

PHENOM 300E



USER MANUAL



FS Reborn

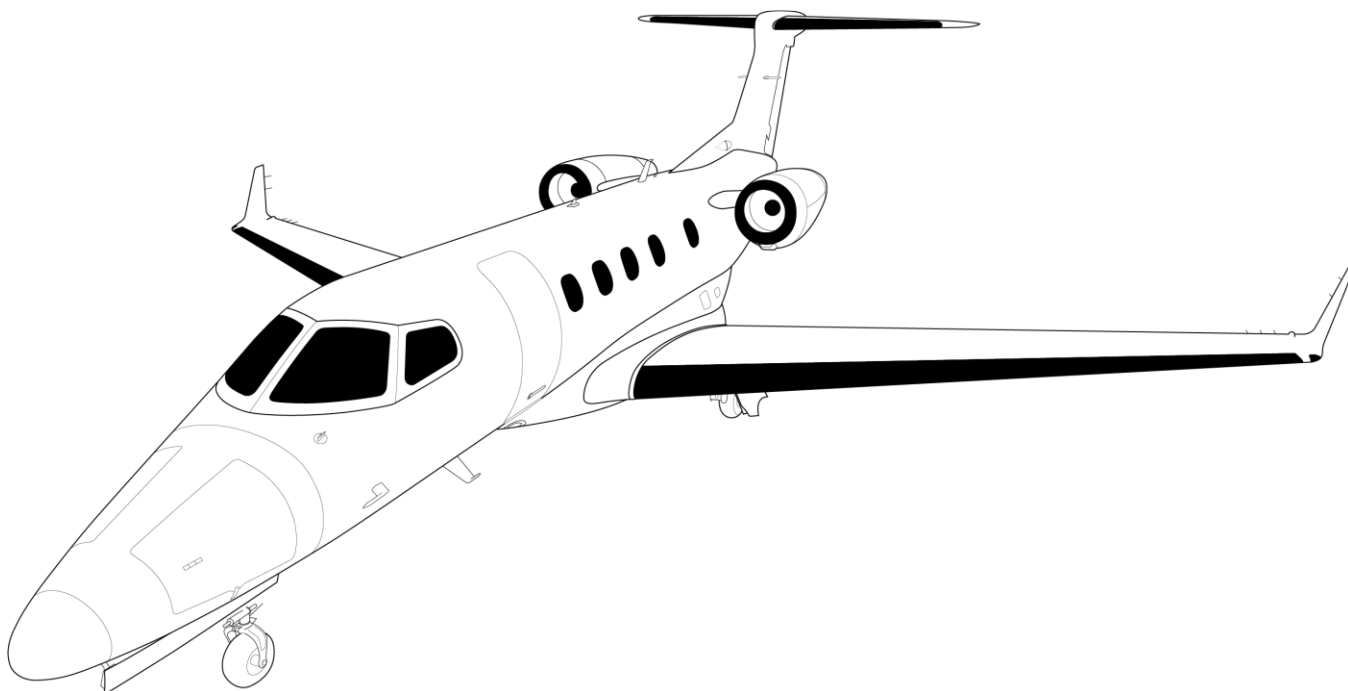
FSR PHENOM 300E

By



USER MANUAL

V1.0



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CHAPTER 1 AIRCRAFT OVERVIEW



Introduction

The Embraer Phenom 300E is a light jet aircraft designed and manufactured by Embraer. It is a low-wing, T-tail, pressurized airplane powered by two rear-mounted Pratt & Whitney PW535E high-bypass-ratio turbofan engines, each producing 3,360 pounds of thrust.

The aircraft features a tricycle landing gear configuration that is fully retractable, with a single tire at each leg. The cockpit is equipped with the Garmin G3000 glass cockpit avionics suite (marketed by Embraer as the Prodigy Touch), providing highly integrated flight management, navigation, and engine indication capabilities.

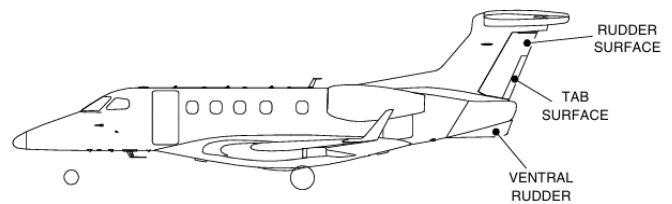
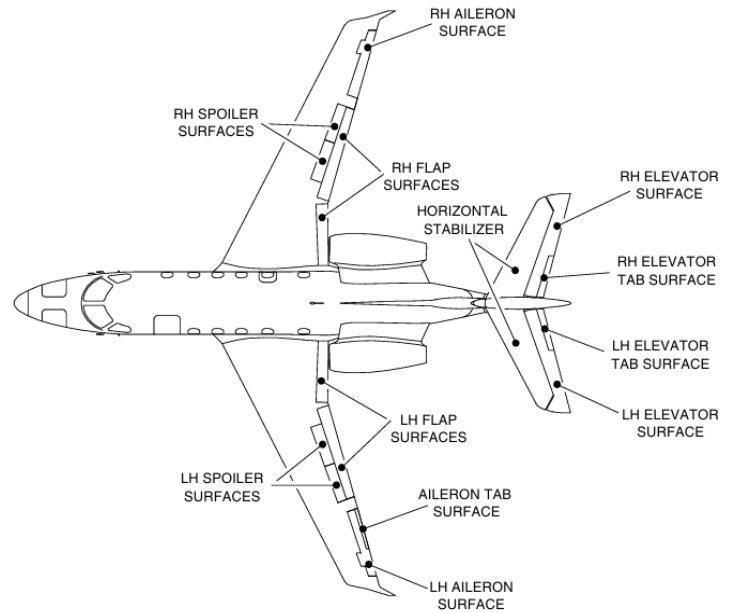
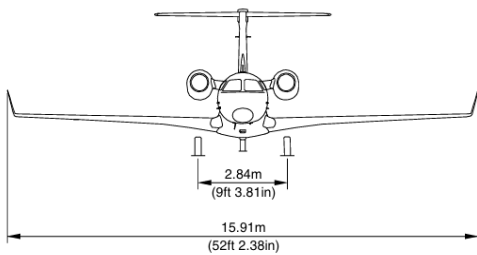
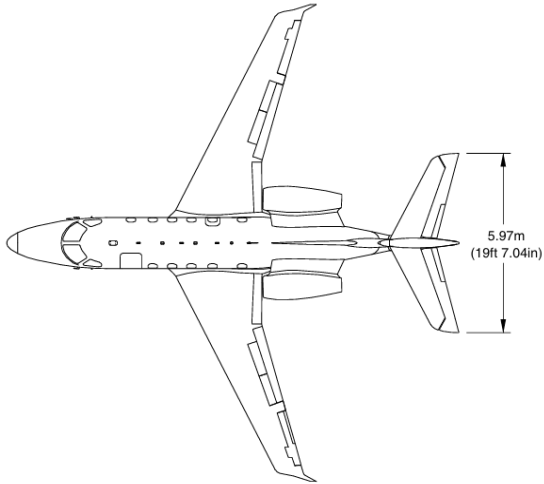
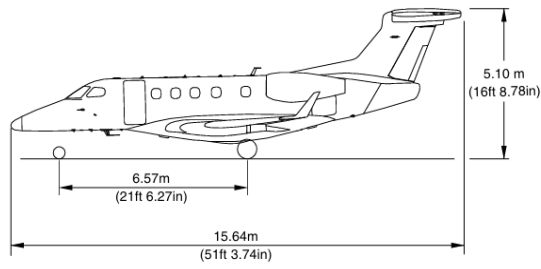
The passenger cabin can accommodate up to 7 passengers in a standard configuration (up to 10 in optional configurations), with a fully enclosed lavatory and generous baggage compartments. The cabin is pressurized to a maximum differential of 9.4 PSI, allowing a cabin altitude of approximately 6,600 ft at the aircraft's maximum operating altitude of 45,000 ft.

About the FSReborn Simulation

The FSReborn Phenom 300E for Microsoft Flight Simulator 2024 is a high-fidelity add-on featuring custom-coded aircraft systems including a full electrical system with dual generators and batteries, a hydraulic system with dual engine-driven pumps, realistic pressurization with bleed air management, pneumatic anti-ice protection, FADEC engine management with accurate startup sequences, and a comprehensive Electronic Flight Bag (EFB).

The simulation also features a unique aircraft maintenance system that tracks engine hours, oil levels, tyre wear, brake pad condition, battery health, and generator status. Neglecting maintenance can lead to realistic failures, adding a layer of operational realism not typically found in flight simulation add-ons.

Aircraft Specifications

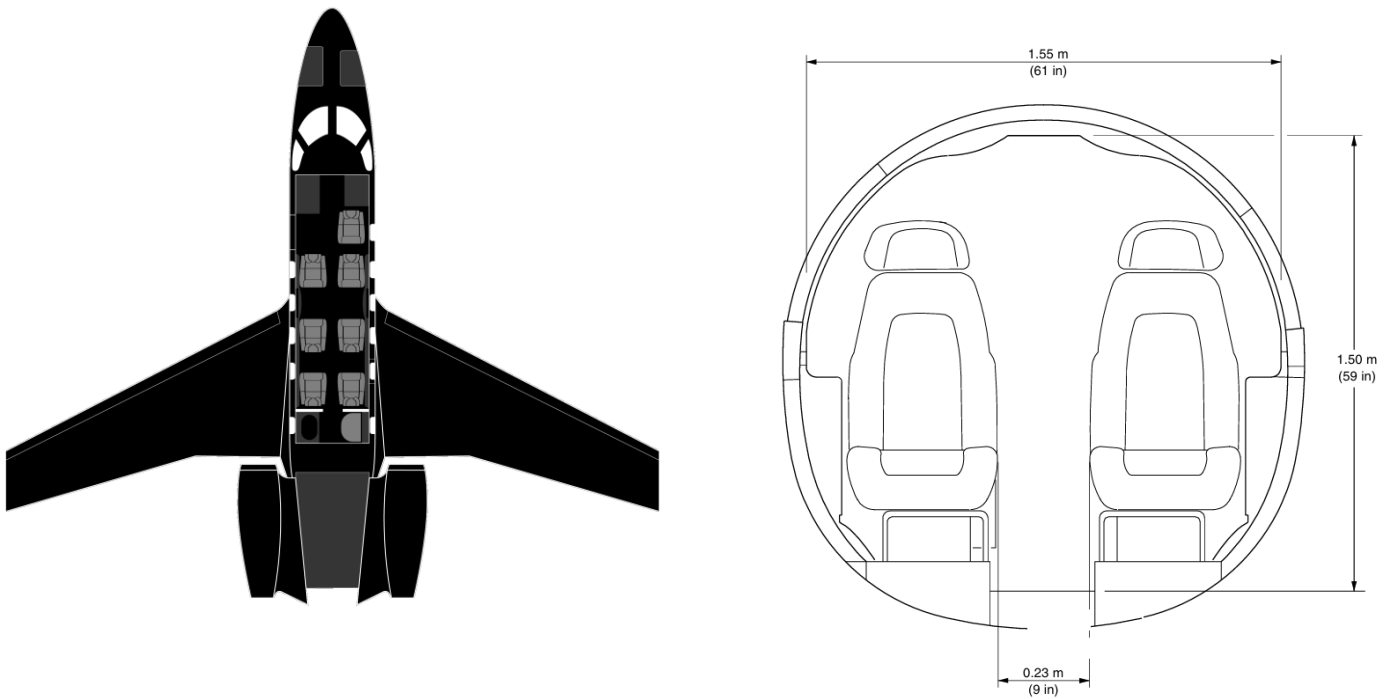


Specification	Value
Wingspan	52 ft 2 in / 15.91 m
Overall Length	51 ft 4 in / 15.64 m
Overall Height	16 ft 9 in / 5.10 m
Cabin Height	4 ft 11 in / 1.50 m
Cabin Width	5 ft 1 in / 1.55 m
Engines	2x Pratt & Whitney PW535E1 (3,478 lb thrust each)
Maximum Ramp Weight (MRW)	18,617 lb / 8,444 kg
Maximum Takeoff Weight (MTOW)	18,551 lb / 8,414 kg
Maximum Landing Weight (MLW)	17,272 lb / 7,834 kg
Maximum Zero Fuel Weight (MZFW)	14,263 lb / 6,469 kg
Fuel Capacity	5,352 lb / 2,428 kg / 798.8 US gal (total usable, both tanks)
Maximum Operating Altitude	45,000 ft
VMO / MMO	See chart / Mach 0.8
Range	Approx. 2,077 nm
Maximum Passengers	7 standard / up to 10 optional
Minimum Crew	1 Pilot
Avionics	Garmin G3000 (Prodigy Touch)

Cabin Layout

The Phenom 300E cabin features a club-four seating arrangement with two pairs of facing seats, plus additional seating options depending on the configuration, the diagram below shows the cabin configuration of the 300E that we modelled. The cabin includes fold-out tables, individual reading lights, air vents, and USB power outlets.

Baggage is distributed across a forward baggage compartment (50 kg max), an aft external baggage compartment (210 kg max), and various internal storage cabinets. The lavatory is located at the aft end of the cabin with an optional belted toilet seat.

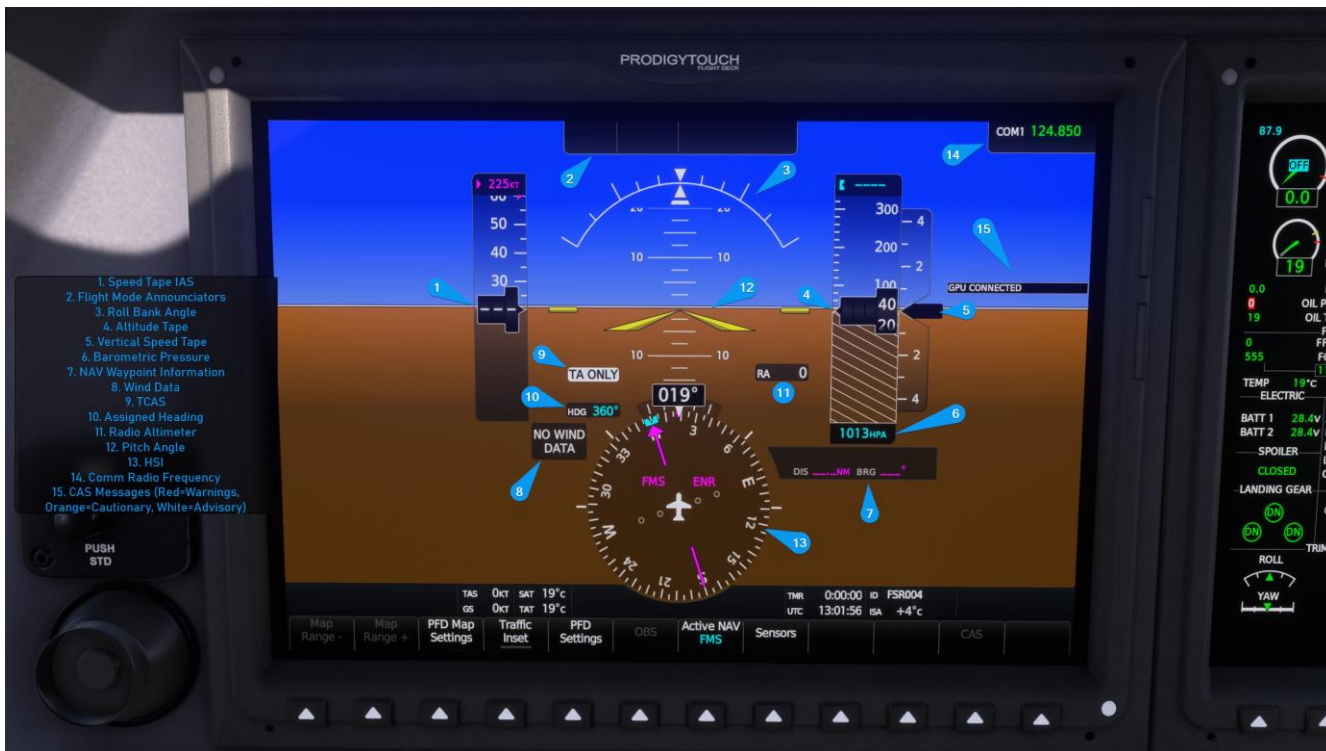


CHAPTER 2 COCKPIT OVERVIEW

Main Instrument Panel

The Phenom 300E cockpit centers around three large Garmin display units arranged across the main instrument panel. Two Primary Flight Displays (PFD 1 and PFD 2) present attitude, airspeed, altitude, heading, vertical speed, and navigation information to the left-seat and right-seat pilots respectively. The center Multi-Function Display (MFD) shows the EICAS engine indications, CAS messages, system synoptic pages, navigation maps, weather radar, charts, and the electronic checklist.

