on or off. The yaw damper should remain engaged in normal operations because it provides continuous yaw stability. If it drops offline due to a fault, pressing the YD switch will re-engage it once the fault clears.
- Mode buttons line up across the controller and select basic flight director commands such as heading, navigation capture, approach, altitude hold or vertical speed. The current mode is annunciated on the controller face and in the top section of the PFD.

The pitch wheel on the controller provides control over the following:

- Flight director pitch reference if flight guidance is in PITCH mode.
- Vertical speed reference if flight guidance is in vertical speed mode.
- Airspeed reference if flight guidance is in FLC (flight level change) mode.

Controls

Below is a quick-reference guide to the flight guidance panel modes you will use in the simulator. Each pushbutton activates or arms a specific flight director or autopilot function and is annunciated at the top of the PFD when active.

- HDG: Guides the aircraft along the selected heading bug on the HSI. Press BANK while HDG is active to limit bank angle to seventeen degrees.
- NAV: Arms, captures and tracks the tuned navigation source: VOR, LOC or FMS lateral guidance.
- APP: Arms and captures localizer and, when available, glideslope signals. Alternatively, it can capture the glide path (GP) if the approach is RNAV/RNP.
- BC: Tracks a localizer backcourse signal.
- ALT: Holds the current barometric altitude.
- VNAV: Follows the vertical path supplied by the active FMS.
- BANK: Reduces bank angle to seventeen degrees. Above roughly 34,300 ft the system automatically reduces bank; descending below that altitude restores full bank authority.
- STBY: Cancels all active flight-director modes. If the autopilot is engaged it reverts to basic pitch and roll hold.
- FLC: Maintains the present indicated airspeed or a new speed selected with the pitch wheel. Airspeed target appears on the PFD and may also follow an FMS-supplied value during VNAV climbs or descents.
- C/O: Toggles the FLC speed target between knots and Mach.
- VS: Holds the current vertical speed or a value selected with the pitch wheel.
- The target rate is shown on the PFD.

Autopilot Functions

The flight guidance panel has separate controls for engaging the autopilot, the yaw damper, and several support functions you will use in normal simulator operations.
Press AP to engage both autopilot and yaw damper together; a second press removes only the autopilot and leaves the yaw damper active. Press YD if you want yaw damping alone. One flight-guidance channel is always in control. A small “A” or “B” lamp next to the AP and YD buttons shows which channel is active.
Mach trim is an automatic stabilizer trim. It powers up already on. If you switch it off with the M TRIM button yaw damping and autopilot are unaffected, but barber pole speed is reduced to 0.85 Mach.
Use the pitch wheel to set the target indicated airspeed for Flight Level Change or the target vertical speed for Vertical Speed mode. Rotating forward lowers the nose and increases airspeed or descent rate; rotating aft does the opposite. If both wheels are moved at the same time their inputs cancel out.
The autopilot can be disconnected at any time by pressing the AP button.
Autopilot engagement is inhibited while the aircraft is on the ground.

Operation

System operation is detailed below. Terminology used is explained in the sections above, which cover the operation of various control panels that manage modes, and in this section, which discusses mode operation.

Pitch Hold

Pitch hold is the fundamental vertical mode for both the autopilot (AP) and flight director (FD). Pitch Hold is similar to locking the aircraft's nose where it is. When you press the Pitch Hold button the autopilot remembers the current pitch angle and keeps the elevators trimmed so the nose stays at that same angle. Your climb rate and airspeed can change, but the nose attitude stays fixed until you choose another mode or move the controls.

Pitch reference can be changed using the pitch wheel.

Roll Hold

Roll hold mode engages and maintains the maneuvered bank angle when the following conditions are met: (1) no lateral Flight Director (FD) mode is selected and the bank angle is between 0° and 45°.

Heading Select

Heading select mode allows the aircraft to intercept and maintain a chosen heading. Activating this mode cancels all previous lateral modes. The flight guidance computer (FGC) calculates the difference between the selected and current heading, then generates a roll command to achieve and maintain the desired heading.

To activate heading select mode:

1. Use the HDG knob on the instrument remote controller to position the heading bug on the on-side HSI.
2. Press the HDG button on the flight guidance controller.

The PFD will show "HDG" in green, and the flight director will display steering commands to intercept and hold the selected heading.

Heading select mode can be deactivated in several ways:

1. Pressing the HDG button on the flight guidance controller.
2. Automatic capture by another selected lateral mode.

VOR NAV

The VOR mode facilitates the interception, capture, and tracking of a selected VOR radial, utilizing the navigation source displayed on the coupled PFD. To engage and operate the VOR mode, follow these steps:

1. Select Navigation Source: On the on-side source controller, press either the left or right NAV button to select NAV 1 or NAV 2.
2. Tune VOR Frequency: Tune the NAV receiver to the correct VOR frequency.

3. Set Course and Heading: On the on-side instrument remote controller, set the desired course and adjust the heading bug to intercept the course.
4. Engage VOR Mode: Press the NAV button on the guidance controller to activate the VOR mode.

Upon engagement, VOR armed and heading select modes will automatically be selected to intercept the beam. This is indicated by "VOR" annunciated in white and "HDG" in green on the PFD.

When the airplane intercepts the lateral beam, heading select is canceled, and the VOR radial is captured. This is indicated by the disappearance of the HDG message and the white VOR message turning green. The flight guidance computer then rolls the airplane onto the radial and tracks it to the station.

The VOR mode can be canceled by any of the following actions:

- Pressing the NAV button on the flight guidance controller.
- Selecting the heading select (HDG) mode.
- Selecting go-around mode.

VOR Approach

The VOR approach (VAPP) mode is used for instrument approach procedures, guiding the aircraft to intercept, capture, and track a selected VOR radial. This mode is similar to the standard VOR mode but features adjusted gains in the flight guidance system for improved performance during an approach.

To set up and engage VOR APP mode, follow these steps:

1. Select Navigation Source: On the on-side source controller, press the NAV button to choose NAV 1 or NAV 2.
2. Tune VOR Frequency: Tune the NAV receiver to the correct VOR frequency.
3. Set Course and Heading: Set the desired course on the on-side instrument remote controller and adjust the heading bug to intercept the course.
4. Engage Mode: Press the APP button on the guidance controller.

Upon engagement, VOR armed and heading select modes will automatically activate to intercept the beam. The PFD will display "VOR" in white and "HDG" in green to indicate this. Once capture occurs, the "VOR" annunciation will turn green. Set the minimum descent altitude (MDA) on the PFD altitude tape, and the radio altitude bug can be set as desired.

To cancel VOR APP mode, selecting go-around, press the APP button on the flight guidance controller, or make any selections that would cancel the standard VOR mode.

Lateral Navigation (LNAV)

To guide the aircraft using courses programmed into the Flight Management System (FMS), follow these steps:

1. Press the FMS button on the source controller.
2. Verify the FMS flight plan's active leg by displaying it on the Multi-Function Display (MFD). Use the MFD MAP button to select ARC or Plan views.
3. Set the heading bug to the correct intercept angle.
4. Engage the mode by pressing the NAV button on the flight guidance panel.

Pressing the NAV button on the mode selector annunciates LNAV on the PFD. The FGS may arm and then capture LNAV, depending on the aircraft's position relative to the desired course. A white LNAV annunciation on the PFD indicates the mode is armed, while a green annunciation signifies that capture has occurred. Once captured, the system calculates a desired intercept track.

LNAV mode is canceled by any of the following:

- Pressing the NAV button on the flight guidance controller.
- Selecting an alternate navigation source on the source controller.
- Selecting heading select mode.
- Selecting go-around mode.

Localizer (NAV Mode)

The localizer mode facilitates automatic interception, capture, and tracking of a front course localizer beam, aligning the aircraft with the runway centerline for landing.

To engage this mode and ensure automatic interception and tracking of the ILS localizer, follow these steps:

1. Select NAV Source: choose NAV 1 or NAV 2 using the source controller NAV button.
2. Tune Localizer Frequency: Tune the selected NAV receiver to the correct localizer frequency.
3. Set In-Bound Course: Rotate the course knob on the respective instrument remote controller to set the localizer in-bound course on the on-side PFD.
4. Set Heading Bug: Position the heading bug to the beam intercept angle.
5. Set Minimums: Using the PFD RA/BARO button and the minimums knob, set both the radio altitude MDA and the barometric minimum descent altitude.
6. Engage Mode: Press the NAV button on the flight guidance controller.

If the beam deviation exceeds the LOC capture range (approximately more than one dot deviation), the LOC is armed. The PFD will display "LOC" in white, indicating the mode is armed, and "HDG" in green until capture. Upon capture, the green "HDG" and white "LOC" will extinguish, and a green "LOC" message will appear and flash for five seconds.

The localizer mode will be canceled by any of the following actions:

- Pressing the NAV button on the flight guidance controller.
- Selecting heading select mode.
- Selecting back course mode.
- Selecting go-around mode.
- Changing NAV sources.

Preview

The preview feature, accessible after the flight management system mode has been captured on the source controller, allows pilots to visualize the aircraft's position relative to a potential approach course. Activating the PRE button displays an additional white course deviation indicator. When the preview function is engaged, the flight guidance system automatically transitions to the previewed mode upon meeting the capture parameters.

To preview and capture the previewed mode, follow these steps:

1. Verify Navigation Source: Ensure the navigation source to be previewed is operational, then press the PRE button.
2. Set Approach Course: Use the remote instrument controller to set the applicable approach course into the electronic horizontal situation indicator.
3. Initiate Approach: Press the APP button on the flight guidance controller.

The following automatic stages will then occur:

1. Primary Flight Display Annunciation: The primary flight display will display the flight director arm modes relevant to the previewed source, and the transition will arm.
2. Flight Guidance System Tracking: The flight guidance system will continue to track the flight management system until the previewed source's lateral deviation reaches its capture value, initiating the capture of the preview mode.
3. Navigation Source Replacement: Upon capture, the flight guidance system will automatically replace the flight management system with the previewed navigation source (VOR or ILS) and will capture and track the lateral signal.
4. Glideslope Capture: The flight guidance system will capture the ILS or MLS glideslope at its intercept point, and the approach will proceed according to standard procedures for that particular approach.