Each PFD bezel includes a warning/caution acknowledgement button (MSG), display scrolling buttons, and softkeys. The MFD bezel includes the FMS knob for menu navigation, range adjustment, and data entry.



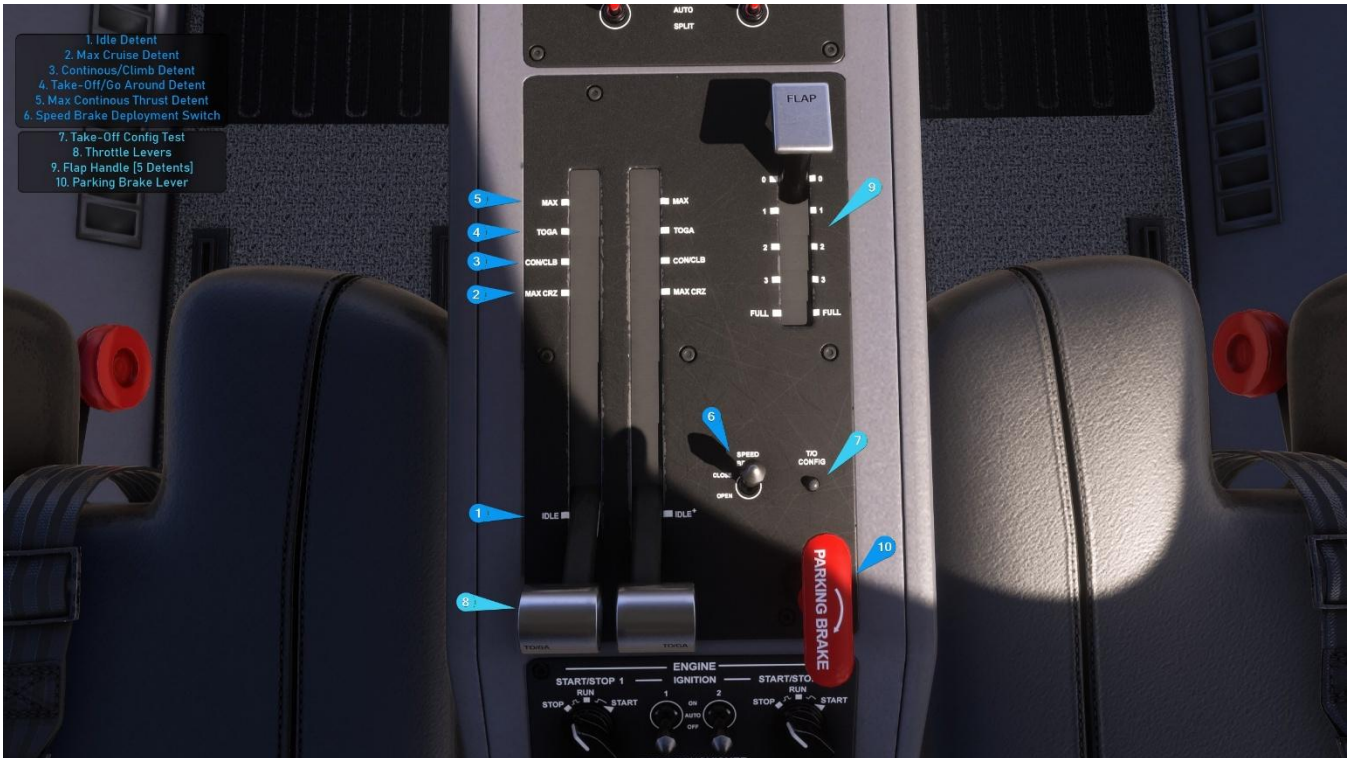
Center Pedestal

The center pedestal houses the primary flight controls and engine management interfaces. From front to back, the key controls include:

Thrust Levers: Two thrust levers with TO/GA buttons for takeoff and go-around mode activation. The levers control engine N1 from idle to maximum takeoff thrust.

Flap Lever: Selects flap positions 0, 1, 2, 3, and FULL. Each position has a corresponding maximum speed (VFE).

Speed Brake Switch: Two positions: CLOSE, OPEN. When armed, the speed brakes deploy automatically on landing. Speed Brake is only available under the following conditions: Flaps retracted, Indicated Airspeed greater or equal to 125 kt, Any TLA lower than MAX CRZ. When put to Open, its an override mode where it will deploy when the mentioned conditions are met. When going outside those conditions they will retract and the switch would need to be cycle/reset if wished to be deployed again.



Start/Stop Knobs: Two rotary knobs (one per engine) with STOP, START, and RUN positions. Used for normal engine start and shutdown sequences.

Trim Controls: Pitch trim switches on the control wheel and yoke, plus yaw and roll trim controls on the pedestal. A backup pitch trim mode switch is available if the normal trim system fails.



Overhead and Side Panels

The overhead area and side panels contain the system control switches organized by function:

Electrical Panel: BATT 1 & 2 switches, GEN 1 & 2 switches (AUTO position for normal operation), BUS TIE knob, GPU button, and ELEC EMER button for electrical emergency transfer.

Test Panel: Selector knob and START TEST button for testing stall protection, ice protection, fire detection, smoke detection, and annunciators.



Ice Protection Panel: ENG 1 & 2 anti-ice switches, WINGSTAB (wing/stabilizer anti-ice) switch with ICE SPEED RESET position, ADS PROBES knob (OFF/AUTO/ON), WSHLD 1 & 2 windshield heat switches, the INSP LIGHT switch for the wing inspection light can be found on the top panel alongside with the rest of the light switches.



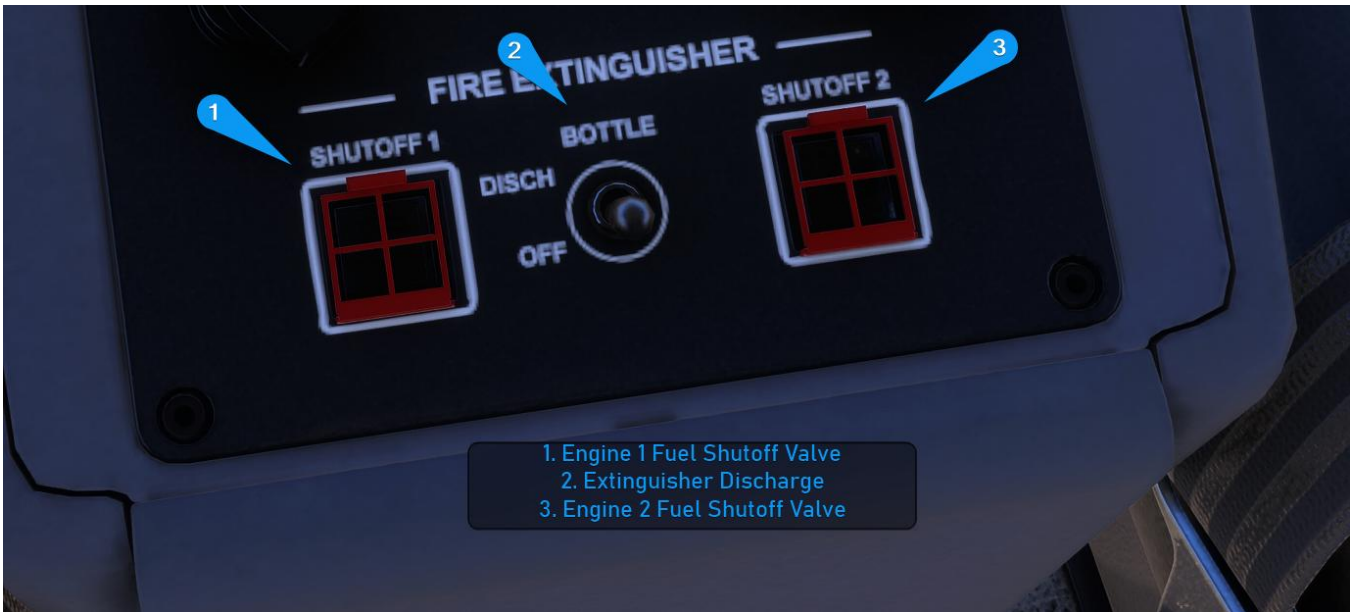
Pressurization Panel: PRESN MODE switch (AUTO/MAN), ECS knob (OFF VENT/ECS 1/BOTH/ECS 2), DUMP button, and CABIN ALT switch for manual cabin altitude control.



Lighting Panel: Controls for panel lights, cockpit dome lights, landing lights, taxi lights, navigation lights, strobe lights and anti-ice wing inspection light.



Fire Protection Panel: Engine fire shutoff buttons (SHUTOFF 1 & 2), BOTTLE switch for fire extinguisher discharge, and the fire detection test.



Integrated Electronic Standby Instrument (IESI)

The IESI provides backup attitude, airspeed, and altitude information independently of the main G3000 avionics system. It is powered by the emergency bus and includes its own barometric setting knob.

The IESI requires 90 seconds for alignment after power-up. The aircraft must not be moved during this period, as movement can cause attitude indication errors that may not be noticeable on the ground.

In the event of a complete electrical emergency (dual generator failure), the IESI is one of the few instruments that remains powered on from the emergency bus, along with essential engine indications and one COM radio.



CHAPTER 3 AIRCRAFT SYSTEMS



Engines PW535E1 Overview

The Phenom 300E1 is powered by two pylon-mounted Pratt & Whitney PW535E turbofan engines, each producing 3,478 pounds of thrust. The engines are mounted on the rear fuselage and provide not only propulsion but also pneumatic power (bleed air for pressurization, heating, and anti-ice), hydraulic power (via engine-driven pumps), and electrical power (via starter-generators).

The PW535E1 is a two-spool turbofan engine with a full-length annular bypass duct. The two spools are the low-pressure (LP) spool, measured as N1 (fan speed), and the high-pressure (HP) spool, measured as N2 (compressor speed). Air entering the engine is split between the bypass duct (providing the majority of thrust) and the core (where it is compressed, mixed with fuel, ignited, and expanded through the turbine stages).

Inter-Turbine Temperature (ITT) is the primary engine health indicator. It measures the gas temperature between the high-pressure and low-pressure turbine stages. ITT is the first parameter to approach limits during high-power operations and engine starts, making it the most critical indication for the pilot to monitor.

The Accessory Gear Box (AGB), driven by the HP rotor shaft via a tower driveshaft, provides mounting and drive for the hydraulic pump, oil pressure pump, Fuel Metering Unit (FMU), and the starter-generator. A shaft shear point in the hydraulic pump drive protects the AGB from damage if the hydraulic pump malfunctions.

Engines — FADEC System

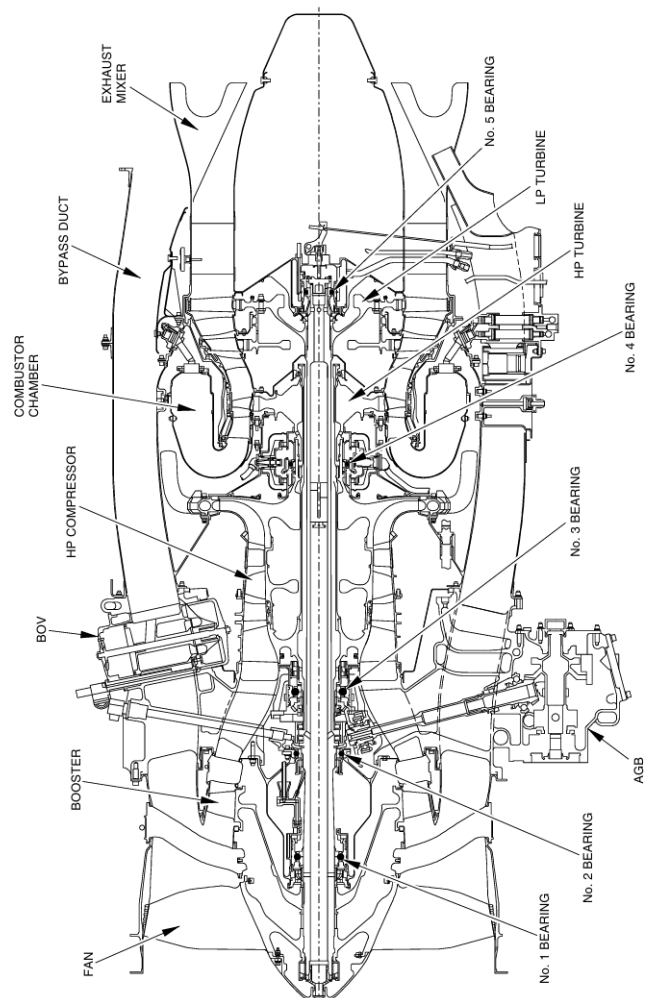
Each engine is controlled by a Full Authority Digital Engine Control (FADEC) system. The FADEC is the brain of the engine, managing all aspects of engine operation from start to shutdown. The FADEC is a twin-channel system with channels designated A and B. Identical software runs in both channels, but only one channel actively controls the engine at any time while the other monitors in standby. The system continuously evaluates which channel is healthier and automatically transfers control if a fault is detected. This dual-channel architecture ensures that engine control is maintained even in the presence of multiple component failures.

During engine starting, the FADEC performs a deliberate channel swap — it temporarily transfers control from the active channel to the standby channel to verify that the standby channel is functional and free from dormant faults. This is a safety feature that reduces the probability of an undetected failure in the backup channel.

The FADEC controls the following functions:

Fuel Metering: The FADEC commands the Fuel Metering Unit (FMU) to deliver the precise amount of fuel required for the current thrust setting, altitude, temperature, and engine condition.

Ignition Control: In AUTO mode, the FADEC automatically activates ignition during engine start and for auto-relight capability in flight. In the ON position, both igniters fire continuously (used in heavy precipitation or icing). In OFF position, ignition is deactivated (though the FADEC overrides this if the engine is running above idle).



Engine Starting Sequence — When the pilot selects START on the Start/Stop knob, the FADEC commands the starter-generator to motor the engine, monitors N2 acceleration, introduces fuel at the correct N2 speed, activates ignition, monitors ITT rise, and manages the transition to self-sustaining idle.

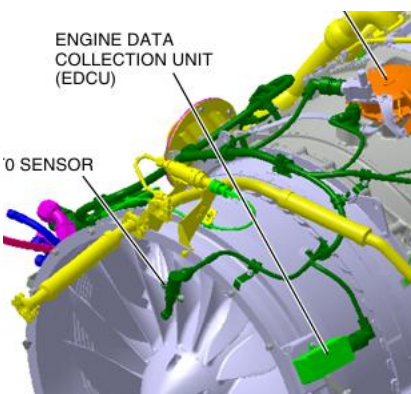
Overspeed and Overtemperature Protection: The FADEC continuously monitors N1, N2, and ITT against their respective limits and automatically reduces fuel flow if any parameter approaches or exceeds a limit.

Thrust Rating Management: The FADEC automatically provides the correct thrust rating based on the thrust lever position and flight phase.

Bleed-Off Valve (BOV) Control: The FADEC manages the compressor bleed-off valve to prevent compressor stall during transient operations (rapid thrust changes, engine start).



The engine data collection unit (EDCU/FADEC) on the PW535E1



Engines— Thrust Ratings and ATR

The FADEC provides several thrust rating modes, each designed for a specific phase of flight. The thrust rating is automatically selected based on the thrust lever position and is displayed on the EICAS as a cyan label:

Takeoff (TO) the standard takeoff thrust rating. Limited to 5 minutes duration. The thrust lever must be at the TO/GA detent. N1 target is computed by the FADEC based on the Outside Air Temperature (OAT) entered in the Takeoff Dataset on the MFD.

Takeoff Reserve (TO RSV) the maximum available thrust. Activated automatically by the ATR system when an engine fails during takeoff, or manually when both thrust levers are pushed to the MAX position with ATR armed.

Pressing the TOGA button manually engages TOGA FMA on the G3000 PFD. It does not physically move the throttle levers to the detents, and they will have to be manually placed. If you are executing a takeoff or go-around in the TO/GA detent and an engine fails, the FADEC will automatically boost the remaining engine's output to ATR (Automatic Thrust Reserve) ratings. Same thrust level as TO, limited to 5 minutes.
Go-Around Reserve (GA RSV) maximum thrust during a go-around with one engine inoperative, activated by ATR.

Maximum Continuous (CON) the highest thrust available for unlimited duration. Used after the 5-minute takeoff limit expires if continued high thrust is needed (e.g., single-engine operations).

Maximum Climb (CLB) optimized for climb operations. Fixed thrust lever position.

Maximum Cruise (CRZ) maximum thrust for cruise with all engines operating. No time limit.

Automatic Thrust Reserve/ATR (MAX): MAX detent commands the FADEC to deliver full maximum takeoff emergency reserve power via the ATR (Automatic Thrust Reserve) system. With a limit of 5 minutes continuous use.

Idle: The FADEC automatically selects the appropriate idle mode from several variants: Ground Idle (All Engines Operating or One Engine Inoperative), Flight Idle (Anti-Ice OFF or ON), and Landing Idle (Anti-Ice ON, AEO or OEI). The idle N2 varies between these modes to ensure adequate bleed air supply when anti-ice systems are active.

Automatic Thrust Reserve (ATR) the ATR is a critical safety feature. When armed (selected ON via the MFD Takeoff Dataset menu, which is the default), it monitors for engine failure during takeoff or go-around. If the FADEC detects a difference of more than 20% N1 between the engines, or a loss of communication between the two FADECs, it automatically advances the operating engine to maximum reserve thrust (TO RSV or GA RSV).

When ATR activates, the green ATR indication on the EICAS disappears and the thrust mode displays the RSV suffix (e.g., 'TO RSV'). The FADEC also automatically commands the ECS flow control valve closed to eliminate bleed air extraction from the operating engine, maximizing available thrust.

The Takeoff Dataset must be configured before every takeoff via the GTC: navigate to AIRCRAFT SYSTEMS > ENGINE SETTINGS, enter the current OAT, and select ATR ON or OFF. If no selection is made, the system defaults to ATR ON.



EICAS showing thrust rating modes

Engines Starting, Hot Starts, and Protections

The engine starting procedure is straightforward but requires attention to ITT monitoring. To start an engine, set the associated thrust lever to IDLE, then rotate the Start/Stop knob from STOP to START (momentary action) and then to RUN. The FADEC takes control of the entire start sequence automatically.

During the start, monitor the EICAS for N2 acceleration, fuel flow introduction, ITT rise, and N1 spool-up. A normal start sees ITT peak well below the starting limit and stabilize at idle within approximately 30-45 seconds of fuel introduction. Oil pressure should rise above 25 PSI at idle.

The pilot can abort any start at any time by moving the Start/Stop knob back to STOP.

Hot Start: A hot start occurs when ITT rises excessively during the start sequence. The primary cause is residual heat in the turbine section from a recent shutdown. If you restart an engine before the turbine has cooled sufficiently, the baseline temperature is elevated, leaving less margin before the ITT limit is reached.

As a rule of thumb, check the ITT indication before initiating a start. If residual ITT is above 100°C, the start will produce a significantly higher peak ITT. Waiting for ITT to cool below 60°C ensures a safe, normal start. The Engine Dry Motoring procedure (Section 3-04 of the AFM) can be used to accelerate cooling by rotating the engine without fuel to force airflow through the turbine. Tailwind conditions can also contribute to hot starts. Wind blowing into the exhaust reduces mass flow through the compressor during the start sequence, causing ITT to spike. The AFM documents a demonstrated tailwind limitation of 10 knots for engine start. Low battery capacity is another risk factor. A weak battery produces sluggish N2 acceleration from the starter-generator. If the compressor is not spinning fast enough when fuel is introduced, there is insufficient airflow to prevent an ITT exceedance. Ensure battery voltage is at least 24V before attempting a start.

FADEC Engine Protections: The FADEC provides multiple layers of automatic engine protection:

N1 Overspeed Protection: Automatically reduces fuel flow when N1 exceeds 100%.

N2 Overspeed Protection: Reduces fuel flow when N2 exceeds 101%.

ITT Overtemperature Protection: Reduces fuel flow when ITT exceeds the rating limit. During ground starts, the FADEC will automatically abort the start if ITT reaches 740°C to prevent mechanical damage.

Shaft Shear Protection: An independent mechanical fuel shutoff system that activates if the LP turbine shaft fractures. The rearward movement of the LP turbine trips a plunger connected to an emergency shutoff valve in the FMU.

Emergency Shutdown: Pushing the ENG SHUTOFF button on the fire protection panel immediately cuts fuel and bleed air to the affected engine and closes the hydraulic shutoff valve.

Engine Warm-Up: After engine start, operate at or near idle for at least 2 minutes before selecting higher thrust settings. This allows thermal stabilization of the engine components. Normal taxi time can count toward this warm-up period.

Starter Limits: The starter-generators have strict duty cycle limitations that must be respected to avoid damage. Each start attempt or dry motoring cycle counts as one motoring, and each motoring must not exceed 60 seconds. The required cool-down periods are shown in the table below. After four sequential motoring, the cycle may be repeated following the 30-minute cool-down.

These limits apply to both normal start attempts and dry motoring (engine cranking without fuel for cooling purposes). In the FSReborn simulation, these starter limits are fully enforced. Exceeding them will damage the starter-generator, requiring repair or replacement through the EFB Maintenance page. This is one of those areas where the simulation rewards patience and punishes impatience, just like the real aircraft.

Motoring 1 → 260 seconds cool-down

Motoring 2 → 360 seconds cool-down

Motoring 3 → 415 minutes cool-down

Motoring 430 minutes cool-down



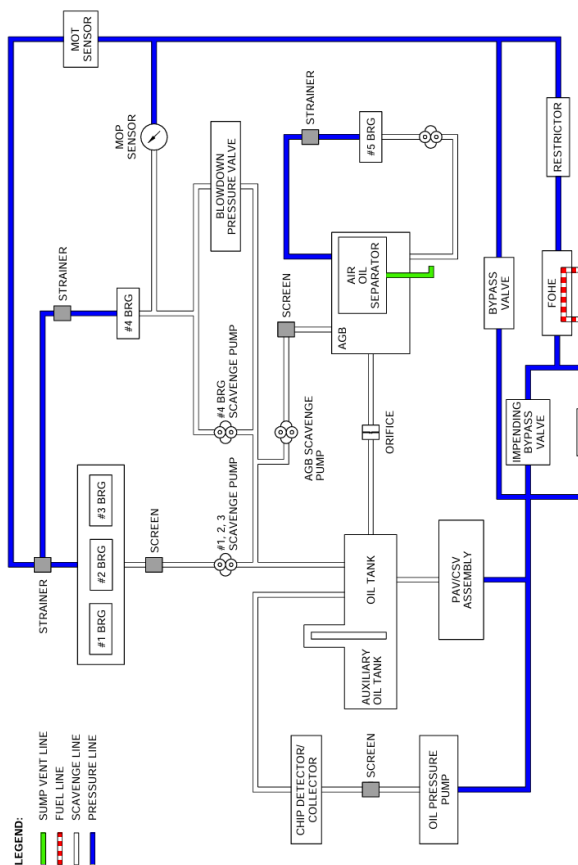
Engine 1 start



Engine 1 & 2 Idle Stable



Engine 2 Hot Start



Engines Oil System and Indications

Each PW535E1 engine has an independent, self-contained lubrication system using a positive-displacement vane-type oil pump. The system provides cooling and lubrication to the engine bearings, gears, and accessories.

The oil system has a total capacity of 4.85 litres per engine, with a recommended operating level of 4.3 litres. Oil is supplied from the tank through a magnetic chip detector (for maintenance monitoring), through a filter, and to the engine components. A Fuel-Oil Heat Exchanger (FOHE) uses fuel flow to cool the oil, preventing overtemperature during sustained high-power operations.

Oil pressure is displayed on the EICAS. Normal operating range is 45-160 PSI (green indication). At ground idle, the minimum acceptable pressure is 25 PSI. Pressure below 45 PSI at N2 speeds above 60% is undesirable and should only be tolerated for flight completion at reduced power. If oil pressure drops below limits, the E1(2) OIL LO PRES warning CAS message is displayed, requiring engine shutdown.

Oil temperature maximum is 132°C. The EICAS will show oil temperature with green for normal range and yellow for caution range.

In the FSReborn simulation, oil is consumed during engine operation at a realistic rate. Oil consumption increases if maintenance is overdue, and oil leaks can develop if the oil change interval is significantly exceeded. The oil quantity and condition can be monitored and maintained through the EFB Maintenance page. Running the engine with critically low oil will eventually lead to engine seizure and failure.

Oil System Capacity	8.14L litres per engine
Recommended Oil Level	4.3 litres
Oil Pressure Normal Range	45-160 PSI
Oil Pressure Ground Idle Min	25 PSI
Oil Temperature Maximum	132°C
Oil Change Interval (Sim)	Every 200 engine hours
Engine Maintenance Interval (Sim)	Every 2,500 engine hours
Engine Overhaul (Sim)	Full overhaul resets tachometer

Electrical System Power Generation



Electrical synoptic page

The Electrical Power Generation and Distribution System (EPGDS) provides all DC power to the aircraft systems. The system is designed for fully automatic operation, with manual override capability available to the flight crew for abnormal situations.

The main power generation consists of two engine-driven 400A starter-generators (SG 1 and SG 2), one mounted on each engine's Accessory Gear Box. Each starter-generator serves a dual role: during engine start, it functions as a starter motor; once the engine is running, it automatically transitions to generator mode and comes on line to power its respective DC bus. The starter-generators provide continuous 28 VDC power rated at 330A on the ground and 390A in flight.

Each starter-generator is monitored and controlled by a dedicated Generator Control Unit (GCU). The GCUs manage connector switching, voltage regulation, overcurrent protection, fault isolation, load shedding, and continuous built-in testing. The GCUs are physically separated and installed in the temperature-controlled rear electronic bay for reliability. For automatic operation, the GEN 1 and GEN 2 switches must be in the AUTO position.

The aircraft carries two Valve-Regulated Lead-Acid (VRLA) batteries: Battery 1 (34 Ah) and Battery 2 (36 Ah). Battery 1 floats on the Emergency Bus and is charged by SG 1. Battery 2 floats on the Central Bus and is charged by SG 2. Battery 2 also provides the primary electrical power for engine starting. During an engine start, Battery 1 is segregated from the start system to prevent electrical transients from affecting aircraft loads — a deliberate design feature.

A Ground Power Unit (GPU) can be connected via an external DC receptacle. The GCU 1 monitors GPU power quality (overvoltage, undervoltage, and reverse polarity protection). The GPU must provide between 24.5V and 29V to be accepted. The GPU AVAIL lamp illuminates when quality checks pass; pressing the GPU button connects it. The EPGDS enforces a power source priority: whichever source (generators or GPU) connects first retains priority until disconnected. The minimum GPU rating required is 400A continuous with 1,000A peak.

The minimum battery temperature for normal operation is -10°C (14°F). At least one battery must be connected before the GPU can power the aircraft.

Electrical System Bus Architecture and Distribution

The power distribution system is built around three independent Power Distribution Units (PDUs): the Left PDU (LPDU), Right PDU (RPDU), and Emergency PDU (EPDU). These units house all the connectors, relays, circuit breakers, fuses, and bus bars. The bus architecture operates in a split-bus configuration during normal operations:

DC BUS 1 — Powered by SG 1 (left engine). Supplies the cockpit flow control valve, weather radar, windshield heater 1, engine 1 anti-ice, flap system, IASP 1, and numerous other loads.

DC BUS 2 — Powered by SG 2 (right engine). Supplies the autopilot pitch servo, cabin flow control valve, engine 2 anti-ice, fuel pump 2, ice detector, rudder spring actuator, and other loads.