Vertical Mode Transition During Preview Capture:

- If flight management system vertical navigation (Vertical Flight Level Change [VFLC] or Vertical Flight Path [VPTH]) was active before the transition capture, the flight guidance computer will switch to pitch hold mode, and no vertical mode will be captured.
- If flight management system vertical altitude was in use before the transition capture, the flight guidance computer will transition to ALT mode.

ILS

The ILS mode facilitates a fully coupled ILS approach to minimums by automatically intercepting, capturing, and tracking the front course localizer and glideslope beams. This system aligns the aircraft with the runway centerline and glideslope, preparing it for landing. Glideslope capture is contingent upon successful localizer capture.

To engage the automatic interception and tracking of the ILS localizer and glideslope, follow these steps:

1. On the flight guidance controller, choose NAV 1 or NAV 2 using the NAV button.
2. Tune the selected NAV receiver to the correct localizer frequency.
3. Set the localizer inbound course on the on-side PFD by rotating the course knob on the respective instrument remote controller.
4. Set the heading bug to the beam intercept angle.
5. Using the PFD RA/BARO button and the minimums knob, set the radio altitude MDA and the barometric minimum descent altitude.
6. Press the APP button on the flight guidance controller to engage the mode.

Mode Engagement and Annunciation:

- If the beam deviation is outside the LOC capture range (approximately more than one dot deviation), LOC armed and HDG select modes will automatically be chosen.
- The PFD will show "LOC" in white to indicate the mode is armed. "HDG" in green will be displayed on the PFD until capture occurs.
- Upon capture, the green "HDG" and white "LOC" will turn off, and a green "LOC" message will appear and flash for five seconds.
- When the glideslope captures, any active vertical mode will be disengaged, and "GS" will be annunciated in green (flashing for five seconds upon capture).

ILS Approach Mode Cancellation:

The ILS approach mode will be canceled by any of the following actions:

- Pressing the NAV or APP buttons on the flight guidance controller.
- Selecting any other lateral or vertical mode on the flight guidance controller.
- Changing NAV sources.
- Selecting go-around mode.

Vertical Speed Hold

The vertical speed hold mode maintains the aircraft at a pilot-selected vertical speed.

To initiate this mode, first, maneuver the airplane, either manually or with the autopilot, to the desired climb or descent attitude. Next, establish the vertical speed reference and engage the mode by pressing the VS button on the flight guidance controller.

The vertical speed reference can be adjusted using the pitch wheel on the pedestal or the one on the flight guidance controller.

When the VS mode is engaged, "VS" will appear in green on the PFD, and the target vertical speed value, in feet per minute, will be displayed in a blue box above the vertical speed scale.

The VS mode can be disengaged by pressing the VS button, selecting another vertical mode, or choosing go-around or standby (STBY).

Flight Level Change

The Flight Level Change (FLC) mode is activated by pressing the FLC button on the flight guidance controller. This mode takes precedence over all other active pitch flight director modes, with the exception of VNAV. If VNAV is already engaged, pressing the FLC button will select the VFLC submode.

Upon engagement, the indicated IAS/Mach becomes the reference speed for FLC. This reference can be adjusted using either pitch wheel. The system will operate based on either an airspeed or Mach reference, controlled by the C/O button on the controller. Switching between IAS and Mach alters the digital readout on the PFD without changing the reference speed or the aircraft's attitude. Characteristics of FLC Mode

Pilot Interaction with FLC Mode:
To climb the aircraft from its current altitude to a preselected altitude using FLC:

1. Set Alert Altitude: Use the altitude preset knob on the remote instrument controller to set the desired alert altitude higher than the current altitude.
2. Engage FLC: Press the FLC button on the flight guidance controller. The current airspeed at the time of engagement will become the target airspeed.
3. Apply Climb Power: Advance the throttles to establish climb power.

The system will then climb the aircraft to the preselected altitude while maintaining the reference speed. The rate of climb achieved will depend on the amount of throttle applied. It is important to note that the capture of any armed pitch mode will override the selected FLC mode.

The Flight Level Change (FLC) mode on the flight guidance controller can be engaged with either an Indicated Airspeed (IAS) or Mach target. Above 34,275 feet, Mach is automatically selected, while below this altitude, IAS is chosen.

You can switch the reference between Mach and IAS by pressing the C/O button. During a climb, the FLC reference automatically transitions from IAS to Mach when the aircraft's Mach speed exceeds 0.70M. Conversely, in a normal descent, the system switches from Mach to IAS when the IAS exceeds 300 knots.

The FLC system operates within a target speed range of 80 to 340 knots IAS or 0.40 to 0.85 Mach. It's important to note that the flight guidance system will not command an airspeed outside the normal flight envelope. The commanded airspeed will be limited to the maximum speed of the airplane (VMO/MMO).

The FLC mode can be disengaged by:

1. Pressing the FLC button.
2. The system capturing another armed pitch mode or selecting any other vertical mode.
3. Selecting go-around mode.

Altitude Preselect

Altitude Preselect Mode (ASEL) works with other vertical modes to automatically capture, level off, and maintain a selected altitude. This altitude is set using the altitude select knob on the copilot's instrument remote controller and displayed on each PFD.

To change altitude using ASEL, follow these steps:

1. Set Altitude: Use the altitude select knob on the copilot's instrument remote controller to set the desired altitude in the PFD's altitude preselect window.
2. Initiate Climb/Descent: Adjust the throttle to begin climbing or descending towards the preselected altitude.
3. Engage Vertical Mode: Select another vertical mode (e.g., VS or FLC) on the flight guidance controller. ASEL will arm (annunciated in white on the PFDs), and the chosen vertical mode will activate (annunciated in green).

Once the selected altitude is captured, the other vertical mode will disengage, and the aircraft will level off. When ASEL has captured, the altitude error is less than 25 feet, and the altitude rate is below 5 feet-per-second, the system will switch to Altitude Hold (ALT), which will be annunciated in green.

Altitude Hold

Altitude hold (ALT) is a vertical mode that maintains a barometric altitude. It is engaged by pressing the ALT button on the flight guidance controller and is annunciated by a green ALT on the PFD. Engaging altitude hold cancels any other vertical mode.

Altitude hold can be disengaged by:

- Moving the pitch wheel on the Flight Guidance Controller or pedestal.
- Pressing the ALT button on the Flight Guidance Controller.
- Selecting another vertical mode.
- Selecting go-around mode.

Vertical Navigation

Vertical Navigation (VNAV) Mode

The VNAV mode, activated by pressing the VNAV button on the flight guidance controller, takes precedence over all other flight director pitch modes. In VNAV, the flight guidance system tracks the vertical flight profile of the flight management system (FMS). An altitude set in the PFD's altitude select window overrides any conflicting FMS-selected altitude. The FMS will not command the flight guidance system to pass an altitude set in the altitude window (upper right of PFDs) via the copilot's remote instrument controller's altitude select knob.

VNAV works in conjunction with the FMS and can utilize several submodes: Vertical Flight Level Change (VFLC), Vertical Altitude Select (VASEL), Vertical Altitude Hold (VALT), and Vertical Path (VPTH).Vertical Flight Level Change (VFLC)

VFLC functions similarly to FLC mode, but it uses the target speed and altitude from the FMS flight plan for climbs or descents. VFLC engages automatically if VALT is active, the target altitude is over 150 feet from the aircraft's current altitude, and the FMS initiates a climb or descent. Alternatively, VFLC can be engaged when VALT or VPTH arm is active and the FLC button on the flight guidance controller is pressed. A green "VFLC" annunciation appears on the PFD.Vertical Altitude Select (VASEL)

VASEL operates identically to ALT SEL. ALT SEL arms when either VFLC or VPTH is engaged. Upon capture, "VASEL" is annunciated in green on the PFDs.Vertical Altitude Hold (VALT)

VALT functions like ALT. VALT engages automatically once VASEL captures the target altitude. It also engages if the VNAV button on the flight guidance controller is pressed and the aircraft is within 250 feet of the FMS-selected target altitude. A green "VALT" indicates this FMS ALT mode on the PFD.Vertical Path Mode (VPTH)

VPTH mode is used for flying a fixed flight path angle to a vertical waypoint during a descent. VPTH engages when the FMS initiates a path descent, which can occur while in VFLC or VALT modes. Upon capture, a green "VPTH" is displayed on the PFD.

To select VPTH mode:

1. Use the FMS control display unit (CDU) to input the required altitude at the waypoint.
2. Use the CDU to enter a specific angle of descent if desired.

TOGA

Takeoff mode, annunciated as a green "TO" on the PFD, activates only on the ground and functions identically to go-around (GA) mode. Pressing the GA button prior to rotation during takeoff will prompt the flight director command bars to indicate a 13° nose-up, wings-level attitude. This mode is cancelled in the same manner as Go-Around Mode.

Multi Function Display (MFD)

Multi Function Display Controller

The bezel beneath each multifunction display uses a single rotary knob and six push buttons to manage most of the map, plan and systems pages the crew will use in flight.

MFD Menu

The bezel beneath each multifunction display contains a rotary knob for range or value entry and six push buttons for menu navigation. The left-arrow key steps between the two main menus and also serves as RTN to return from a submenu. Main Menu 1 appears automatically at power up. From either main menu you can reach the following functions.

- **PFD Setup:** Allows you to choose between a single or split-cue flight director symbol, toggle the barometric scale between inches and hectopascals. A boxed outline confirms each selection.
- **MFD Setup:** Controls the map overlay. You can enable VOR stations, airports, traffic symbols from the collision-avoidance system, a vertical-profile window, and either XY wind components or a single wind vector.
- **ET Set / Flight Timer:** Configures the cockpit clock. After pressing this key choose ET to load a start value with the rotary knob or pick Flight Timer to track block time from take-off to landing.
- **EICAS Sys**: Brings system synoptic pages onto the MFD without disturbing the center EICAS. Pages include Fuel / Hydraulic, Electrical, Auxiliary power, and Engine status.
- **V Speeds** lets you enter take-off and landing reference speeds. Select V1, VR, V2, VREF or VAPP then use the knob to set the required value. Speed bugs appear when the flaps are deployed before flight and upon approach.