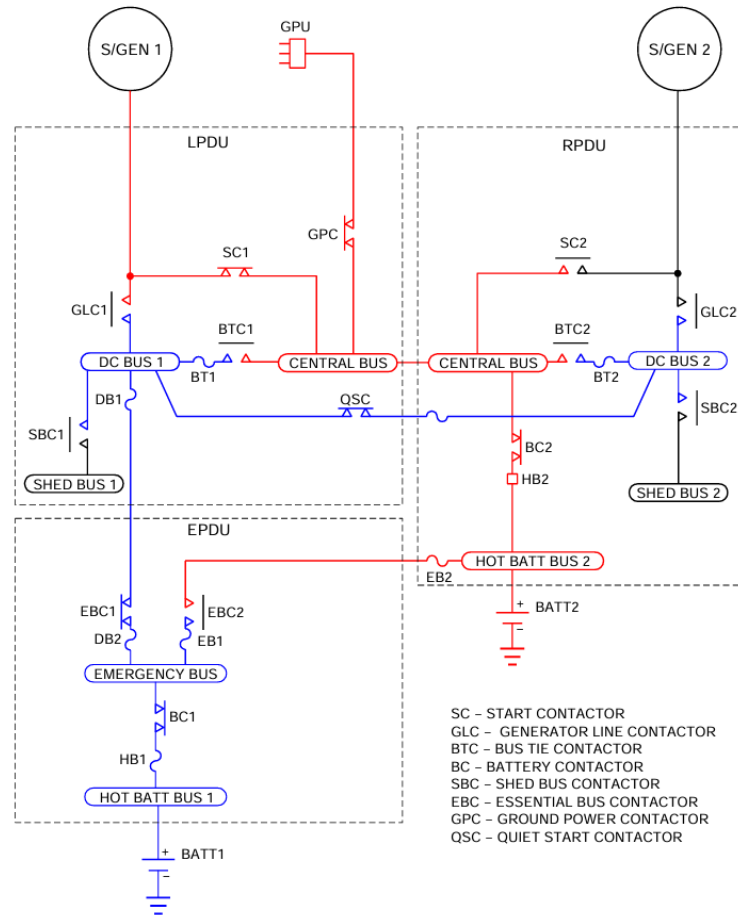
CENTRAL BUS — Normally powered by SG 2 through Bus Tie connector 2 (BTC 2). BTC 1 remains open to maintain channel isolation. The Central Bus connects to Battery 2 for engine starting.

EMERGENCY BUS - Powered by SG 1 through Emergency Bus connector 1 (EBC 1) via hardwire logic. This is the most critical bus, powering PFD 1, IESI, Audio Panel 1, AHRS 1, FADEC channels 1A and 2A, fuel pump 1, landing gear control, brake control, transponder 1, emergency lighting, engine fire extinguisher, and the fuel/crossfeed shutoff valve actuators.

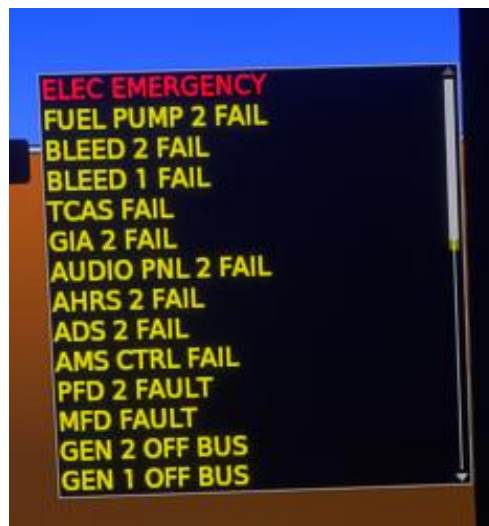
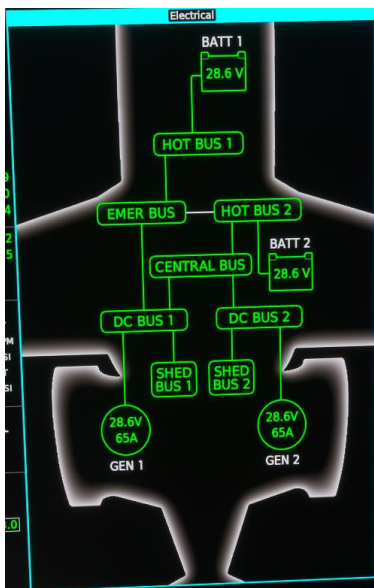
HOT BATTERY BUSES 1 & 2 - Always energized whenever batteries are installed, regardless of switch positions. These power the battery connectors, GCU battery power, and the rudder gust lock actuator.

SHED BUSES 1 & 2 - Power non-essential loads (cabin entertainment, galley equipment, water/waste systems). These are automatically disconnected during single-generator operation or electrical emergency to protect remaining power sources from overload.

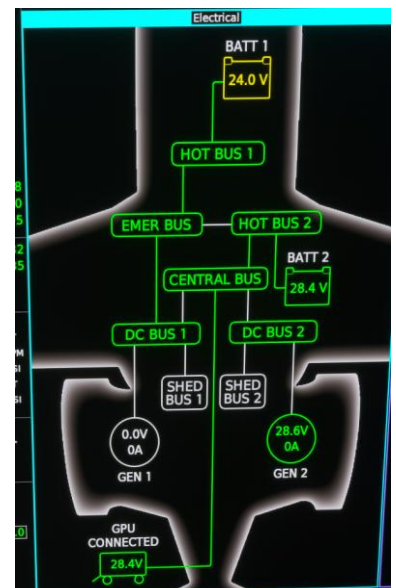
BUS TIE knob — In AUTO position, the bus tie connectors operate automatically. If one generator fails, the remaining generator picks up all loads except the shed buses through automatic bus tie connector closure. Setting to '1 OPEN' or '2 OPEN' manually isolates the respective bus.



Electrical bus schematic diagram



normal generator operation vs single generator failure & Electrical Emergency CAS



Electrical System — Emergency Power and Sim Features

If both generators fail in flight, the EPGDS automatically configures the electrical emergency: Generator Line connectors and Shed Bus connectors open, Bus Tie connectors are locked out, and both batteries are paralleled on the Emergency Bus through EBC 2. The ELEC EMER CAS warning message is displayed.

The Emergency Bus provides approximately 45 minutes of battery-powered operation. During this time, the aircraft can be flown manually using PFD 1, IESI, basic COM radio, and essential engine indications. The EMER LT switch should be set to OFF to conserve battery power unless emergency lighting is needed for landing.

If the automatic transfer fails (ELEC XFER FAIL CAS message), the pilot can force emergency power by pushing the ELEC EMER button on the electrical panel.

Key equipment lost during electrical emergency includes: AHRS 2, anti-ice system, autopilot, flap system, flight director, GPS 2/VOR 2/ILS 2, MFD, pitch trim (normal), PFD 2, pressurization auto mode, roll/yaw trim, spoiler system, strobe lights, weather radar, windshield heaters, and yaw damper.

In the FSReborn simulation, the electrical system is fully modelled with realistic connector logic and bus distribution. Battery capacity depletes realistically, and neglecting battery maintenance (via the EFB Maintenance page) will reduce battery lifespan and eventually cause electrical issues. Generator maintenance is required every 250 hours; neglected generators can cause electrical faults. All electrical failures can be disabled via the Realism settings.

Battery 1 Capacity	34 Ah (VRLA)
Battery 2 Capacity	36 Ah (VRLA)
Min Battery Voltage for Dispatch	23.5V each
Min Battery Voltage for Engine Start	24V
Min Battery Temp for Operation	-10°C (14°F)
Min GPU Voltage for Battery Charge	27V
GPU Voltage Acceptance Range	24.5V – 29V
Max Generator Load (Ground)	330A each
Max Generator Load (In Flight)	390A each
Emergency Bus Battery Duration	~45 minutes
Alternator/Generator Maintenance (Sim)	Every 250 hours
Battery Maintenance Interval (Sim)	~600 hours lifespan

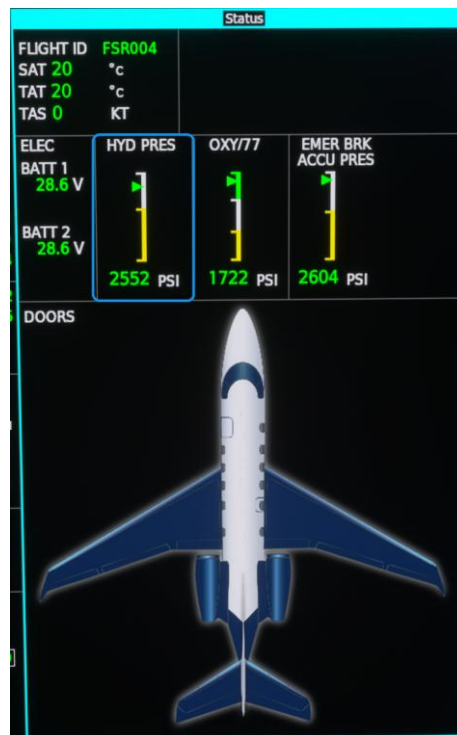
Hydraulic System

The hydraulic system provides pressure for operation of the landing gear, multifunction spoilers (speed brakes and roll spoilers), wheel brakes, stick pusher (stall protection), and rudder booster.

The system consists of two engine-driven pumps (EDP), one per engine, providing variable flow at 3,000 PSI nominal pressure. Two shutoff valves (HYD PUMP SOV 1 & 2) are located upstream of each pump and can be commanded from the cockpit or close automatically in the event of hydraulic over temperature or engine fire.

A priority valve ensures that in low-pressure conditions, hydraulic power is maintained for critical systems (spoilers, stick pusher, rudder booster, brakes) by restricting flow to the landing gear. The priority valve allows full flow above 2,500 PSI and restricts flow below 2,100 PSI.

A hydraulic accumulator provides additional pressure during simultaneous brake applications and ground spoiler deployment. Hydraulic system status is displayed on the MFD synoptic page, with pressure indications turning yellow below 1,800 PSI.



In the FSReborn simulation, hydraulic pump maintenance is required every 200 hours. Neglecting maintenance can lead to hydraulic failures affecting gear extension, braking, and spoiler operation.

Fuel System Storage, Feed, and Distribution

The fuel system provides storage, distribution, and indication for fuel carried aboard the aircraft. The system is powered by 28V DC and controlled by the Electronic Fuel Control Unit (EFCU), a dual-channel microprocessor unit that processes fuel quantity data, manages pump logic, and provides cockpit warnings.

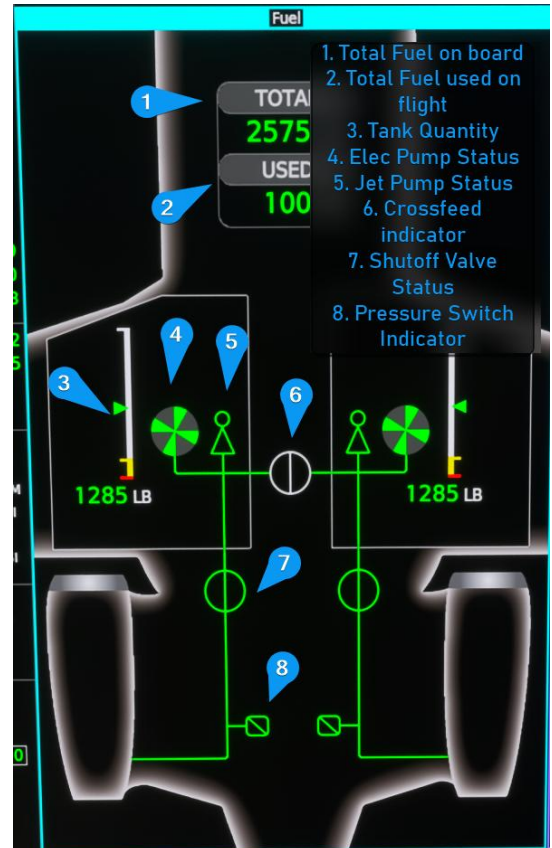
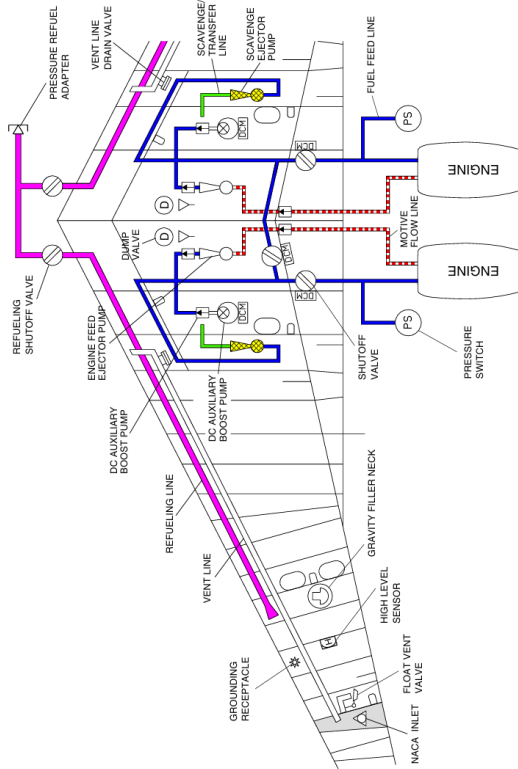
Fuel is stored in two integral wing tanks, one in each wing. Total usable fuel capacity is 5,352 lb (2,428 kg), carried in two integral wing tanks of 2,676 lb (1,214 kg) each. This equates to 798.8 US gallons (3,024 litres) total, or 399.4 US gallons (1,512 litres) per tank. Each wing tank has a collector tank at its lowest point that ensures a constant fuel supply to the engine during all flight attitudes, including uncoordinated manoeuvres. Scavenge ejector pumps continuously transfer fuel from the main tank area into the collector tanks.

Normal Engine Feed - Under normal operation, each engine is fed by its own wing tank through ejector pumps. These ejector pumps are driven entirely by high-pressure motive flow returned from the engine — no electrical power is required. This is a critical safety feature: even in a total electrical failure, fuel continues to flow to the engines.

DC Auxiliary Boost Pumps - Two electrical centrifugal fuel pumps (one per wing, inside the collector tank) provide pressurized fuel for three purposes: engine starting (before motive flow is available), crossfeed operations, and as a backup if the primary ejector pumps fail. In AUTO position on the fuel panel, the EFCU automatically activates the DC pump when low pressure is detected (below 6 PSI). If the DC pump activates automatically, the FUEL 1(2) FEED FAULT advisory CAS message is displayed, alerting the crew that the primary feed system has failed and the backup is running.

Engine Fuel Shutoff Valves (SOVs) - Two ball-type shutoff valves (one per engine feed line) are installed in the wing-to-fuselage fairing, outside the fuel tank. These valves are normally open and close only when the crew pushes the fire shutoff button on the fire protection panel, cutting fuel to the affected engine. Thermal relief features prevent pressure build up from fuel expansion after shutdown

Fuel Quantity Measurement - Eight capacitance fuel quantity probes (distributed across both tanks) measure fuel mass. The system is self-calibrating and requires no adjustment. Fuel quantity is displayed on the EICAS and the fuel synoptic page on the MFD in the pilot's selected units (lbs or kg). If one wing tank quantity indication is lost, the total fuel indication is also lost. There is no electrical wiring inside the fuel tanks — a deliberate safety design to prevent any ignition source near fuel vapours.



Fuel System Crossfeed, Indications, and Refuelling

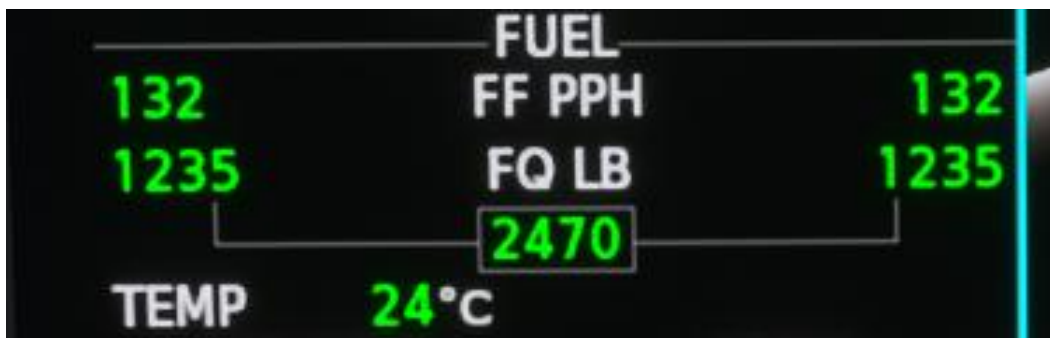


Crossfeed Operation: The crossfeed system balances fuel between the left and right wing tanks. If an imbalance greater than 100 kg (220 lb) persists for more than 10 seconds, the FUEL IMBALANCE caution CAS message is displayed.

To correct an imbalance, set the XFEED knob to the lowest fuel side: LO1 if the left wing is lower (opens crossfeed valve and activates the right tank DC pump to feed both engines from the right tank), or LO2 if the right wing is lower (activates the left tank DC pump). An arrow on the MFD fuel synoptic shows fuel flow direction through the crossfeed valve.

The FUEL IMBALANCE CAS message clears when the imbalance reduces to approximately 60 kg (132 lb). When the tanks are balanced (difference less than 10 kg / 22 lb), the FUEL EQUAL advisory message appears, signalling the crew to return the XFEED knob to OFF. The crossfeed valve does not close automatically and the crew must manually set it to OFF. Crossfeed must not be used during takeoff or landing phases.

Fuel Indications: The MFD provides comprehensive fuel information: individual tank quantities with color-coded scales (green = normal, yellow = low, red = zero), total fuel remaining, total fuel used, fuel flow per engine, fuel temperature (measured in the left tank), electric pump status, jet pump status, crossfeed valve position, shutoff valve status, and low pressure switch indications. Fuel temperature limits are important: minimum -37°C (below this, fuel may begin to gel), maximum 52°C on the ground and 80°C in the air.



Refuelling: Pressure refuelling is performed through a standard 2.5-inch single-point adapter on the right wing-to-fuselage fairing. The refuelling control panel (located externally near the adapter) provides quantity preselection via INC/DEC switches, a repeater display, tank selection, refuel SOV control, shutoff test, and power selection (NORM = DC BUS 1, BATT = HOT BUS 2).

In automatic mode, the EFCU controls fuel flow and closes the valves when the target quantity is reached. In manual mode, the crew operates the refuel switch directly. High-level sensors in each tank provide automatic shutoff override as a safety backup. Maximum refuelling time from empty to full is less than 12 minutes at 50 PSI.

Gravity refuelling is also possible through filler caps on the top surface of each wing, with grounding ports provided near each cap.

Pressurization and Air Conditioning Pneumatic System

The Air Management System (AMS) encompasses the pneumatic system, environmental control system (air conditioning), and pressurization system. These subsystems work together to provide a safe, comfortable cabin environment from sea level to the aircraft's maximum operating altitude of 45,000 ft.

Pneumatic System - Two independent engine bleed air circuits, one from each engine, provide temperature and pressure-controlled pneumatic supply. Each circuit consists of a Pre-Cooler heat exchanger (cross-flow type, cooled by fan air), a Pressure Regulating Shutoff Valve (PRSOV) that regulates the supplied air pressure and shuts off bleed extraction when necessary (fail-safe position is closed), a Fan Air Valve (FAV) that regulates cooling airflow through the pre-cooler (fail-safe position is open), dual-element bleed temperature sensors, and a pressure transducer.

The BLEED 1 and BLEED 2 switches on the overhead panel control the PRSOVs. In AUTO position, the system operates fully automatically under the authority of the AMS Controller. The XBLEED knob controls the Cross Bleed Valve (XBV): in AUTO mode, the XBV opens automatically when one engine is not providing bleed air, allowing the operating engine to supply both sides of the system. In OFF mode, the bleed systems are completely isolated from each other.

The pneumatic system supplies bleed air to three user systems: Air Conditioning (cabin heating and cooling), Cabin Pressurization, and Wing/Horizontal Stabilizer Anti-Ice (WHSAIS).

Automatic Bleed Management: This is an important aspect of the pneumatic system that often surprises pilots who are new to the Phenom 300E. When the BLEED switches are in AUTO, the AMS Controller has full authority to open and close the PRSOVs based on the current operating conditions. This means the bleeds will not always be open just because the switches are in AUTO. The AMS Controller continuously evaluates the system and will automatically command a PRSOV closed for a variety of reasons, including: the associated engine is not running or not producing sufficient bleed pressure, bleed air temperature is outside the controlled range, a bleed leak or overpressure condition has been detected, a component failure has been identified, or the system simply determines that bleed air is not required in the current configuration.

When a PRSOV closes for any reason the BLEED 1 OFF or BLEED 2 OFF advisory CAS message is displayed on the EICAS. This is entirely normal behavior and does not indicate a fault. It simply tells you that the respective bleed side is currently not supplying air.

On the ground, the AMS Controller uses Outside Air Temperature (OAT) to determine how much bleed air the cabin needs. The logic follows three distinct temperature bands:

Above 30°C (86°F) Both PRSOVs are commanded closed. The cabin does not need heating in hot conditions, and keeping the bleeds closed reduces unnecessary engine load and prevents overheating the already-warm cabin. You will see both BLEED 1 OFF and BLEED 2 OFF CAS messages. This is completely normal on a hot day.

Between 11°C and 30°C (52°F to 86°F) The system operates in single-bleed mode. Only one PRSOV opens (the one associated with the first engine that was started), while the other remains closed. One bleed circuit provides sufficient air conditioning in moderate temperatures. You will see one BLEED OFF message for the side that remains closed.

Below 8°C (46°F) Both PRSOVs open for dual-bleed operation. In cold conditions, the cabin needs maximum heating capacity, so both engines contribute bleed air. Both bleeds will show as active on the ECS synoptic.

Between 8°C and 11°C (46°F to 52°F) This is a hysteresis zone. The system maintains whatever mode it was already in to prevent the bleeds from constantly cycling open and closed as the temperature fluctuates around a single threshold.

Additionally, after an engine start, there is a brief delay of several seconds before the AMS Controller opens the associated PRSOV. This allows the engine to stabilize at idle before bleed air extraction begins. During this delay, the BLEED OFF message is displayed and is perfectly normal.

In flight, the ground temperature logic no longer applies and the AMS Controller manages bleed extraction based on the demands of the air conditioning and pressurization systems. The key point is: if your BLEED switches are in AUTO and you see a BLEED OFF message, the system is doing its job.

If the AMS Controller detects a genuine fault such as a bleed leak, overpressure, or component failure — it will display a more specific CAS message such as BLEED 1 FAIL, BLEED 1 LEAK, or BLEED 1 OVERPRES. These messages require crew action per the emergency procedures. The simple BLEED OFF message, by contrast, is advisory only and typically requires no pilot intervention.

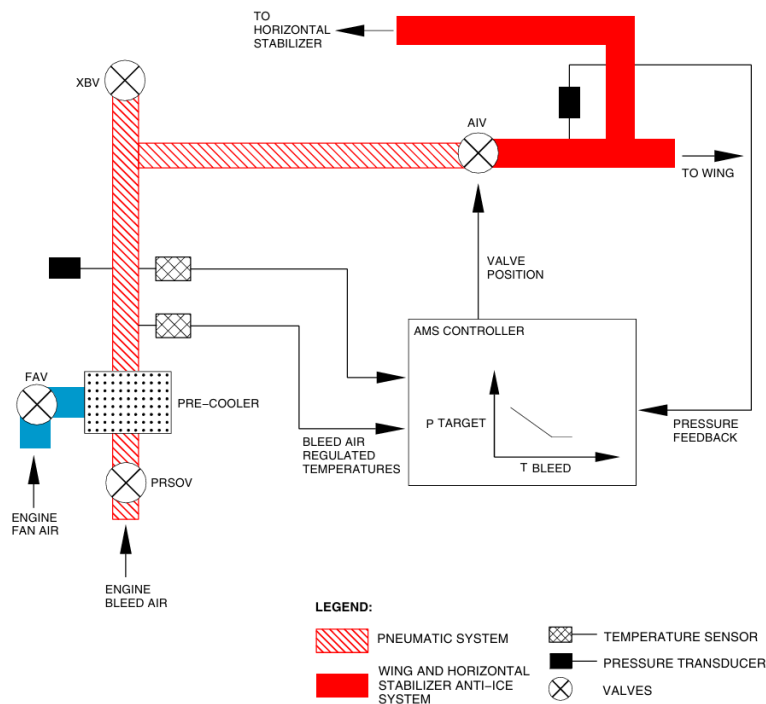
The cross bleed valve (XBV) also operates automatically in AUTO mode. If one engine is running and the other is not, the XBV opens to allow the running engine's bleed air to supply both sides of the system. This is essential for single-engine ground operations and ensures the air conditioning and pressurization systems continue to function with one engine shut down.

Bleed Air Temperature Regulation: The AMS Controller regulates the bleed air temperature delivered to the user systems via the pre-cooler and Fan Air Valve. The target temperature varies with conditions: approximately 120°C when below 25,000 ft with only

air conditioning operating, 220°C above 25,000 ft, 260°C when the wing/stabilizer anti-ice system is operating on both engines, and 280°C when anti-ice is operating on a single engine. These temperatures are managed automatically and do not require pilot input. Bleed air leakage is monitored by dedicated sensors throughout the pneumatic ducting. If a leak is detected, the BLEED 1(2) LEAK



CAS message is displayed and the AMS Controller automatically closes the affected PRSOV and the cross bleed valve to isolate the leak. This is a protective action that requires crew assessment per the emergency procedures.



Pressurization and Air Conditioning Cabin Pressure Control



The Cabin Pressure Control System (CPCS) maintains the cabin at a safe and comfortable pressure throughout all phases of flight. The system controls the outflow valve position to regulate the rate at which cabin air escapes, thereby controlling cabin altitude and cabin rate of climb/descent.

The maximum cabin differential pressure is 9.4 PSI. At the aircraft's maximum operating altitude of 45,000 ft, this maintains a cabin altitude of approximately 6,600 ft, well within the comfortable range for passengers without supplemental oxygen.

Automatic Mode: In AUTO mode (PRESN MODE switch set to AUTO), the system automatically manages cabin altitude based on the Landing Field Elevation (LFE) entered by the crew via the MFD. The system calculates an optimal pressurization schedule that ensures the cabin reaches field elevation just as the aircraft lands, while maintaining comfortable cabin climb and descent rates throughout.

Manual Mode: In MAN mode the pilot directly controls cabin altitude using the CABIN ALT switch (UP to increase cabin altitude / decrease pressurization, DN to decrease cabin altitude / increase pressurization). Manual mode is used as a fall back if automatic pressurization fails (PRESN AUTO FAIL CAS message), or when the pilot needs direct control of cabin pressure.

ECS Knob: The ECS knob on the pressurization panel selects which air conditioning pack(s) supply the cabin: ECS 1 (left engine bleed only), BOTH (normal operation = both packs active), ECS 2 (right engine bleed only), or OFF VENT (both packs off, emergency ram air ventilation only through the Ram Air Valve).

DUMP Button: Pushing the DUMP button immediately opens the outflow valve fully, allowing cabin pressure to equalize rapidly with ambient pressure. This is used during emergency descent procedures (to prevent the cabin from being pressurized above the aircraft's rapidly decreasing altitude) or before emergency evacuation. The pressurization system displays cabin altitude, cabin vertical speed, and cabin differential pressure on the MFD pressurization synoptic page. Cabin altitude rising above approximately 10,000 ft triggers the CABIN ALTITUDE HIGH warning CAS message, which is one of the most critical warnings in the aircraft, requiring immediate oxygen mask donning and emergency descent



Pressurization Values during climb

Max Cabin Differential Pressure **9.4 PSI**
 Cabin Altitude at FL450 **~6,600 ft**
 Cabin Altitude Warning Trigger **~10,000 ft**
 Normal Cabin Rate of Climb **~500 ft/min max**
 Normal Cabin Rate of Descent **~300 ft/min max**

Cabin Temperature Simulation Environmental Factors

The FSReborn Phenom 300E features one of the most detailed cabin temperature simulations available in any flight simulation add-on. The cockpit and cabin are modelled as two independent thermal zones, each with their own heat loads, cooling sources, and thermal inertia. The temperature you see on the ECS synoptic page is not a simple number, it is the result of a continuous thermodynamic calculation that accounts for every significant heat source and sink affecting the aircraft.

Solar Radiation: The sun's position throughout the day directly affects cabin temperature. Solar heating follows a realistic daily cycle: zero heat at night (before 6AM and after 6PM), a gradual increase through the morning, reaching peak intensity between noon and 2PM, then declining through the afternoon. On a hot sunny afternoon parked on the ramp, the cabin can become uncomfortably warm before the air conditioning has time to cool it down exactly as happens on a real aircraft.

The cabin has 9 windows (5 on the left, 4 on the right), and the cockpit has a large windshield area. Each window allows solar energy to enter the cabin, but passengers can close their window shades to reduce solar heat gain significantly. With shades open, a window absorbs approximately 70% of incident solar energy; with shades closed, this drops to about 15%. On a sunny day, encouraging passengers to close their shades (or closing them yourself via the cabin management system) can make a meaningful difference to cabin temperature.

The cockpit windshield has no shades and is always exposed to full solar radiation, which is why the cockpit often runs warmer than the cabin during daytime ground operations.

Outside Air Temperature: The external temperature constantly drives heat through the fuselage insulation. On hot days, heat flows inward, warming the cabin. At cruise altitude where, outside air temperatures can reach -50°C or below, heat flows outward through the fuselage, cooling the cabin. The insulation provides resistance to this heat transfer, but it is never perfect just as in a real aircraft.

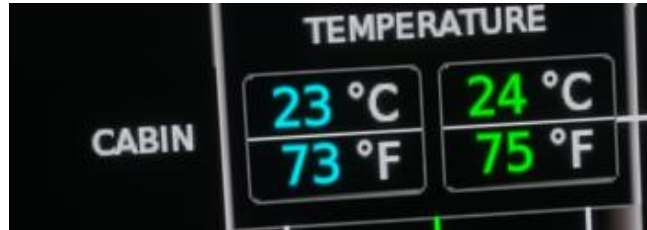


Airspeed Effects: The aircraft's speed through the air significantly affects heat transfer. The cockpit, positioned at the front of the aircraft, experiences increased convective heat loss at speed due to direct wind impact on the nose and windshield. The cabin, located behind the cockpit, is aerodynamically shielded by the boundary layer — at cruise speed, the cabin actually loses less heat than it would standing still. This means the cockpit tends to cool down faster at speed, while the cabin retains heat more effectively. This differential is noticeable on the ECS synoptic page during climb and cruise.