Additional notes for cockpit use:

• The rotary knob changes function whenever its line label switches from RNG to another parameter name.
• Switching menus or formats never alters your altitude-minimums or barometric settings on the PFD.

PFD/MFD Dimming Controller

A small dimming controller sits to the side of the displays. The outer knob adjusts brightness for the primary flight screens, and the inner knob adjusts brightness for the multifunction screens.

IRS REV swaps attitude and heading data to the opposite source when required.

Inertial Reference System

The aircraft contains an inertial reference unit that simulates laser gyros and accelerometers to calculate attitude, heading, position, velocity, wind and inertial altitude. These data streams feed the flight management computer, primary and multifunction displays, autopilot and other avionics.

Key Points

- Normal Configuration
    - Each display normally receives data from the unit on its own side. This state is not annunciated.
- Reversion Control
    - A single press of the IRS REV button on the reversionary and dimming controller switches both displays to the opposite-side unit. Amber text at the top of each primary display confirms that both sides now share the same source. Press the button again to return to the normal split-source arrangement.
- Alignment Behaviour
    - After power-up each unit must align. This cycle can vary depending on the latitude of the aircraft. At very high latitudes alignment can take longer; a white “IRS HI LAT ALN” status message appears on the engine and crew alerting page as a reminder until alignment completes.
- For IRS to align you must have the standby battery on.
- Turn the knob to ALIGN first. When the NAV READY light illuminates, turn the knob to NAV.
- BATT FAIL
    - The BATT FAIL annunciator will illuminate when the battery voltage from the battery which is used for backup power for the IRS system has fallen below 21 volts and is inadequate to sustain IRS operation if the need should occur.
- You must complete POS INIT in the FMC for the alignment process to be successful.
- Users can adjust the timing of the process in the V.A.M.S.

No other pilot interaction with the system is required during normal simulator use.

Weather Radar

Radar returns are shown on the multifunction display, which becomes the radar indicator whenever weather is selected. Control of range, mode, tilt and gain is handled from the dedicated radar panel on the center pedestal.

In the weather mode the screen is black when no significant return is detected, green shows light rain, yellow indicates moderate activity, red marks heavy precipitation and magenta highlights the most severe cells.

Operate the radar in weather mode to assess thunderstorm activity along the route. Use terrain mode only when precipitation masking is not a concern and you need topographical cues.

OFF turns off the radar and removes the label WX from the MFD.

WX turns on normal airborne weather mode. A green WX label confirms the selection and precipitation returns are colour-coded from green to magenta.

Engine Indicating and Crew Alerting System (EICAS)

The center screen on the panel replaces the traditional engine gauges and annunciator lights. It shows engine power, control-surface positions and system status gathered by two data-acquisition units and routed through the avionics computers. Messages and symbols use standardized colors so you can judge urgency at a glance.

The center screen is dedicated to the engine and crew alerting system. It always shows the core engine parameters—fan speed (N1), core speed (TURB), inter-turbine temperature, oil temperature and pressure, fuel quantity and flow—along with ram air temperature. Trim, flap position and the wing synoptic can be removed by the declutter function to reduce visual load.

System pages for fuel, hydraulics, electrics and other aircraft functions are available on demand.

Operation

A small reversionary controller on the panel lets you decide where the engine and alert display appears and which symbol generator drives the screens. Turn the left knob to NORM to keep the alert page on the center screen, to L to move it to the pilot multifunction display or to R to move it to the copilot multifunction display.

The center engine and alert screen is divided into fixed and variable areas. Engine power, oil parameters, fuel flow, quantity and ram air temperature stay in their dedicated locations at all times so you can monitor them without hunting. Two zones change as conditions require. The crew alerting section sits at the lower center and shows text messages that describe system status; colour tells you urgency with green for normal, amber for caution and red for warning.

- White: routine status information, no pilot action needed.
- Cyan: crew should note the condition, action may follow; flashes for five seconds when first posted.
- Amber: abnormal condition that calls for prompt attention; the screen flashes, a single chime sounds and the master caution light comes on until you acknowledge. Once acknowledged the message stops flashing and can be scrolled off the list.
- Red: immediate action required; the message and master warning flash, a double chime sounds, and the text also appears on the side display until you cancel the alert. Red items stay visible until the fault is cleared.

Most alerts remain on the list until the underlying condition is resolved.

The lower right corner is reserved for system pages. Soft keys lined up beneath the display have white labels; pressing a key draws a white box around the label and brings that system’s synoptic into the page area.

N1

The N1 gauge sits in the upper left corner of the engine and alert screen and is labeled FAN %. Digital readout shows three whole digits plus one decimal while a vertical tape covers 20 to 105 percent. A fixed red line marks 100 percent and both tape and numbers turn red if that limit is exceeded. A cyan bug on the outside of the scale marks the FADEC-computed target setting and cannot be adjusted by the pilot.

An additional sim only bug can be displayed to show the target N1 values for the current throttle position if enabled in the EFB.

To either side of the FAN % title a single thrust-mode indicator appears in green showing the current power setting such as maximum take-off, take-off, climb, cruise.; when the levers reach the detent the label changes to green.

A green IGN annunciation can appear above the mode label whenever the FADEC energises the igniters.

An engine sync switch on the pedestal lets you align fan or core speeds; when either sync function is active the word SYNC shows in green between the two N1 tapes.

ITT

The inter-turbine temperature scale occupies the upper middle of each engine column. Its tape begins at fifty degrees Celsius and runs to nine-hundred fifty, with a fixed red limit line at eight-hundred fifty. White bar pointers track temperature and change to red when the reading crosses the red line. Digital ITT numbers appear only during engine start, after an over-temperature event, or when the ENG system page is selected; they sit just beneath the tape on the relevant engine side.

Beneath the fan-speed gauge a digital N2 read-out shows core speed in whole percent values. The numbers change colour with engine status; under normal conditions they are green, turning amber or red when limits are approached or exceeded.

Ram Air Temp. (RAT)

The temperature readout beneath the ITT tape is labeled RAT and shows total air temperature.

Oil Temp/Pressure

Oil temperature and pressure are shown together at the upper-right corner of the alert screen for each engine. Temperature uses a two-zone vertical bar while pressure uses a three-zone bar. A small triangular marker on each bar points to the current value; the marker takes on the colour of the zone it touches and turns solid when it enters a non-green region to highlight an abnormal reading.

Digital values appear only when you open the ENG system page, during engine start.

Fuel

Fuel information on the center screen shows both quantity and flow. Three green boxed read-outs give the pounds remaining in the left, center and right tanks, and a larger boxed total appears beneath them. Numbers change in steps of tens, so the right-hand digit is always zero. While the engines are running the flow line reads between 140 and 4000 lb hr-1.

Low-level warnings rely on colour. Any wing tank below 500 lb turns its quantity digits amber and if total usable fuel drops under 1200 lb the boxed total also changes to amber.

Flaps

The flap gauge appears on the engine and alert screen as a simple synoptic. A white airfoil-shaped pointer slides along a fixed scale marked 0, 5, 15 and 35 degrees, stopping in one-degree steps as the flaps travel. The scale numbers remain white at all times; only the pointer moves to indicate the current flap position.

Stabilizer Trim

The stabilizer trim gauge shows both a digital readout and an analog pointer. While the aircraft is on the ground, take-off inhibit logic highlights the take-off range in green. With flaps at 5 degrees the take-off band spans minus 2 to minus 5 units; with flaps at 15 degrees it spans minus 5 to minus 8. When the pointer sits inside that band it also turns green and the digital value, displayed in tenths of a degree above the scale, adopts the same colour.

Once airborne the green overlay disappears and the white scale represents the full usable trim range from about plus 1.2 to minus 12.

Wing View

A wing synoptic on the center display gives you an at-a-glance check of slat, speed-brake and roll-spoiler positions—useful because these surfaces are not visible from the cockpit. During walk-around and before-taxi checks you can confirm that speed-brakes are stowed, slats are set and spoilers match commanded positions.

Slats

On the wing synoptic each slat appears as a filled white bar when extended and disappears when retracted.

Spoilers

On the wing synoptic the two outer spoiler panels on each wing are represented by filled white bars. The bars appear any time the spoilers are deployed regardless of how far they are extended. When the spoilers are fully stowed no bar is shown.

System Pages

The lower-right corner of the center alert screen is reserved for system pages that you call up with the soft keys along the bottom edge of the display. Pressing a key puts a white box around its label and loads the corresponding page.

- **NORM** shows the standard engine, electrical and hydraulic summary that appears at power-up
- **FUEL HYD** replaces the summary with detailed fuel quantities, temperatures, and hydraulic pressures
- **ELEC** presents generator and battery volts and amps plus battery temperature
- **CTRL POS** displays real-time positions for ailerons, elevators, rudder, speed-brakes and flaps
- **ENG** lists which channel is controlling each engine and shows additional engine-related status items

FUEL

Selecting the Fuel Hyd page replaces the standard summary with a detailed view of each system. For the fuel system it adds the temperature in both wing tanks and the temperature at each engine fuel-heater outlet. For the hydraulic system it shows pressure for systems A and B, the reservoir quantity expressed as a percentage of full and the fluid temperature in degrees Celsius. Labels remain white while the numeric values appear green under normal conditions and shift to caution or warning colours when limits are exceeded.

NORM

The electrical hydraulic summary page shows key power and pressure data in one view. DC volts and amps for each generator are presented along with hydraulic pressure for systems A and B in psi. If a HYD RUD SYS FAIL or HYD PUMP FAIL B message appears, the standby rudder system pressure is added and labeled RSS (it shows only when a value is available). Normal readings are green. Values that exceed limits change color to reflect the associated caution or warning level.

ELEC

Choosing the electrical menu shows available DC parameter in numeric form only. Generator volts and amps for the left side appear on the left of the page and the right-side figures on the right.

CTRL POS

The control-position page lets you confirm that ailerons, elevators, rudder, flaps and spoilers move through their full range before departure. Each surface is shown as a horizontal or vertical bar with a center tick for neutral and end ticks for travel limits. A small triangular bug moves along the bar to mirror the actual surface position and keeps the same shape across the entire span.

RUDDERS

On the control-position page each rudder is shown by a triangular marker that slides left or right across a horizontal scale. Five tick marks span the scale: the center tick is neutral, the outer ticks represent the full travel of the lower rudder. In unrestricted conditions both rudders can move together to about eighteen degrees left or right and the lower rudder can continue to thirty degrees.

ELEVATOR

On the control-position page each elevator appears as a triangular marker that slides up and down a vertical scale. The upper tick corresponds to eighteen degrees nose-up deflection and the lower tick to seventeen degrees nose-down. The marker moves proportionally with the actual elevator, allowing you to confirm full travel during pre-flight checks.

AILERONS

On the control position page each aileron is shown by a triangular marker that travels up and down a vertical scale. The top and bottom tick marks represent fifteen degrees of up and down deflection. A difference of up to two degrees between the two aileron markers is within tolerance.

ENG

Selecting the ENG system page adds numerical readouts next to the normal engine tapes. Oil temperature, oil pressure and inter-turbine temperature appear in digital form alongside their analog bars. These figures are shown automatically if any limit is exceeded, regardless of which page is up.

The page also tells you which control channel, A or B, is managing each engine and shows how many quarts each engine is below a full oil service level. Beneath the engine data a START PRESS line gives the current bleed-air duct pressure whether it is coming from the APU, an opposite-side engine or a ground cart. The pressure value follows the normal colour logic for range and exceedance.

If the APU is running a white APU ON message appears. A second white line immediately below indicates whether the APU bleed-air valve is open or closed. The same information can be viewed on an auxiliary engine page available on either multifunction screen.

MFD PAGES

From the EICAS SYS option in Main Menu 1 you can repeat selected system pages on either multifunction screen while the original page remains on the center display. Use the bezel keys on an MFD to pick FUEL HYD, ELEC, APU or ENG; any combination of these four pages can run at the same time on the two MFDs and the center unit. The layout and colour logic are identical to the center display, so values and caution colours match exactly. The NORM summary and the control-position page are not transferable to the MFDs. The supplementary APU page on an MFD shows turbine speed in percent and exhaust-gas temperature in Celsius, giving you a quick check of auxiliary-power health without leaving the main engine screen on the center panel.

ENG MSGS

If an engine is shut down the alert logic suppresses certain messages that are irrelevant with the engine not running. In this condition the system adds an ENG MSGS option above the left-arrow soft key. Pressing ENG MSGS uncovers all messages that were inhibited by the shutdown logic so you can review them. Press the key a second time to re-enable the inhibit and clear the extra messages. If both engines are running the ENG MSGS label is absent; pressing the left-arrow key in that state briefly shows a white CAS notice KEY NOT ACTIVE.

CAS Messages

The center of the alert screen is reserved for crew-alerting messages. Items appear in four levels of urgency: warning, caution, advisory and status. Warning messages are red, caution messages amber, advisory messages cyan and status messages white. They stack in that order with red at the top and white at the bottom. A red message triggers a double chime, while amber or cyan messages sound a single attention tone.

During the take-off roll and the landing flare the system uses phase-inhibit logic so that non-critical alerts do not appear until the aircraft leaves those phases. Some alert texts are suppressed on the ground for the same reason, while others are inhibited only in flight.

Warning

Level-three alerts show in red and signal conditions that demand immediate recognition and action. When one appears the message flashes on the alert line until you press either MASTER WARNING light, after which it stays steady. The same text also pops up on the opposite-side multifunction screen and disappears there once acknowledged. Both MASTER WARNING lights flash and a double chime sounds, repeating up to three times or until the warning is cancelled. A red alert cannot be scrolled off the page; it remains visible, occupying one of the twelve available lines, until the underlying problem is cleared.

Caution

Amber (level-two) alerts flag abnormal conditions that demand prompt crew awareness but not immediate flight-path correction. When such a condition occurs the alert behaves in three ways: it flashes on the alert line until you press either MASTER CAUTION light, after which it remains steady; both MASTER CAUTION lights illuminate steadily until pressed; and a single attention chime sounds once at the moment of appearance. The message stays on the crew-alerting list until the underlying fault is cleared but unlike red warnings it may be scrolled off the screen. If messages have been scrolled a status line shows the direction and number of hidden items. After the first alert is acknowledged further amber messages appear silently until the crew clears the originating condition.

Advisory

Level-one alerts appear in cyan text and simply call the crew's attention to a condition that may later require action. They flash for the first five seconds after appearing, then stay steady. No chime sounds, no master light illuminates and you do not need to acknowledge them. The message stays on the list until the underlying issue clears and, if space is needed, you can scroll it off the screen just like other non-critical items.

Status

Level-zero CAS items appear in white text to provide pure status or operational information. They illuminate steadily, require no acknowledgement, do not trigger any chime or master light and may be scrolled off the list. They remain on the display until the underlying condition is cleared.

Display

The alert window can hold eleven messages plus one status line, each up to eighteen characters long. If several related faults occur a single line may expand: for example GEN OFF L turns red and becomes GEN OFF L-R if the second generator also drops, and it moves to the top of its colour group for a fresh acknowledgement. Use the MSG knob at the lower right of the screen to scroll when more messages exist than lines available. When items are hidden the status line shows an arrow and a count; its colour matches the most urgent off-screen message and flashes for five seconds if a new cyan or white item is added while the list is already full of higher-level alerts. An indented white END label appears beneath the last line when no further messages are available. If the display self-test fails the single prompt CHECK DU 3 replaces all other content.

No Takeoff

The system monitors aircraft configuration before every departure. When it detects a take-off-critical condition such as flaps, slats or trim outside the approved band, flight controls not centered or a major system fault; it posts NO TAKEOFF in the alert window.

If the throttles are below about sixty degrees the message appears in cyan, serving only as an advisory that the aircraft is not in a take-off-ready state. The moment either throttle is advanced past roughly sixty degrees the message escalates to a flashing red warning, the master warning lights flash and a repetitive chime sounds. A steady NO TAKEOFF line also pops up on the opposite multifunction screen. Acknowledging the warning stops the flashing text and extinguishes the master lights, but the chime and the steady red message remain until every causal condition is cleared. There is no way to mute the audio without rectifying the configuration.

Conditions to check if you see No Takeoff Crew Alert Message:

- Parking Brake ON
- Spoilers above 1deg
- ELEV TRIM not in takeoff position
- FLAPS not in takeoff position

Altitude Alerting and Reporting

Altitude information comes from two micro air-data computers. Each computer supplies the transponders with encoded pressure-altitude for ATC and feeds both primary flight displays for alerting.

Target altitude for the alert system is set with the altitude-select knob on the copilot's pedestal controller. One detent changes the value by one hundred feet; spinning the knob quickly makes larger jumps. The selected altitude appears in a cyan box at the top of each altitude tape and a matching bug rides the tape.

- Alert behaviour follows a simple colour and audio scheme.
- While the aircraft is more than two hundred fifty feet from the target both the bug and the boxed digits are amber.
- Approaching within one thousand feet triggers a single chime.
- Inside two hundred fifty feet the bug and digits switch to cyan.
- Deviating more than plus or minus two hundred fifty feet after capture causes another chime and reverts the bug and digits to amber until the aircraft returns within the band or a new target is set.

These cues, together with the altitude bug, allow you to confirm capture and detect any unintended departures from the selected level.

Engine FADEC (Full Authority Digital Engine Control)

Each engine is controlled by dual Full Authority Digital Engine Controls (FADECs), labeled A and B. Both operate continuously.

Control and Switching

FADEC selection is managed using the LH and RH FADEC RESET/NORM/SELECT switches. These are spring-loaded to the NORM position.

- SELECT (momentary): Commands a switch to the opposite FADEC, unless that FADEC has failed.
- RESET (momentary): Clears stored fault memory but does not remove the fault condition.

EICAS Integration

The active FADEC:

- Commands actual engine thrust
- Outputs real-time N1 (digital and tape) and all engine parameters to EICAS

The standby FADEC:

- Displays commanded thrust as digital target N1
- Provides N1 target bugs based on the lowest target computed by both standby FADECs

Throttle Lever Operation

The active (command) FADEC determines and schedules actual engine thrust, which is shown as both a tape and digital N1 on the EICAS engine display. The inactive (non-command) FADEC calculates and displays commanded thrust as a digital N1 target, along with N1 target bugs.

When the throttle lever is moved to cutoff, a microswitch sends a signal to the FADEC, instructing it to shut down the engine. As the lever moves above cutoff and increases from idle, the throttle resolvers command the FADEC to adjust thrust linearly up to three defined detents:

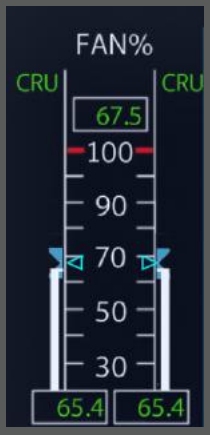
- CRU (Cruise) – Commands normal maximum cruise thrust
- CLB (Climb) – Commands normal maximum climb thrust
- TO/MCT (Takeoff/Max Continuous) – Commands normal takeoff thrust, which is also the maximum continuous thrust

Where manual linear area of operation is between IDLE and CRU detent. As the commanded thrust increases linearly between IDLE and CRU. moving above CRU to CLB commands the rated climb thrust immediately with no intermittent steps,Same is applicable for TO.MCT detent.

CRU/CLB and TO thrust ratings are calculated based on data base schedule and are dependent on sensors fitted on the aircraft measuring pressure altitude and ambient temperature and accordingly N1 and thrust values are continuously updated.