Altitude: As the aircraft climbs, the outside air temperature drops and the air becomes thinner. Both of these factors affect heat transfer through the fuselage. Additionally, the cabin air density inside the pressurized cabin changes based on the cabin pressure altitude (not the aircraft altitude), which affects the thermal capacity of the air — a subtle but physically accurate detail.

Body Heat: Every person aboard generates body heat. Two pilots and seven passengers all contribute to warming the cabin. The avionics systems (particularly in the cockpit) also generate significant electrical heat. A full aircraft will warm up faster than an empty one.

Open Door: When the main cabin door is open on the ground, there is massive heat exchange with the outside air. On a hot day, this brings hot air flooding into the cabin. On a cold day, it rapidly cools the cabin. Wind speed on the ground amplifies this effect. Closing the door is the first step toward establishing temperature control.



Cabin temperature rising on a hot sunny ramp with door open — before ECS activation



Window shades effect — comparison of cabin solar heat with shades open vs closed

Cabin Temperature Simulation Heat Exchanger and Temperature Control

The heart of the temperature control system is the Heat Exchanger (HX) and the Temperature Modulating Valves (TMVs). Understanding how this work will help you manage cabin comfort more effectively.

Bleed Air Source: Hot, compressed air is drawn from the engines through the Pressure Regulating Shutoff Valves (PRSOVs). This bleed air arrives at very high temperatures (typically 120-280°C depending on engine power setting). It is far too hot to be used directly for cabin heating.



Heat Exchanger (HX): The bleed air passes through a heat exchanger that is cooled by ram air drawn through a NACA scoop on the fuselage. The HX cools the bleed air to a much lower temperature. The effectiveness of the HX increases with airspeed (more ram air flowing through it) and altitude (colder ram air). On the ground with no airspeed, a ground cooling fan provides airflow through the HX, but it is less effective than ram air in flight. The HX has thermal inertia meaning it does not respond instantly but gradually adjusts as conditions change.

Temperature Modulating Valves (TMV): Two independent TMVs control the temperature of air delivered to the cockpit and cabin respectively. Each TMV mixes cold air from the HX output with hot bleed air that bypasses the HX. The mixing ratio determines the duct temperature: full cold position delivers the coldest possible air from the HX, while full hot position delivers the hottest bleed air. Any position in between provides a proportional blend.

Automatic Mode: In AUTO mode, the TMVs automatically adjust their position based on the difference between the selected setpoint temperature (set by the CKPT TEMP and CABIN TEMP knobs) and the actual zone temperature. If the cabin is too warm, the TMV moves toward the cold position to deliver cooler air. If the cabin is too cold, it moves toward hot. The system uses proportional control with integral action, meaning it gradually eliminates any steady-state error over time. The TMV movement rate is limited to prevent abrupt temperature swings, it moves smoothly and progressively, just like the real system. Duct temperature limits are enforced in auto mode to prevent excessively hot air from entering the cabin: approximately 80°C on the ground and 92°C in flight (higher in flight because the cabin loses heat faster at altitude and may need more heating capacity).



Manual Mode: In MAN mode, the pilot directly controls the TMV position using the AIR CONDITIONING TEMP switch (press up for hotter, down for colder). This provides direct authority over the duct temperature without the automatic control loop. In manual mode, the full duct temperature range is available (approximately 5°C to 150°C), and the independent cockpit/cabin zone control is not available because both zones respond to the same manual input. Manual mode is primarily used as a fallback if the automatic controller fails (AMS CONTROLLER FAILURE CAS message), but some pilots prefer it for specific situations such as rapid cabin warm-up on cold days.

Vapor Cycle System (VCS): In addition to the bleed air system, a Vapor Cycle System (compressor-based air conditioning, similar to a household air conditioner) provides supplemental cooling. The VCS has an evaporator in both the cockpit and the cabin, each with an independent fan (controllable at Low, Medium, or High speed via the CKPT FAN and CABIN FAN switches). The VCS is most effective on the ground where the HX cooling is limited by low ram airflow. In flight, the VCS is less critical because the cold outside air makes the HX very effective.

The evaporator fans serve a dual purpose: with the VCS compressor running, they circulate cooled air. Without the compressor, they simply recirculate cabin air, helping to distribute temperature more evenly which is useful for eliminating hot and cold spots. **Thermal Inertia:** The cabin does not respond instantly to temperature control inputs. The seats, panels, walls, and cabin structure all have thermal mass that must be heated or cooled along with the air. This means it takes time for the cabin to reach the selected temperature after engine start, especially if the aircraft has been sitting in the sun. **Plan accordingly:** starting the engines and setting the desired temperature a few minutes before passenger boarding gives the system time to condition the cabin.

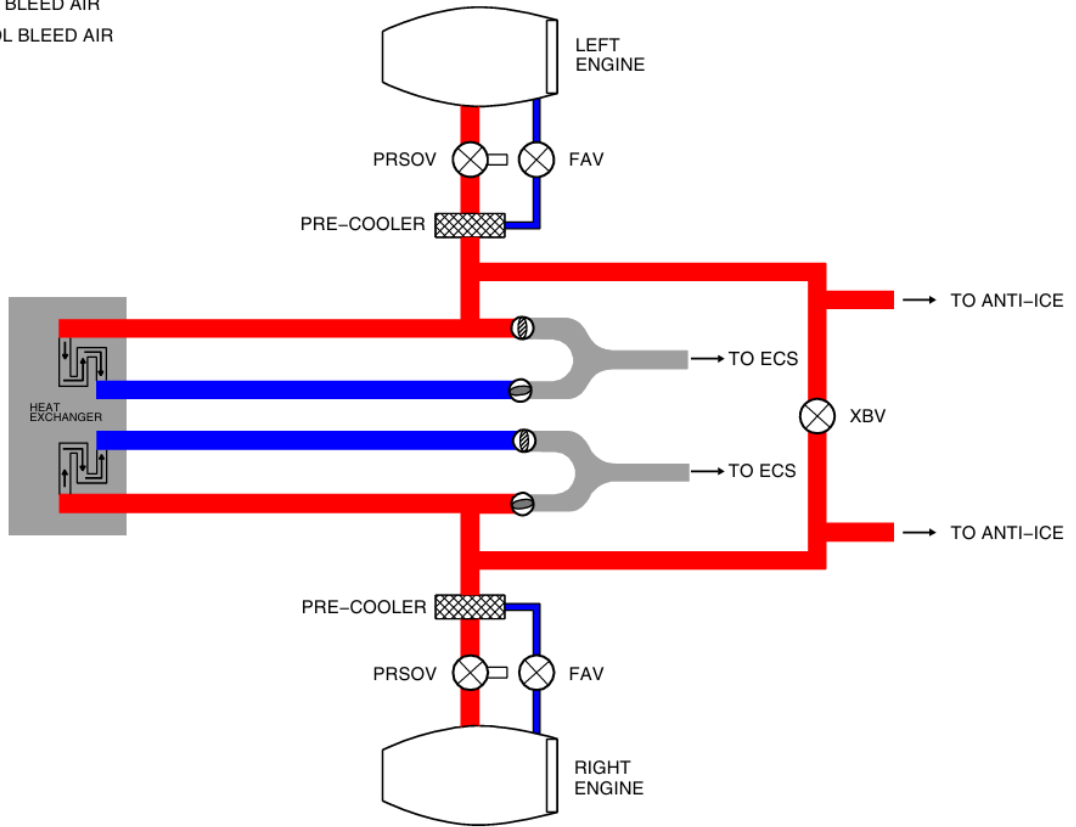
Inter-Zone Heat Transfer: The cockpit and cabin are not completely isolated from each other. Heat transfers between the two zones through the gap between them. If the cockpit is significantly warmer or cooler than the cabin, heat will flow between the zones until



they equalise somewhat. This is why very different cockpit and cabin temperature settings can be difficult to maintain since the zones influence each other.

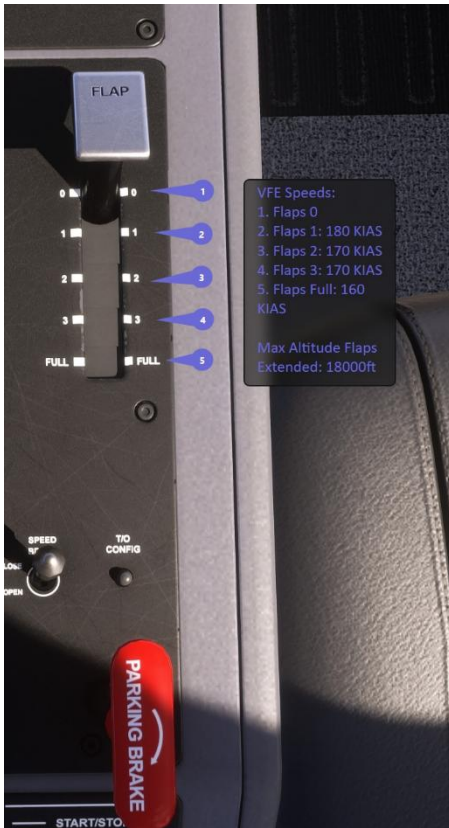
LEGEND:

- █ HOT BLEED AIR
- █ COOL BLEED AIR



Flight Controls

The Phenom 300E uses conventional flight controls with mechanical linkages for the primary surfaces (ailerons, elevator, rudder) and hydraulically-actuated secondary surfaces (flaps, spoilers).



The flap system provides five positions: 0, 1, 2, 3, and FULL, each with a corresponding maximum speed (VFE). The Flap Control Electronics (FCE) manages flap operation, and a FLAP FAIL CAS message is displayed if the system detects a malfunction. The multifunction spoilers serve as both speed brakes (symmetric deployment) and roll spoilers (asymmetric deployment to assist aileron authority). A ground spoiler function provides automatic deployment on landing when the speed brake switch is in the ARMED position.

Pitch trim is provided by a movable horizontal stabilizer, with normal and backup modes. The backup pitch trim mode (PITCH BKP) provides an alternate trim path if the normal system fails.

A yaw damper provides directional stability and reduces roll oscillations. It should be engaged above 400 ft AGL after takeoff and disengaged before landing. The ventral rudder provides additional directional stability at high altitudes.

The stick pusher is part of the stall protection system and physically pushes the control column forward to reduce angle of attack when an impending stall is detected. The PUSHER CUTOUT button on the central pedestal can disable the pusher if an inadvertent actuation occurs.

VFE Flap 1	180 KIAS
VFE Flap 2	170 KIAS
VFE Flap 3	170 KIAS
VFE Flap FULL	160 KIAS
Max Altitude Flaps Extended	18,000 ft

Ice and Rain Protection

The Phenom 300E has three independent ice protection systems, each protecting different parts of the aircraft. Understanding when and how to use each one is critical for safe flight in icing conditions.

Icing conditions exist whenever the Static Air Temperature (SAT) on the ground, or Total Air Temperature (TAT) in flight, is 10°C or below and visible moisture is present in any form such as clouds, fog, rain, snow, sleet, or ice crystals. The pilot has primary responsibility for activating ice protection. Even if an ice detector is installed, the pilot should not rely solely on it; the windshield is the best indicator of early ice formation in flight.

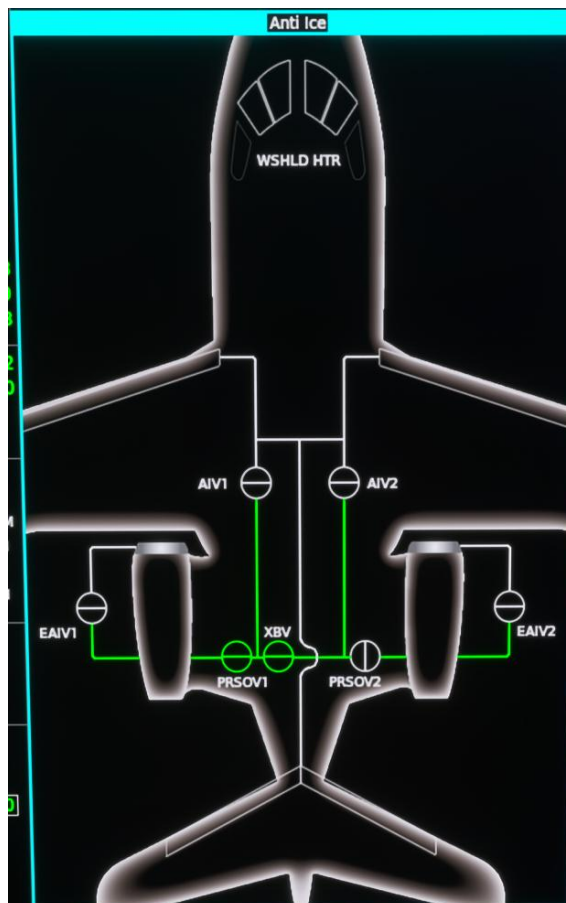
The three systems are: Engine Anti-Ice (EAI), Wing and Horizontal Stabilizer Anti-Ice (WHSAIS), and Windshield/Probe Heating. Each has different activation criteria and operational limits.

Ice and Rain Protection Engine Anti-Ice

The Engine Anti-Ice (EAI) system prevents ice formation on the engine inlet cowls. Each engine has an independent system using hot bleed air from its own compressor section, routed through piccolo tubes in the inlet lip. Because the EAI draws air from a dedicated engine bleed port, it is always available whenever the engine is running — it does not depend on the pneumatic system PRSOVs.

The EAI is controlled by two switches on the ICE PROTECTION panel: ENG 1 and ENG 2. These are simple ON/OFF switches. When ON, the A-I E1 ON or A-I E2 ON advisory CAS message is displayed to confirm the system is operating.

The EAI valve is spring-loaded to the open position, meaning that if the electrical system fails, the anti-ice defaults to ON — a deliberate safety feature.



Anti-ice Synoptic Page

When to use it: Turn ENG anti-ice ON whenever flying in icing conditions ($TAT \leq 10^{\circ}\text{C}$ with visible moisture). On the ground, turn it ON when SAT is between 5°C and 10°C with visible moisture. Below 5°C on the ground, turn ON all ice protection systems.



Ice and Rain Protection Wing and Stabilizer (WHSAIS)

The Wing and Horizontal Stabilizer Anti-Ice System (WHSAIS) is the most complex ice protection system on the aircraft, and the one that generates the most questions from pilots.

The WHSAIS uses hot bleed air from the pneumatic system, routed through Anti-Ice Valves (AIVs) to piccolo tubes in the wing and horizontal stabilizer leading edges. Unlike the engine anti-ice, the WHSAIS depends on the pneumatic system and has a defined operational envelope so it cannot operate at all altitudes and temperatures as limitation.