When in CRU detent, power is delivered so as to maintain the fastest possible cruise speed for a given altitude and ISA deviation temperature during straight and level flight . Meaning for the most part the resultant speed would be almost at the barber pole speed for sensed ambient condition.
Manual adjustment to be made when the aircraft is not flying straight and level or an overspeed condition is imminent.

The current thrust mode (CRU, CLB, or TO) is indicated by the FADEC mode annunciator, located adjacent to the command N1 box on the EICAS display,will display in white showing the next detent and will turn to green if the throttle levers fall within a specific detent as well as the scheduled N1 target for the detent shown in green text in a whit box.



N1 target bugs reflecting the schedule N1 value are shown on the tape in cyan.
Example below of thrust lever in CRU detent. Rated N1 under the specific conditions when the image was taken was 67.5% N1

Autothrottle Operations

The optional Autothrottle fitted on the citation X is capable of controlling the throttles for target airspeeds during all phases of flight. The system consists of the following:

Annunciator Screen: shows the current mode of operation.

ATS On/Off Push Button: turns On/Off the autothrottle system . An amber light is shown on the switch when the system is On or Armed.

FMS/MAN Knob: selects the source of the target speeds driving the autothrottle systems. If FMS is selected this indicates the ATS is operating in “Managed mode”.where target speed bug shown on the PFD is coloured in magenta highlighting it is being automatically controlled by the FMS. Otherwise the speed value and bug are in Cyan if in MAN (manual) mode , where the pilot selects the target speed either via the pitch wheel on the autopilot panel , or the tuning knob on the ATS system.

SPD Selection Knob : used to select manual speed reference if ATS mode is in manual.

Operating Modes of ATS:

- OFF : ATS system is turned OFF and hasn’t been armed.
- ARMED: ATS is ON , but aircraft is on the ground and TOGA mode hasn’t yet been commanded

Throughout a typical flight , The ATS will automatically cycle through the below modes depending on the phase of flight, active autopilot modes, FMS restrictions. The pilot will observe the below modes showing up on the Mode Annunciator Screen. Below is an explanation of when each mode is activated and what it commands.

Always Armed Modes (modes that are always armed even if ATS is OFF)**:**

- AOA LIMIT : Activates if normalized AOA falls below 0.83, commands full thrust from the engines to prevent stall.
- SPEED LIMIT : Activates if airspeed is above barber pole speed + 8 knots, command idle thrust from the engine to mitigate overspeed condition.

Rated Thrust Modes:

- N1 TO : Activates if on the ground, and TO/GA button on the throttle lever is pressed. Commands take off thrust.
- N1 GA : Activates if in flight and the TO/GA button on the throttle lever is pressed. Commands maximum continuous thrust.
- N1 CLB : Activates if in flight, and FLC autopilot mode is activated and altitude selector is higher than the aircraft's current altitude. Command maximum climb power.
- DESCENT : Activates if in flight, and FLC autopilot mode is activated and altitude selector is lower than the aircraft's current altitude. Command idle thrust for level change descent.
- RETARD : Activates if descending , and radio altitude is crossing 50 feet from runway threshhold. Command idle thrust for flaring.

Manual Speed Hold Mode:

- SPEED : Activates if in flight if ATS is ON and none of the above modes are active and ATS is not in managed mode. Commands needed thrust to hold the manually set (cyan) speed reference.

Managed Speed Hold Mode (If ATS is in FMS managed mode):

- SPEED DES : Activates if in flight , and an autopilot descent mode is active eg. VS (vertical speed) of VPATH. Commands needed thrust to hold the descent profile speed set up in the FMS Descent Init.
- SPEED CRU : Activates if in flight ,and an autopilot ALT hold mode is active. Commands needed thrust to hold the Cruise profile speed set up in the FMS Cruise Init.
- SPEED CLB : Activates if in flight , mode and an autopilot climb mode is active eg. VS (vertical speed) of PIT. Commands needed thrust to hold the climb profile speed set up in the FMS Climb Init.

Restriction Based Speed Hold Modes (Lowes applicable restriction is selected):

- SPEED ALT LIM : Activates if in flight , and aircraft is tracking SPD/ ALT LIM restriction defined in the FMS PERF INIT page. Set by default to 250kts below 10,000 feet.
- SPEED FLAP LIM : Activates if in flight ,and flaps are not retracted. Commands a target speed as per flaps position.
    - Flaps 5 => 210 Knots
    - Flaps 15 => 170 Knots
- SPEED APP : Activates if in flight ,ATS is in managed mode and Flaps are set to 35 degrees, Commands needed thrust to hold approach speed (Vapp) calculated by the FMS is it exists. Default to 135 Knots if none is yet calculated.
- SPEED FPLN : Activates if in flight , and Flight plan contains a speed restriction that the FMS calculates is close enough to start capturing. Commands the needed thrust to hold waypoint restriction speed.

Flight Management Computer

Overview Of All Implemented Pages

Typical FMS Workflow

This section provides a comprehensive guide to utilizing the Flight Management System (FMS) for a typical flight. It will detail a step-by-step workflow, encompassing critical functions such as:

- Flight Plan Insertion: Learn how to accurately input your desired route, including departure and arrival airports, waypoints, airways, and Standard Instrument Departures (SIDs) and Standard Instrument Arrivals (STARs).
- Performance Parameter Setup: Understand the process of configuring the aircraft's performance parameters within the FMS. This includes inputting data such as aircraft weight, fuel load, passenger and cargo distribution, and environmental factors like temperature and wind.
- Vertical Navigation (VNAV) Configuration: setup of the FMS's vertical navigation
- Takeoff/Landing Performance Calculation: To accurately calculate takeoff and landing performance data. This includes determining required runway lengths, V-speeds (V1, VR, V2), and braking distances, taking into account aircraft weight, runway conditions, and environmental factors. .

Sample Flight Plan

Route

KPHX/08 BROAK1 JNIPR ZUN J.102 ALS DVV J114.ONL MCW BLUEM4 KMSP/30L

Departure:

- Airport: KPHX — Phoenix Sky Harbor International Airport Runway: 08
- SID (Standard Instrument Departure): BROAK1 — BROAK ONE Departure
    - This SID transitions Phoenix departures northeastward.
    - The BROAK1 SID ends at the fix JNIPR, which is the handoff to enroute navigation.

Enroute:

- From JNIPR → direct to ZUN (Zuni VORTAC, New Mexico)
- Join Jet Route J102:
    - ZUN → ALS (Alamosa VOR, Colorado)
- Then Jet Route J114:
    - ALS → DVV (Denver VOR)
    - Continue on J114 to ONL (O'Neill VOR
    - Nebraska)
- Then direct to MCW (Mason City VOR, Iowa)

Arrival:

- STAR (Standard Terminal Arrival Route): BLUEM4 — BLUEM FOUR Arrival
- Runway 30L ILS approach.

Nav Ident (Initial Power Up)

Upon power-up, the NAV ident page is displayed. This page, which shows the validity of the aircraft's installed navigation database, does not require pilot action. Proceed to the POS INIT page by clicking the right selection key 4 (RSK 4).

POS INIT

Position initialization (POS INIT) is where the GPS position is entered for the Inertial Reference System (IRS). This allows the IRS to align and display position and attitude information on the Multi-Function Display (MFD) and Primary Flight Display (PFD).

Once POS INIT is opened, it will take approximately 5 seconds for "GPS 1 POS" to appear. After it appears, press Right Soft Key 3 (RSK3) to load the GPS position.

If the IRS is already aligned, this action will immediately acquire position and attitude information. If it is not yet aligned, the information will be acquired once the IRS is correctly aligned.

Notice that "FLT PLAN" is now shown at RSK4, indicating it is the next logical step in the workflow.

Note: Wait for the GPS position to activate on this page.

ACTIVE FLT PLAN

Access this page via the FMS FPL button or through the previously outlined steps. This is the primary interface for flight plan management, where you define your Origin, Destination, and enroute waypoints. SID, STAR, and Approach procedures, while configured elsewhere, will also be displayed here. For instance, the Origin (KPHX) should be automatically populated based on the loaded GPS position.

Type KMSP for the destination and then click the corresponding RSK2 to populate the destination field.

Your next waypoint is ZUN. Enter ZUN into the scratchpad, then select LSK2 to set it as the next waypoint in your flight plan. Your current flight plan is KPHX->ZUN->KMSP.

To correctly input the next step in the flight plan, which involves navigating via airway J102 to waypoint ALS, use the format "AIRWAY.EXIT WAYPOINT". Type "J102.ALS" and then upselect it to LSK3. This action will automatically insert the appropriate waypoints along the airway from ZUN to ALS into your flight plan.

Navigate multi-page displays, indicated by the page indicator (e.g., [1/3]) in the top right. For instance, if an airway waypoint expands the flight plan to three pages, use the NEXT and PREV buttons to move between them.

Go to page 3 to find the next entry point in the flight plan.

Remaining en route waypoints and airways should be added to the flight plan as described previously.

FLIGHT PLAN ENTRY: DVV, J114.ONL, MCW

Upon completing the enroute portion of the flight plan, the next logical step in the flow is to access the PERFORMANCE INIT page. This is exemplified below, where PERF INIT is indicated as the subsequent action at RSK4.

PERFORMANCE INIT:

The Perf Init page can be accessed by clicking the PERF button, which leads to PERF INIT, or by selecting the relevant key during the flow.

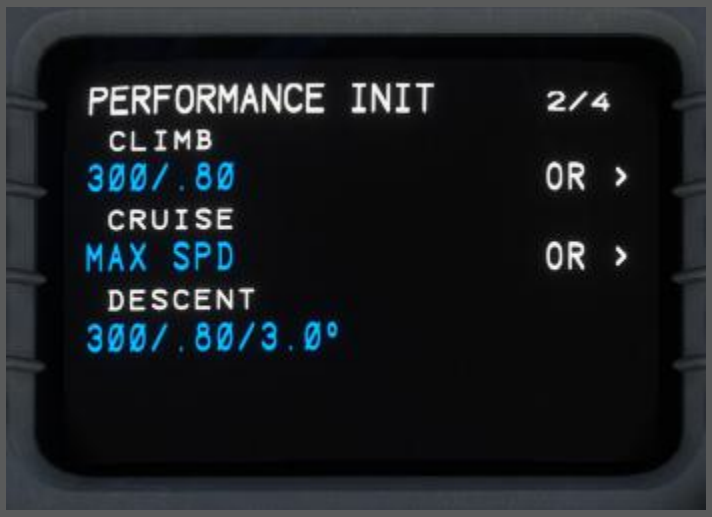
This section, consisting of four pages (navigate using the NEXT and PREV buttons), is where data is entered for the FMC to calculate the performance plan.

Page 1/4

This section provides general information regarding the aircraft type, tail number, and PERF MODE. In this version, PERF MODE is set to full performance.

Page 2/4

VNAV profiles for climb, cruise, and descent phases of flight are selected here. If no waypoint constraints are present, the magenta airspeed will default to values based on the detected flight phase. These values can be modified by choosing from available presets or by manual entry. To alter an active profile, press the OR selection key corresponding to the desired phase.

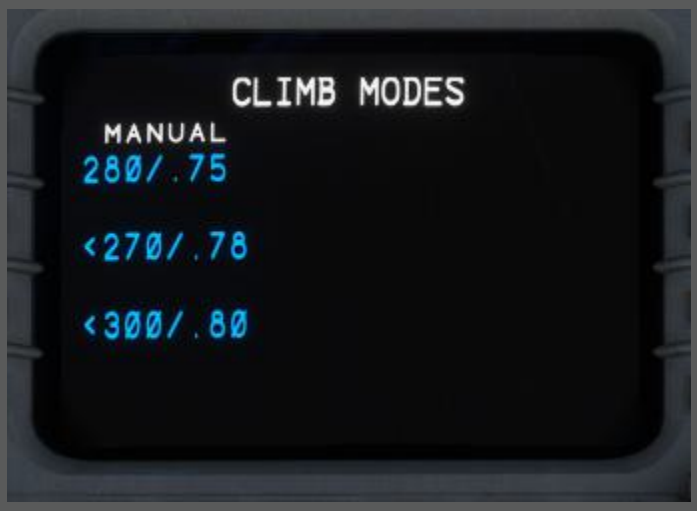


CLIMB MODES

Flight Management Computer (FMC) Speed Presets

The FMC offers several speed presets to optimize your flight profile:

- MANUAL: Allows the pilot to manually input a desired speed in the format `KIAS/MACH` into the scratchpad.
- LRC (Long Range Cruise): The FMC automatically selects the most fuel-efficient speed for the longest range under current conditions.
- 270/.78: Commands the aircraft to maintain 270 KIAS or Mach 0.78, whichever is lower. This preset prioritizes climb rate over forward speed and is typically used for optimal climb performance.
- 300/.8: Commands the aircraft to maintain 300 KIAS or Mach 0.8, whichever is lower. This is the default preset and is commonly used for a cruise climb profile, prioritizing forward speed to achieve a shorter block time.



CRUISE MODES

The Citation X offers three distinct speed settings:

- MANUAL: Pilots can directly input their desired speed (e.g., `345/0.9`) into the scratchpad using the `KIAS/MACH` format. The Flight Management Computer (FMC) will then transition between these two speeds, automatically selecting the lower value based on altitude and ambient temperature. Typically, Mach speed is utilized at higher altitudes, while Knots Indicated Airspeed (KIAS) is preferred at lower altitudes.
- LRC (Long Range Cruise): This preset directs the FMC to calculate the most efficient speed for achieving the longest possible range under the current flight conditions.
- MAX SPD (Maximum Speed): This preset instructs the FMC to attain the highest achievable speed given the current operational parameters.

DESCENT

The profile does not contain presets and can be adjusted manually. Users can input values in the format KIAS/MACH/FPA, representing indicated airspeed, a Mach number, and the desired flight path angle.

PAGE 3/4

This section is where VNAV altitudes and associated information are configured.

The editable fields are:

- TRANS ALT: Sets the transition altitude.
- SPD/ALT LIM: A global speed restriction linked to an altitude. This restriction is active below the specified altitude. The default is 250 knots below 10,000 feet, but it can be changed by inputting the desired speed and altitude in KIAS/ALTITUDE format.

INIT CRZ ALT

Depending on the chosen cruise mode (LRC or MAX SPEED), this field will automatically display one of the following altitudes:

- OPTIMUM: This is the ideal altitude for either maximum speed or the longest range, depending on whether MAX SPEED or LRC cruise mode is selected.
- FPL LIMIT: If the flight plan is too short, the maximum achievable altitude will be indicated by "FPL LIMIT" in parentheses.
- MANUAL: A pilot-entered altitude, in feet or Flight Level format (e.g., 13000 for FL130), will override any automated calculations and become the default cruising altitude for VNAV.

ISA DEV

This value, representing the temperature deviation from standard conditions in Celsius, can be accessed from the EFB tablet's home page. ISA deviation is crucial for calculating VNAV cruise speeds and determining landing and takeoff performance.

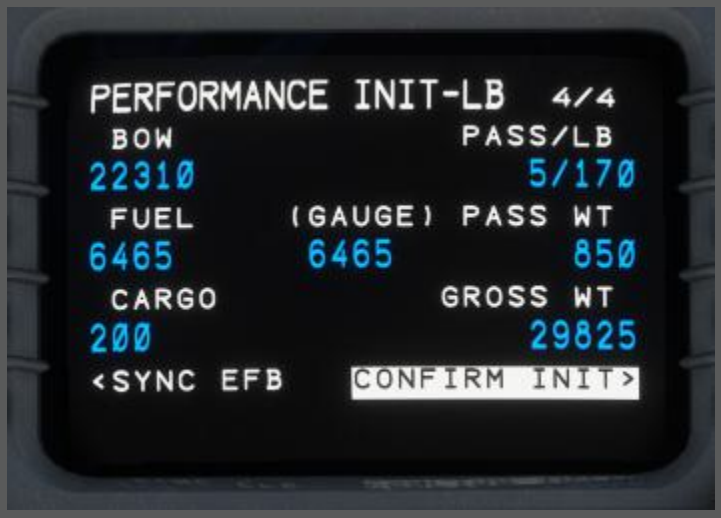
Page 4/4

Pilots can input the aircraft's current weight on this page, either manually or by using the "SYNC EFB" shortcut to load values from the EFB load manager.

The available fields are:

- BOW (Basic Operating Weight)
- FUEL (Total fuel available in all tanks)
- CARGO (Total weight in cargo hold)
- PASS/LB (Number of passengers and average weight per passenger): For example, "5/175" indicates 5 passengers with an average weight of 175 lbs.
- PASS WT: This field is non-editable and is calculated based on the PASS/LB input.
- GROSS WT: This field is also non-editable and is calculated from all the weight data provided above.

After data entry, a white "CONFIRM INIT" message will flash on RSK4, prompting confirmation of all entered data.



PERF DATA

Clicking "CONFIRM INIT" will take you to the PERF DATA page. This page summarizes the performance calculations performed by the FMC, based on the flight plan and performance data.

The following fields are available as read only:

PAGE 1/2

CRZ/CEIL ALT: This value indicates the cruising altitude used for VNAV and performance calculations. CEIL ALT refers to the maximum altitude the aircraft can achieve given its current weight and ambient conditions. It updates throughout the flight and can suggest when to initiate a step climb.

ETE: Estimated time en route to the destination.

FUEL REQ: Estimated fuel required to reach the destination.
FUEL FOM: An estimated margin of error for the fuel calculation, represented as a +/- value.

PAGE 2/2

DIST: total flight plane distance, including departure and arrival procedures.
ETA: expected time of arrival
FUEL REM : expected remaining fuel at destination.

DEPARTURE

From the flight plan, we can now insert our departure procedure and specify the takeoff runway. To access the DEPARTURE page, navigate to NAV -> DEPARTURE.

The first step is selecting the departure runway. For KPHX, the assigned runway is RW08, which can be selected using RSK3.

Available SIDs for this runway will be displayed. Please note that multiple pages are available if the desired SID is not on the first page.

Choose BORAK1.

For the chosen SID, available transitions are listed on the next page. Select JNIPR, as per the flight plan.

After selecting the runway, SID, and transitions, click "ACTIVATE" to insert them into the flight plan.

NOTE: "ACTIVATE" can be clicked at any time during the selection process. If no SID is needed, choosing the runway and then clicking "ACTIVATE" will skip the remaining selections and insert only the runway into the flight plan. Transitions can be skipped in the same manner.

TAKEOFF

To set up takeoff data and calculate takeoff performance, navigate to the TAKEOFF page. This can be accessed by clicking the PERF button, then selecting TAKEOFF.

PAGE 1/3

Displays information that are either loaded from the database or through the aircraft sensors.
Runway data includes heading and length loaded from the database.

Fields in blue are loaded from the aircraft sensors but can be manually overridden.

The pilot needs to enter the ambient wind in the format of DEGREES/SPEED KTS. example 300/8 means winds are coming from heading 300 at speed of 8 KTS. and populate using RSK2.

PAGE 2/3

This page displays detailed runway information from the database, including slope, width, and threshold data. Pilots can specify the runway condition as either DRY or WET using LSK2.

PAGE 3/3

Available settable fields:

- ANTI-ICE state: Toggle OFF/ON using LSK1.
- FLAPS setting: Toggle 5/15 using LSK2.

- T.O weight: Pre-populated from earlier entries during PERF INIT.

Once all fields on all three pages are sufficiently filled, a white background "CONFIRM INIT" will display. Confirming this will allow the FMC to use the inserted data to calculate takeoff performance.

TAKEOFF DATA

After confirming "TAKEOFF init," the TAKEOFF DATA page will open, allowing you to review the following information:

PAGE 1/2

T.O. WT: Takeoff weight.
RWY USE/REQ: Available/required runway length in feet.
WIND: Headwind and crosswind components in knots.

PAGE 2/2:

Displays calculated V1, VR, and V2 speeds. These speeds are transmitted to the PFD for display when flaps are extended to 5 degrees or more.