The WHSAIS Operational Envelope: The system is designed to work within a precisely defined altitude and temperature envelope. Outside these limits, the engines cannot provide sufficient bleed air pressure and temperature to effectively de-ice the wings and stabilizer. The system is automatically inhibited outside its operational envelope.

The envelope boundaries are defined by Static Air Temperature (SAT) and altitude:

Cold Boundary: -45°C SAT. Below this temperature at any altitude, the system is inhibited.

Warm Boundary: $ISA + 20.8^{\circ}\text{C}$. This is a sliding limit that varies with altitude because ISA temperature decreases with altitude. At sea level, this equates to approximately $+36^{\circ}\text{C}$. At 10,000 ft, it is approximately $+16^{\circ}\text{C}$. At 20,000 ft, it is approximately -4°C . At 30,000 ft, it is approximately -24°C .

AEO Ceiling: 30,000 ft. Above this altitude with all engines operating, the system transitions to ARM mode (see CAS messages below).

OEI Ceiling: 15,000 ft. With only one engine providing bleed air, there is insufficient energy to protect the aerofoils at higher altitudes. If you lose an engine above 15,000 ft with WINGSTAB active, the system will be inhibited on the failed engine's side. The practical effect of the warm boundary is that at higher altitudes, the envelope narrows significantly. At 25,000 ft, the system only operates between -45°C and approximately -14°C . At 30,000 ft, the window is even narrower: -45°C to approximately -24°C . This is because at high altitude the engines are producing less bleed air energy, and the system needs colder ambient conditions to function effectively.

The system is auto-inhibited outside its operational envelope. This is where the CAS messages become important:

A-I WINGSTB ARM (Advisory): The WINGSTAB switch is ON and the system is armed but not yet actively providing anti-ice protection. This appears on the ground before takeoff (normal pre-departure state) and when above the operational envelope ceiling. The system is ready and will activate when conditions allow.

A-I WINGSTB ON (Advisory): The system is operating normally and actively protecting the wing and stabilizer. This is the message you want to see in icing conditions.

A-I WINGSTB INHB (Caution): This is the critical one. The WINGSTAB switch is ON, but the aircraft is outside the operational envelope and the system is INHIBITED meaning it is NOT protecting the aircraft. This is a caution-level CAS message because the pilot may believe they have ice protection when they do not. On the ground, if the temperature is below 6°C and this message appears, takeoff is prohibited until the condition is resolved. In flight, maintain 165 KIAS minimum, keep flaps up, and exit icing conditions.

A-I WINGSTB OFF (Advisory): The system is off, either because the switch is OFF, the aircraft is in single-bleed configuration, or the aircraft is above 15,000 ft OEI.

A-I LO CAPACITY (Caution): There is insufficient thermal energy for WHSAIS operation. Advance thrust levers to the N1 anti-icing bug. If the message persists, turn WINGSTAB OFF and exit icing conditions.

The ICE SPEED RESET: The WINGSTAB switch has a special position: ICE SPEED RESET. When wing anti-ice is active, the stall protection system increases the reference speeds (ice speeds) to provide additional margin for the weight of ice on the airframe. When the pilot turns WINGSTAB OFF after leaving icing conditions, the ice speeds remain active until the pilot explicitly selects the ICE SPEED RESET position. This is a safety feature as ice speeds must not be reset until the pilot is certain that ALL ice has been removed from the aircraft.

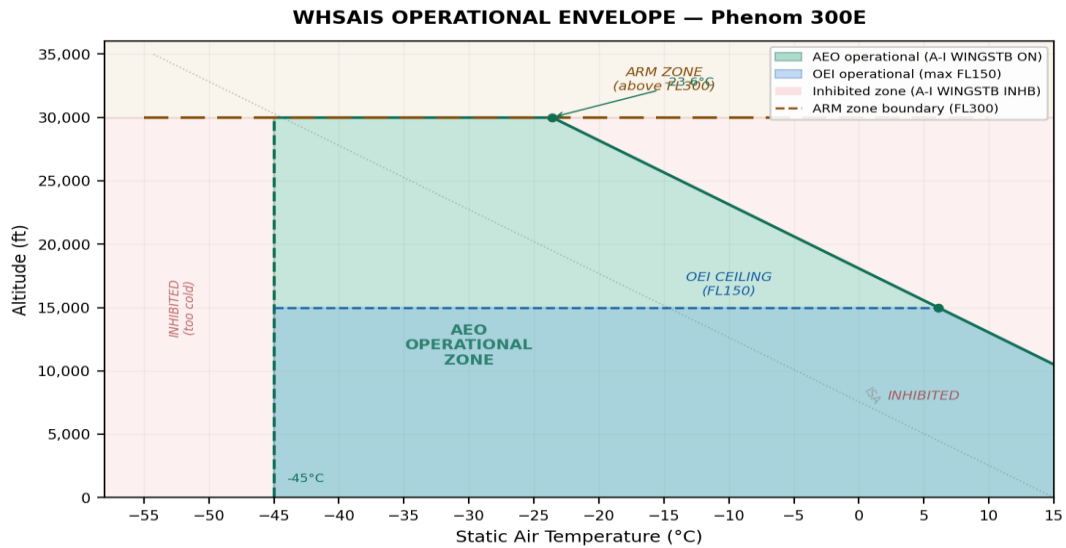


Figure: WHSAIS Operational Envelope — Green = active protection, Red = inhibited, Amber dashed = ARM zone above FL300

WHSAIS Max Altitude (AEO)	30,000 ft
WHSAIS Max Altitude (OEI)	15,000 ft
Min Speed — WHSAIS Inhibited	165 KIAS (flap/gear up)
Min Speed — WHSAIS Armed	165 KIAS (flap/gear up)
Min Speed — WHSAIS Operating	150 KIAS (flap/gear up)
Bleed Temp (Dual Bleed)	260°C (500°F)
Bleed Temp (Single Bleed)	280°C (536°F)

Ice and Rain Protection When to Use What

The AFM prescribes specific ice protection configurations based on temperature and conditions. This is a common source of confusion, so here is a clear summary:

Condition	Action
Ground — SAT 5°C to 10°C + moisture	ENG 1 & 2 Anti-Ice: ON. WINGSTAB: OFF. Windshield: OFF.
Ground — SAT below 5°C + moisture	ENG 1 & 2 Anti-Ice: ON. WINGSTAB: ON (A-I WINGSTB ARM displays). WSHLD 1 & 2: ON.
In Flight — TAT 5°C to 10°C + moisture	ENG 1 & 2 Anti-Ice: ON. WINGSTAB: OFF. Windshield: as required.
In Flight — TAT below 5°C + moisture	ALL systems ON: ENG 1 & 2, WINGSTAB, WSHLD 1 & 2.
After Leaving Icing — All ice removed	WINGSTAB: OFF, then ICE SPEED RESET. ENG and WSHLD: OFF.

Ice Protection Understanding A-I WINGSTB INHB

The A-I WINGSTB INHB caution message is the single most frequently misunderstood CAS message on the Phenom 300E. This section explains exactly what it means and what to do about it.

What it means: The WINGSTAB switch is set to ON, but the aircraft is currently outside the WHSAIS operational envelope. The system cannot provide effective anti-ice protection in the current conditions. The wings and stabilizer are NOT being protected, even though the switch is ON.

Why it happens: The WHSAIS requires a minimum bleed air temperature and pressure to work effectively. At certain altitude and temperature combinations, the engines cannot deliver enough energy to the anti-ice system. The FADEC communicates the aircraft's position relative to the envelope to the AMS Controller, which inhibits the system when conditions are outside the certified limits.

Common scenarios where you will see WINGSTB INHB:

On the ground in cold weather is the scenario that confuses most pilots. You have set WINGSTAB to ON as part of your before-takeoff ice protection setup, and the system shows INHB instead of ARM or ON. This happens because on the ground at low engine power (idle), the bleed air temperature and pressure may not be sufficient for the WHSAIS to operate. The system will transition from INHB to ARM or ON as engine power increases during the takeoff roll.

The critical rule on the ground: if the A-I WINGSTB INHB message is displayed and SAT is below 6°C, takeoff is prohibited. You must wait for conditions to change or the system to transition. If SAT is at or above 6°C, you may select WINGSTAB OFF then ICE SPEED RESET and proceed but keep the engine anti-ice ON if SAT is below 10°C.

Above the AEO ceiling (30,000 ft) high cruise altitudes, the WHSAIS operational envelope is exceeded. The post-modification aircraft will show A-I WINGSTB ARM above 30,000 ft instead of INHB, indicating the system is armed and ready to activate if the aircraft descends into the envelope. Pre-modification aircraft may show INHB in this situation.

One Engine Inoperative above 15,000 ft with only one engine providing bleed air, the WHSAIS can only operate up to 15,000 ft. Above this altitude OEI, the system is inhibited.

What to do in flight if you see WINGSTB INHB: Maintain a minimum airspeed of 165 KIAS with flaps and gear up. Keep the WINGSTAB switch ON. Exit icing conditions by changing altitude or heading. The system will re-activate automatically when the aircraft returns within the operational envelope.

ADS Probes — The ADS PROBES knob should normally be in AUTO. In this mode, the pitot-static and IASP probe heating activates automatically based on aircraft configuration. Select ON to manually force heating. The probes are electrically heated and operate independently of the bleed air systems.

Windshield Heat — Controlled by WSHLD 1 and WSHLD 2 switches. Electrically heated. Also useful for defogging the windshield on the ground in humid conditions. The windshield is the best visual reference for detecting early ice formation in flight — if ice starts building on the windshield, activate all ice protection systems immediately.

Critical Warnings — Takeoff is prohibited with the A-I WINGSTB INHB message displayed. Flight in freezing drizzle or freezing rain is prohibited. If icing conditions are encountered with WHSAIS operating, do not select Flap 2 or higher for landing — use Flap 1 only, and add 30 KIAS to the normal Vref. Multiply the unfactored landing distance by 1.40.

Condition / CAS Message	Action
WINGSTB INHB on ground, SAT < 6°C	DO NOT TAKEOFF. Wait for conditions to change.
WINGSTB INHB on ground, SAT ≥ 6°C	WINGSTAB OFF → ICE SPEED RESET. Keep ENG anti-ice ON if SAT < 10°C.
WINGSTB INHB in flight	Maintain 165 KIAS min. Flaps UP. Keep WINGSTAB ON. Exit icing conditions.
WINGSTB ARM (above 30,000 ft)	Normal — system armed, will activate on descent into envelope.
WINGSTB ON	System operating normally — wings and stabilizer are protected.
WINGSTB OFF	System off — switch is OFF, or single bleed above 15,000 ft.
LO CAPACITY	Advance thrust to N1 anti-icing bug. If persistent: WINGSTAB OFF, exit icing.

Landing Gear and Brakes

The landing gear is a fully retractable tricycle configuration with a single tire at each leg. Normal extension and retraction is hydraulic, controlled by the LDG GEAR lever.



Emergency gear extension is available via the free-fall handle on the center pedestal. Pulling the handle releases the unlocks and allows the gear to extend by gravity. If the gear does not lock down, the pilot can slip the aircraft to assist locking.

The brake system uses hydraulic pressure from the main system with anti-skid protection. Emergency/parking braking is available through a separate accumulator that allows approximately 6 brake applications without hydraulic pressure.

The FSReborn Phenom 300E tracks tyre wear, tyre pressure (which varies with temperature, simulating nitrogen-filled tyres), and brake pad condition. Neglecting tyre and brake maintenance can lead to realistic failures including tyre blowouts and brake failure.

VLO / VLE	250 KIAS
Max Tyre Ground Speed	182 Kt
Main Gear Tyre Pressure (Recommended)	180 PSI
Nose Gear Tyre Pressure (Recommended)	150 PSI

Warning Systems

The Crew Alerting System (CAS) provides visual and aural warnings to the flight crew. CAS messages are displayed on both PFDs and categorized by priority:

WARNING (Red): Emergency condition requiring immediate corrective action. Accompanied by master warning tone and flashing MSG button.

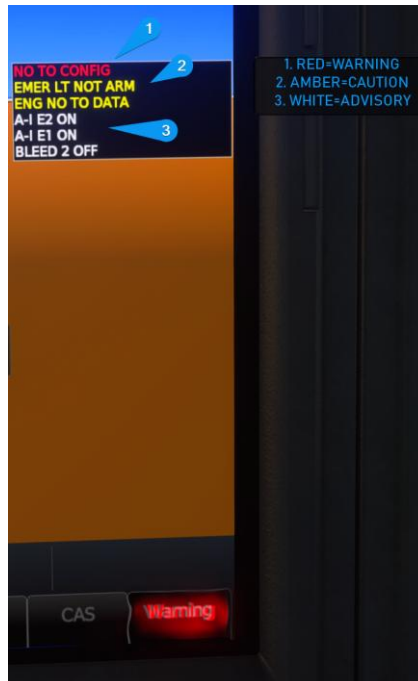
CAUTION (Amber/Yellow): Abnormal condition requiring immediate crew awareness and subsequent action. Accompanied by master caution tone.

ADVISORY (White): Operational condition requiring crew awareness. May or may not require future action. Automatically reverts from reverse to normal video after 5 seconds.

The stall warning and protection system provides aural warnings ('STALL, STALL') and stick pusher actuation when an impending stall is detected. The system must be tested before each flight using the TEST panel.

The Terrain Awareness and Warning System (TAWS) provides terrain proximity alerts and warnings. When a TAWS warning occurs, the crew should immediately initiate a climb.

The Traffic Collision Avoidance System (TCAS II), when installed, provides Traffic Advisories (TA) and Resolution Advisories (RA) to assist in avoiding mid-air collisions. See CAS examples below:



CHAPTER 4

LANDING TECHNIQUES

Introduction

The real aircraft SOP, AFM and POH contains hundreds of pages with numbers stating landing distances, approved weights, and landing performance data. However, the intention of this user manual is for simulation purposes and flight sim pilots, and accordingly, we will present here the minimum amount of data to allow users land the aircraft safely in MSFS and perform perfect approaches.

If you are a real world phenom 300E pilot, you can go ahead and use your SOP, AFM, etc. as usual, so please understand the wording below is intended to reach a different market, flight sim users do not have thousands of hours of training like yourself, the AFM + SOP + POH has more than 2500 pages combined, and it takes several months for brand new pilots to learn these effectively. The objective of this document is to help flight sim users to get up to speed much quicker and enjoy their simulation experience.

Landings Tips

The best way to nail your landings in MSFS is to ensure you have loaded your flight plan correctly, and loaded your landing speeds in the performance page, once you have your weights set on this page, select landing with "full flaps" and accept the landing speeds.

The computer will display for you now all you required in terms of approach speed, VRF, etc. and if you follow these steps, you will have zero problems landing the aircraft:

- Take your time, do not rush to descend to land, this will cause you to overspeed and miss your approach or worse, a runway overrun due to not enough runway to slow down your aircraft.