CLIMB

This page displays the calculated climb performance, which is determined by the performance initialization settings.

- TOC ALT: Altitude at the top of climb.
- ETE/ETA: Estimated time en route to the top of climb / Estimated time of arrival at the top of climb.

CRUISE

This page presents the cruise profile established during initialization, providing the following informational fields:

- CRZ ALT: The target cruising altitude.
- SPD CMD: The cruise speed, determined by the selected cruise mode during initialization. This value also accounts for altitude and density, and it controls the speed target carat when VNAV mode is active during the cruise phase.
- RANGE: The estimated cruise range before reaching IFR reserves.
- TIME: The estimated flight time before reaching IFR reserves.

ENROUTE

The PROGRESS page, accessible via the PROG button on the CDU, offers real-time flight metrics based on current conditions. This page displays:

- Next Waypoint (magenta): Name, distance, estimated time en route (ETE), and fuel remaining upon arrival.
- Destination (green): Name, distance, ETE, and fuel remaining until reaching the destination.

Additionally, the page provides selected navigational radio frequencies.

DESCENT

The Descent Performance page, accessible at any time during flight or on the ground via PERF -> DESCENT, offers vital information for managing your descent.

This page displays:

- BOD ALT: Bottom of Descent Altitude, representing the altitude of the first anticipated level-off.
- ETE/ETA: Expected Time to/Arrival, showing the estimated time to reach the top of descent.
- SPD CMD: The selected profile speed for the descent phase.
- ANGLE: The set flight path angle for the descent phase, with a default of 3 degrees.

Arrival

The ARRIVAL prompt, which facilitates the setup of arrival procedures, appears on LSK4 of the ACTIVE FLT PLAN page when the aircraft is within 200 nautical miles of its destination. Alternatively, this page can be accessed via NAV -> ARRIVAL. It is used to input arrival information into the flight plan.

The process involves the following steps:

1. Select the arrival runway.
2. Choose the approach.
3. Select the STAR (Standard Terminal Arrival Route).

For example, if the flight plan dictates an ILS approach to runway 30L via the BLUEM4 Arrival, these steps would be followed.

Choose RUNWAY (LSK1) -> RW30L (RSK4)

Next, the approach ILS Z 35, needs to be selected (RSK4).

Next, request Approach transition. While VECTORS is an option, be aware that choosing it will result in a flight plan discontinuity that you will need to clear..

Next, select the STAR if necessary; otherwise, choose ARRIVAL->ACTIVATE to continue. Since the flight plan calls for the BLUEM4 Arrival, select it (LSK2).

Once all information has been entered, an arrival summary will be displayed, outlining the selections made. These procedures will only be added to the flight plan upon clicking ACTIVATE (RSK4).

After activating the flight plan, you will see "\>\>DISCONTINUITY\<\<" on the flight plan page. This signifies a break in the flight plan, which will prevent LNAV from sequencing. To resolve this, you can either:

- Press the DEL button and select the corresponding selection key (LSK3).
- Copy the name of the next waypoint to the scratchpad and then select the discontinuity's corresponding selection key to replace it.

LANDING

PAGE 1/3

The LANDING PERF page, accessible via PERF -> LANDING or when prompted, is used to calculate landing performance. This page displays information loaded from the database for the arrival runway. Pilots need to input the outside air temperature (OAT) and surface winds at the arrival airport. Note that OAT and wind data can be obtained from the EFB tablet when within 75NM of the destination, if METAR information is available.

PAGE 2/3

This page displays landing runway information from the database, including slope, width, and threshold offset. It also allows the pilot to select the runway condition (DRY or WET).

PAGE 3/3

This page allows the pilot to input the expected landing weight, select anti-ice ON or OFF, and specify landing flaps at either 15 or 35 degrees.

LANDING DATA

This section shows the calculations of landing performance based on the provided data.

Page 1/2

LANDING WT : Shows the reference landing weight
RWY USE/REQ : Shows runways length vs required landing distance
WIND: Shows both cross and head wind components as per the data provided

Page 2/2

This page displays the calculated approach and reference speeds, derived from the provided data. These speeds will automatically populate the PFD speed bugs upon the selection of landing flaps.

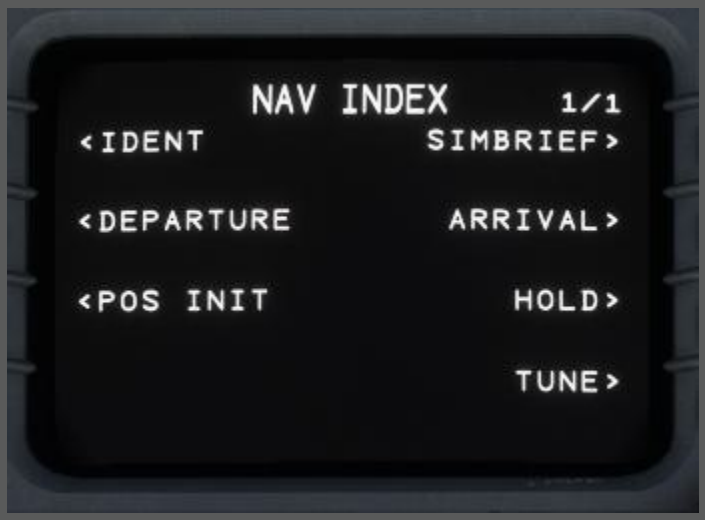
Other Important Pages

Performance Index

The Performance Index screen can be accessed by pressing the “PERF” function key on the FMS. This page displays all performance functions that can be accessed at any time, by pressing the line select keys adjacent to the respective function.

Nav Index

Pressing the "NAV" function key on the FMS brings up the Nav Index screen. This screen provides access to all navigation functions, which can be selected at any time using the line select keys next to each function.



Radio Tunning

This page can be accessed by pressing TUNE function on the NAV INDEX page. The pilot can use the FMS to tune all available aircraft radio.

Holding Pattern

The HOLD function on the NAV INDEX page provides access to this page, where pilots can define and review holding patterns. Users can set the holding quadrant, inbound course, turn direction, and the inbound leg's time.

To create a new Hold, the pilot must press “New Hold” on the Holding Pattern page.

Selecting the desired holding fix waypoint will return you to the active flight plan page.

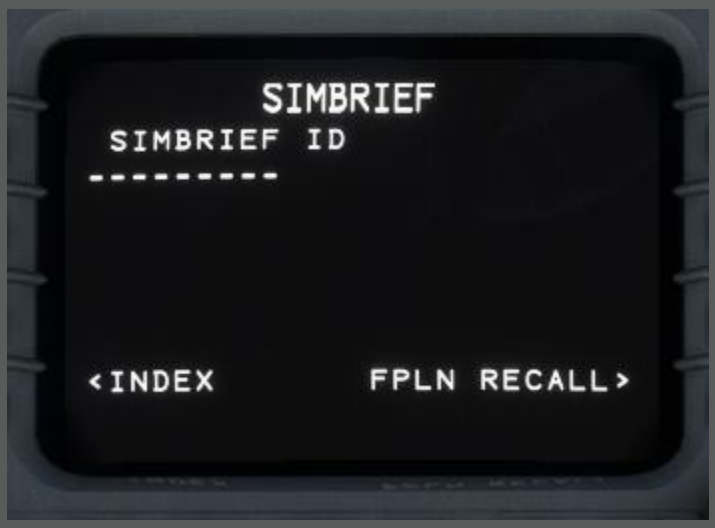
Once all necessary adjustments to the holding pattern have been made, select "Activate."

A new "Hold At" waypoint will be inserted after the desired waypoint on the active flight plan page.

You can exit the hold using the Holding Pattern page or by selecting "Exit Hold" on the active flight plan page, once the Hold waypoint is activated.

Simbrief

This page can be accessed by pressing the SIMBRIEF function on the NAV INDEX page. Enter your SimBrief ID (six digit number not the username) on this page to retrieve the latest flight plan using the FPLN RECALL button.

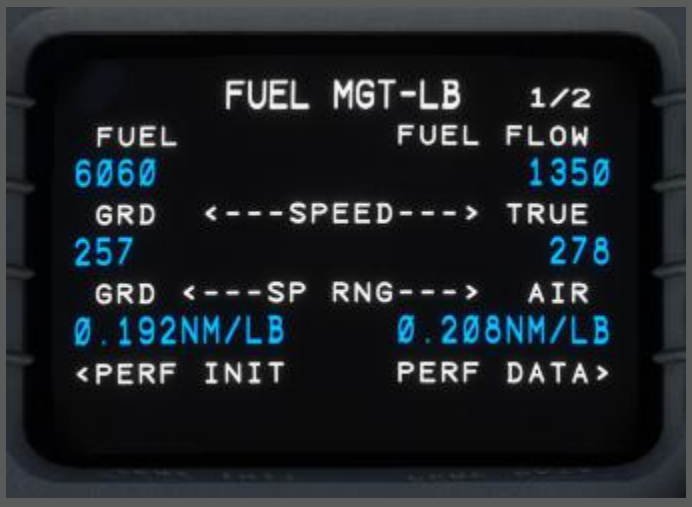


Direct To

This page can be accessed by pressing the DIR key on the FMS. This page displays your active flight plan. You can select a waypoint to initiate the direct-to procedure. Once a waypoint is chosen, the aircraft will calculate the course and begin turning towards it.

Fuel Management

This page can be accessed by pressing the FUEL MGT function on the NAV INDEX page. This page displays your current fuel quantity and flow, as well as ground speed, true airspeed, and specific range (ground/air).



Progress

This page can be accessed by pressing the PROG key on the FMS. These pages summarize the Citation X's important flight parameters and its relationship to the flight plan.The first page provides the Estimated Time Enroute (ETE), distance to the TO waypoint and destination, and fuel projection. Additionally, it indicates the current NAV mode, the number of long-range NAVs in use, and the currently tuned navaids.

On the second page of Progress, you can also access the Air Data page by pressing LSK4.

Air Data

This page can be accessed by pressing the Air Data on the second page of Progress.

Checklists

For your convenience, both a complete and an abbreviated printable checklist are provided below in the link below.

https://bit.ly/msfsffx-c750-checklists

Citation X for MSFS 2020 and 2024 Full Checklist

Before Start

- STBY PWR Switch: ON
- EMERG LT Switch: ARM
- BATT 1 and BATT 2 Switches: ON
- EICAS POWER Switch: ON
- APU START: REFER TO APU START CHECKLIST
- AVIONICS POWER Switch: ON
- IRS: ALIGN/NAV
- FMS: INSERT PRESENT POSITION
- Parking Brake: VERIFY SET
- Wheel Chocks: REMOVED - Use Settings page in Tablet
- Cabin Door: CLOSE/LOCK
- Passenger Briefing: COMPLETED
- Seats/Belts/Harnesses/Pedals: ADJUST/SECURE
- Exterior Lights: AS REQUIRED
- EICAS: CHECK for warnings
- ATIS/Clearance/FMS: AS REQUIRED. Program FMS
- Instruments/Avionics/FLPN: Set course bugs and pointers as required for departure. COMM/NAV/ADF radios tuned and verified. Transponder set to STBY
- Fuel Quantity/Balance: CHECK - Maximum intentional fuel imbalance is 400 lbs
- CTR WING XFER Switches: NORM/AS REQUIRED
- V-Speeds: SET - TAKEOFF DATA FMS page

APU Start

- BATT 1 and BATT 2 Switches: ON
- LH FUEL BOOST Switch: NORM
- APU STARTER DISENGAGE Switch: NORMAL

- APU MASTER Switch: ON
- APU TEST: PUSH
- APU GENERATOR Switch: ON
- APU DC VOLTS: CHECK (22 volts minimum)
- APU: START
- Hold APU START switch up until APU RELAY ENGAGED light illuminates: APU RELAY ENGAGED light ON
- APU RELAY ENGAGED Light: ON, then OFF before READY TO LOAD light ON
- LOAD SHED Switch: NORM
- GPU: DISCONNECT/CLEAR (if used)
- APU Ammeter: CHECK (400A max on ground/200A max in flight)
- APU BLEED AIR Switch: ON (for engine start) AS REQUIRED (for PAC bleed)

Starting Engines

- APU START: REFER TO APU START CHECKLIST
- PAC ISOL VALVE Knob: CLOSED
- Start duct pressure: At least 30 PSI
- Right Engine - START: PRESS (confirm START button and DISENGAGE button illuminate)
- Throttle: IDLE (by 10% N2 RPM)
- N1 Rotation: CONFIRM
- Oil Pressure: CHECK
- ITT: MONITOR
- Hydraulic Pressure: VERIFY
- Left Engine - START: Same as right engine
- Hydraulic Pressure: VERIFY
- Generators: ON
- Ground Air Service/GPU (if used): DISCONNECT
- APU Bleed Air Switch: OFF (check bleed sources)
- Select EICAS SYS, ENG on the MFD: Duct pressure is from right engine
- R ENG BLD AIR Knob: OFF (pressure should be zero)
- PAC ISOL VALVE Knob: OPEN (pressure is from left engine)
- L ENG BLD AIR Knob: OFF (pressure should be zero)
- L ENG BLD AIR Knob: HP/LP (check pressure)
- PAC ISOL VALVE Knob: CLOSED (pressure should be zero)
- R ENG BLD AIR Knob: HP/LP (check pressure)
- APU Bleed Air Switch: AS DESIRED

Starting Second Engine: Cross Bleed Method

- PAC ISOL VALVE Knob: OPEN
- PAC BLEED SELECT Switch: HP
- Opposite ENG BLD AIR Knob: HP/LP
- Opposite Engine: Adjust THR maintain 30 PSI minimum start pressure (approximately 55% N1)
- Left Engine - START: PRESS (confirm START button and DISENGAGE button illuminate)
- Throttle: IDLE (by 10% N2 RPM)
- N1 Rotation: CONFIRM
- Oil Pressure: CHECK
- ITT: MONITOR
- Opposite Engine: IDLE
- Hydraulic Pressure: VERIFY
- Generators: ON
- PAC BLEED SELECT Switch: NORMAL
- PAC ISOL VALVE Knob: CLOSED

Before Taxi

- Flight Controls: FREE/CORRECT EICAS INDICATIONS
- Flaps/Slats Lever: UP
- Rudder Control/EICAS: VERIFY UPPER RUDDER REMAINS CENTERED WITH FLAPS UP
- Flaps/Slats: SET FOR TAKEOFF/CHECK EICAS INDICATIONS
- Speed Brakes: CHECK/STOWED/EICAS INDICATIONS
- AHRS or IRS: ALIGNED/NO FLAGS
- EICAS: CHECK (all messages either normal or resolved)
- Standby Gyro: UNCAGED
- Anti-Ice Systems: AS REQUIRED
- Pressurization ALT SEL: NORM
- Passenger Advisory Lights: PASS SAFETY
- Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors: CHECK/SECURE/LATCHED OPEN

Taxi

- Exterior Lights: AS REQUIRED
- Brakes: APPLY and HOLD
- Parking Brake: RELEASE
- Brakes: CHECK
- Nose Wheel Steering: CHECK
- Thrust Reversers: CHECK/STOWED

- Flight Instruments: CHECK

Before Takeoff

- Anti-Ice Systems (if required): CHECK
- LH and RH ENGINE, STABILIZER, and SLAT ANTI-ICE: ON/CHECK COLD MESSAGES (2-3 minutes)
- Throttles: APPROXIMATELY 40% N1
- Check CAS: COLD (messages go out, No HOT or LEAK messages)
- ANTI-ICE Switches: AS REQUIRED. It is suggested that Pitot/Static Anti-Ice be employed for all flights
- Throttles: IDLE
- Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors: CHECK/SECURE/LATCHED OPEN
- Flaps/Slats: SET FOR TAKEOFF
- Speed Brakes: RETRACTED (0%)
- Trims: SET FOR TAKEOFF
- Yaw Damper and Mach Trim: CHECK ON
- Crew Briefing: COMPLETE
- Radar: AS REQUIRED
- Transponder: TA/RA
- LH and RH PITOT STATIC Anti Ice Switches: BOTH ON
- Exterior Lights: AS REQUIRED
- Engine Instruments: CHECK
- EICAS: CHECK

Takeoff

- Throttles: TO/MC DETENT
- Brakes: RELEASE
- EICAS: CHECK NORMAL INDICATIONS, N1 matches command
- Elevator Control: ROTATE AT VR to achieve 13 deg initial pitch

After Takeoff/Climb

- Landing Gear: UP
- Flaps/Slats: UP (airspeed above 170 KIAS)
- Throttles: CLB DETENT
- Anti-Ice Systems: AS REQUIRED
- ENG SYNC Knob: AS DESIRED
- Pressurization: CHECK
- Passenger Advisory Lights: AS REQUIRED
- Altimeters (transition altitude): SET

- Exterior Lights (FL180): AS DESIRED
- APU (prior to climb above FL310): OFF

Cruise

- Throttles: CRU detent or AS REQUIRED
- Pressurization: CHECK
- Fuel Transfer: VERIFY

Descent

- LH and RH WINDSHIELD ANTI-ICE Switches: BOTH ON
- Side Window Vent Knobs: CLOSED
- Pressurization: CHECK/SET LANDING ELEVATION
- ANTI-ICE Switches: AS REQUIRED
- APU: AS DESIRED
- Exterior Lights (FL180): AS REQUIRED
- Altimeter (transition level): SET

Approach

- Landing Data: CONFIRM
- Crew Briefing: COMPLETE
- Avionics/Flight Instruments: CHECK/SET
- Minimums: SET (RA/BARO)
- FUEL CROSSFEED Switch: OFF
- Exterior Lights: AS REQUIRED
- Flaps/Slats: AS REQUIRED
- Passengers: BRIEF
- Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors: CHECK/SECURE/LATCHED OPEN
- Passenger Advisory Lights: PASS SAFETY
- LH and RH IGNITION Switches: NORM
- Pressurization: ZERO DIFFERENTIAL at touchdown
- ENG SYNC Knob: OFF

Before Landing

- Landing Gear: DOWN and LOCKED (3 green lights)
- Flaps: AS REQUIRED
- Speed Brakes: RETRACTED (0%)

- EICAS: CHECK
- Airspeed: VREF
- Autopilot: OFF above minimum use height

Landing

- Throttles: IDLE
- Speed Brakes: EXTEND at touchdown (100%)
- Elevator Control: FORWARD PRESSURE at touchdown
- Brakes: APPLY after nose wheel ground contact
- Thrust Reversers: DEPLOY after nose wheel ground contact
- Thrust Reversers: IDLE BY 65 KIAS

Shutdown

- Parking Brake: SET
- Anti-Ice Systems: ALL OFF
- Thrust Reversers: CUTOFF
- IRS Mode Control Knobs: OFF
- Passenger Advisory Lights: OFF
- Standby Gyro: CAGED
- STBY PWR: OFF
- Avionics Power/EICAS Switches: OFF
- EMERG LT Switch: ARM
- GRVTY XFLOW Switch: OFF
- APU MASTER Switch: OFF
- Exterior Lights: OFF
- BATT 1 and BATT 2 Switches: OFF

Useful Information for Flying the Citation X in Microsoft Flight Simulator 2020 and 2024

This section is taken from our Closed Beta Team's collection of useful information when operating or flying the Citation X.

There are shortcuts for your convenience to control autopilot functions like heading, alt select and cdi course: You can change these values by using the labeled screws shown below:

V-Speeds are not generated or populated to the PFD until the flaps are placed in T/O position (15)

No Takeoff?
Things to check:

- Parking Brake ON
- Spoilers above 1deg
- ELEV TRIM not in takeoff position
- FLAPS not in takeoff position. V-Sp

Can you enter a custom waypoint? Yes - entering a string value such as CAI/320/10 (PLACE/BEARING/DISTANCE) will create a user waypoint that is 320 degrees from CAI 10NM in distance.