Speed brakes are inhibited on the air when flaps are down, this means, if you are coming too fast already with flaps down, you are out of luck, go around and try again.
- Go for long approaches, especially when you are getting familiar with the aircraft, is a "light" jet, is slippery, if you not careful, you will lose the chance to slowdown. for your first landings use 10-15nm approaches so you get a feeling of the aircraft.
- Aim to start your 1st approaches using autopilot, ILS between 200 to 220 knots.
- Once you are intercepted, **with a long approach**, it will give you now time to think and start getting into the landing configuration.
- Sets Flap to 1, wait for the initial aircraft slowdown. Idle your throttles and get the aircraft to 170 to 180 knots.
- Sets Flap to 2, continue slowdown your aircraft to 150-160 knots, this should be your approach speed now to maintain until approved to land.
- Sets Flap to 3, (This tells the aircraft, you are on landing configuration, the flaps will remain same angle), monitor you remain close to 150 knots.
- Gear Down, check 3 greens and sets Flap to full, now you will feel the full drag, **you will need to increase your power now**, stay with the plane. Keep now your VREF speed.
- Fly the slope and follow the landing technique on flare described below.

Crabbing and Flare

The maximum demonstrated crosswind component and for landing is 28 knots, anything above this and you should not attempt to land the aircraft as you most likely will end up losing control on the runway.

The correct way to perform approaches with crosswind is flying into the wind (crabbing), the autopilot will do this for you, so is a good idea to disengage the AP with plenty of time ahead to get hold of the wind and heading the AP was following.

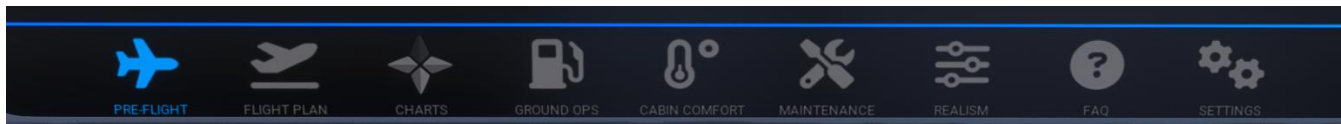
The ideal time to disengage your AP is when you get all ready for the approach and you have full visual with the runway. Fly a runway heading that keeps you aligned, one of the advantages of the G3000 avionics is the green vector indicator on the PFD display, which will predict where the aircraft is going, so if you fly the correct heading to perform the crabbing, you should see the cursor vector aligning to the runway.

CHAPTER 5 ELECTRONIC FLIGHT BAG (EFB)

EFB Overview

The Electronic Flight Bag (EFB) is a tablet device located in the left side pocket of the cockpit. It provides comprehensive flight planning, operational, and maintenance capabilities through a touch-screen interface.

The EFB can be accessed using the custom instrument camera (CTRL+4 on PC). You can also drag the tablet to reposition it. An



auto-position camera option is available in Settings that automatically moves your view to the EFB when you take the tablet out. The EFB has the following pages, accessible via the icon bar at the bottom of the screen:

Page	Description
PRE-FLIGHT (Status)	Aircraft status, battery voltage, doors, hydraulic pressure
FLIGHT PLAN (OFF)	SimBrief flight plan import, route, weather, NOTAMs
CHARTS	Navigraph chart viewer — departure, arrival, alternate
GROUND OPS	Fuel loading, payload, ground services, doors, chocks, covers
CABIN COMFORT	Cabin services, passenger status, seatbelt sign
MAINTENANCE	Engine, battery, tyre, brake, hydraulic, generator maintenance
REALISM	Failure and wear settings
FAQ	Frequently asked questions
SETTINGS	SimBrief username, sound volumes, preferences

Pre-Flight / Status Page

The Status page is the default view when the EFB is first opened. It displays essential aircraft status information including battery voltage for both batteries, hydraulic system pressure, door status (all doors open/closed), oxygen pressure, and emergency brake accumulator pressure.

This page provides the same information available on the MFD Status synoptic page but in a convenient tablet format that can be consulted before powering up the main avionics.



Flight Plan (OFF) Page

The Flight Plan page integrates with SimBrief to import your Operational Flight Plan (OFF). To use this feature:

1. Enter your SimBrief username in the Settings page.
2. Create a flight plan on SimBrief using the Phenom 300E aircraft profile.
3. Navigate to the Flight Plan page and tap 'Import from SimBrief'.

Once imported, the OFF displays your route, waypoints, fuel data, weather (METAR/TAF for origin, destination, and alternate), NOTAMs, and runway information. The flight plan can be automatically loaded into the G3000 avionics if the 'Send SB Plan to G3000' option is enabled in Settings.

The page is organized into tabs: Route, Origin weather/NOTAMs/runways, Destination weather/NOTAMs/runways, Weather summary, and full OFF view.

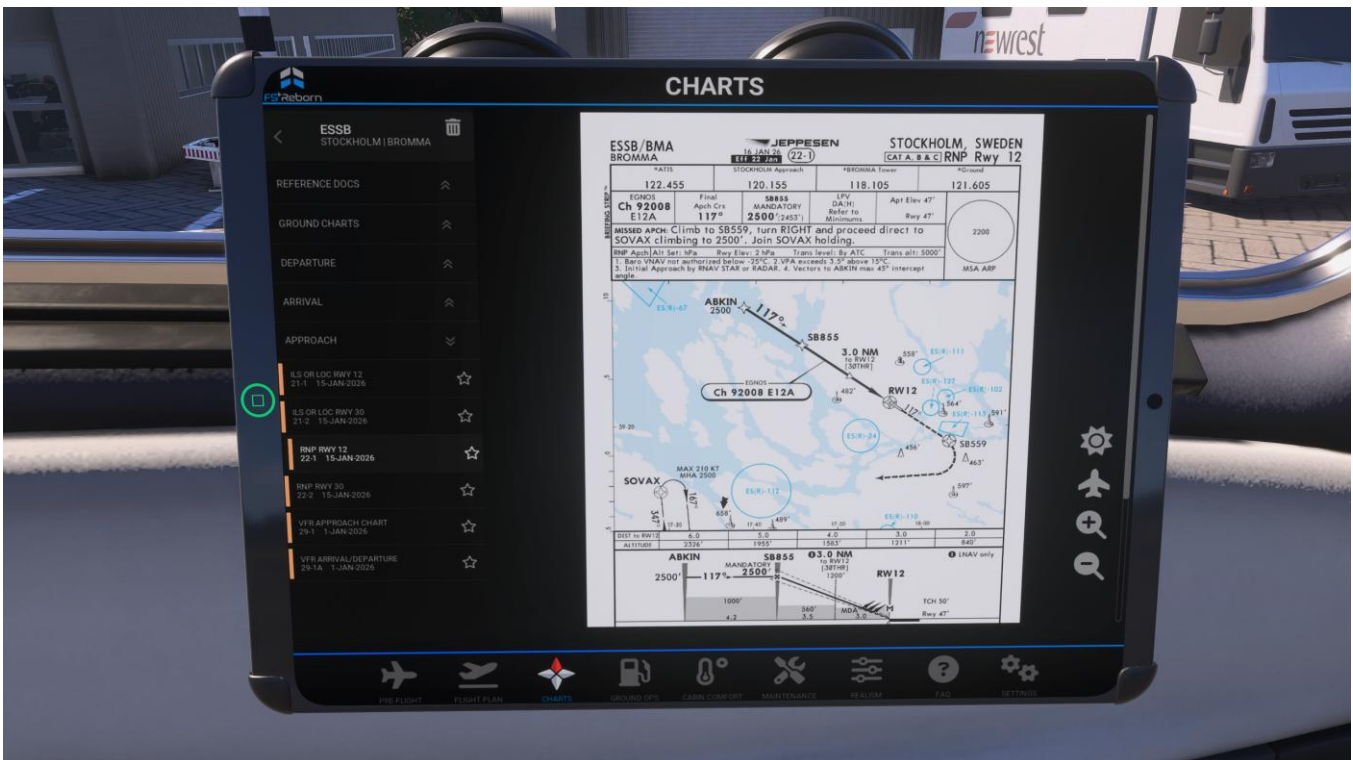




Charts Page

The Charts page provides access to Navigraph aeronautical charts for your departure, arrival, and alternate airports. Charts are automatically loaded based on your imported SimBrief flight plan.

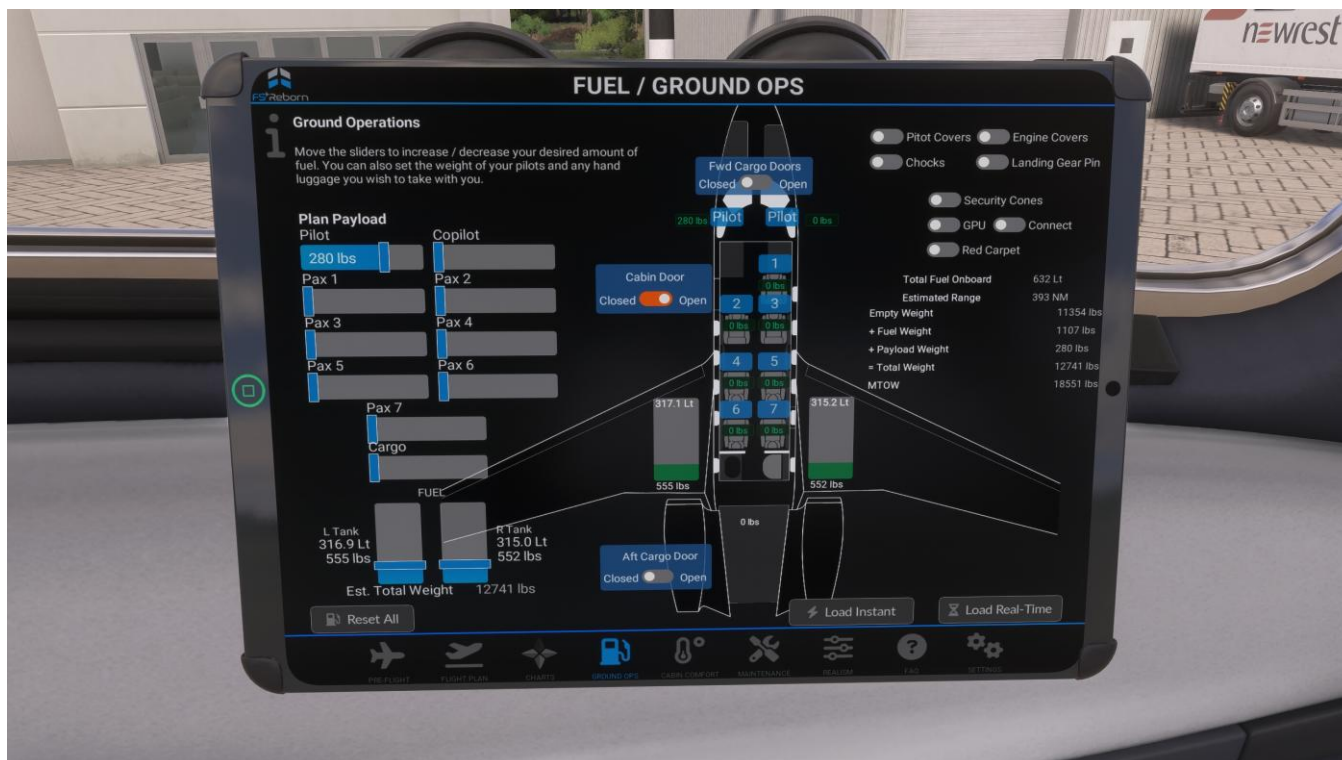
You can browse SID, STAR, approach, airport, and taxi charts for each airport. The chart viewer supports pinch-to-zoom and pan gestures. Charts require a valid Navigraph subscription linked to your SimBrief account.



Ground Operations Page

The Ground Operations page (FUEL / GROUND OPS) is your primary interface for configuring the aircraft before flight. It manages fuel loading, payload configuration, and ground services.

Fuel Loading: Two sliders allow you to set the left and right wing tank quantities independently. The EFB displays total fuel onboard, estimated range, and a weight summary (empty weight, fuel weight, payload weight, total weight, and MTOW). The simulation models fuel volume expansion with temperature: on hot days, the same weight of fuel occupies more volume, so the tanks physically hold less fuel by weight. This means fuel capacity is slightly reduced on hot days. It is strongly recommended to use only the EFB for fuel loading rather than the default MSFS fuel panel, as the MSFS panel does not account for this temperature simulation.



Payload: Individual sliders for pilot, copilot, and up to 7 passengers, plus luggage/cargo weight. Each passenger can be set individually, allowing you to simulate different loading scenarios.

Ground Services: Toggle switches control wheel chocks, pitot tube covers, engine inlet covers, GPU connection, and cargo doors (forward and aft). These items are also accessible during the external walkaround. Remember to remove pitot covers before flight or your airspeed indicator will not function. Remove wheel chocks or the aircraft will not move regardless of thrust applied.

Ground Operations Loading Modes

When you have configured your fuel and payload, you have two options for how the aircraft is loaded:

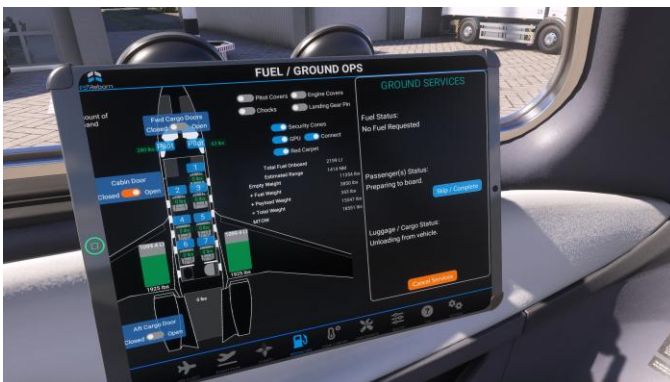
Instant Load: Press the 'Instant Load' button and all fuel and passengers are loaded immediately. The aircraft transitions to the configured state without any waiting. This is ideal for quick turnarounds or when you want to get flying as soon as possible.

Realistic Load (Real-Time): Press the 'Load Real-Time' button to experience the full realistic loading sequence. This process simulates the real-world steps involved in preparing the aircraft:

- 1: The fuel truck is called and must physically drive to the aircraft. You will see its distance count down on screen as it approaches.
- 2: Once arrived, the fuel hose is connected to the aircraft's single-point refuelling adapter (located on the right wing-to-fuselage fairing).
- 3: Fuel is pumped into both tanks simultaneously at approximately 310 gallons per minute (155 GPM per tank).
- 4: Once fuelling is complete, the hose is disconnected and the fuel truck departs.
- 5: A passenger vehicle is then called. Like the fuel truck, it must drive to the aircraft.
- 6: Passengers board one at a time, each taking a few seconds to settle into their seat.
- 7: Luggage and cargo are loaded.

During the realistic loading sequence, the EFB displays status updates for each stage (fuel truck status, refuelling progress, passenger boarding progress). You can skip the wait for the passenger vehicle by pressing the 'Skip' button.

To unload the aircraft (for turnarounds), use the 'Unload Real-Time' or 'Instant Unload' buttons. The process reverses: passengers disembark, cargo is removed, and optionally the fuel truck arrives to refuel.



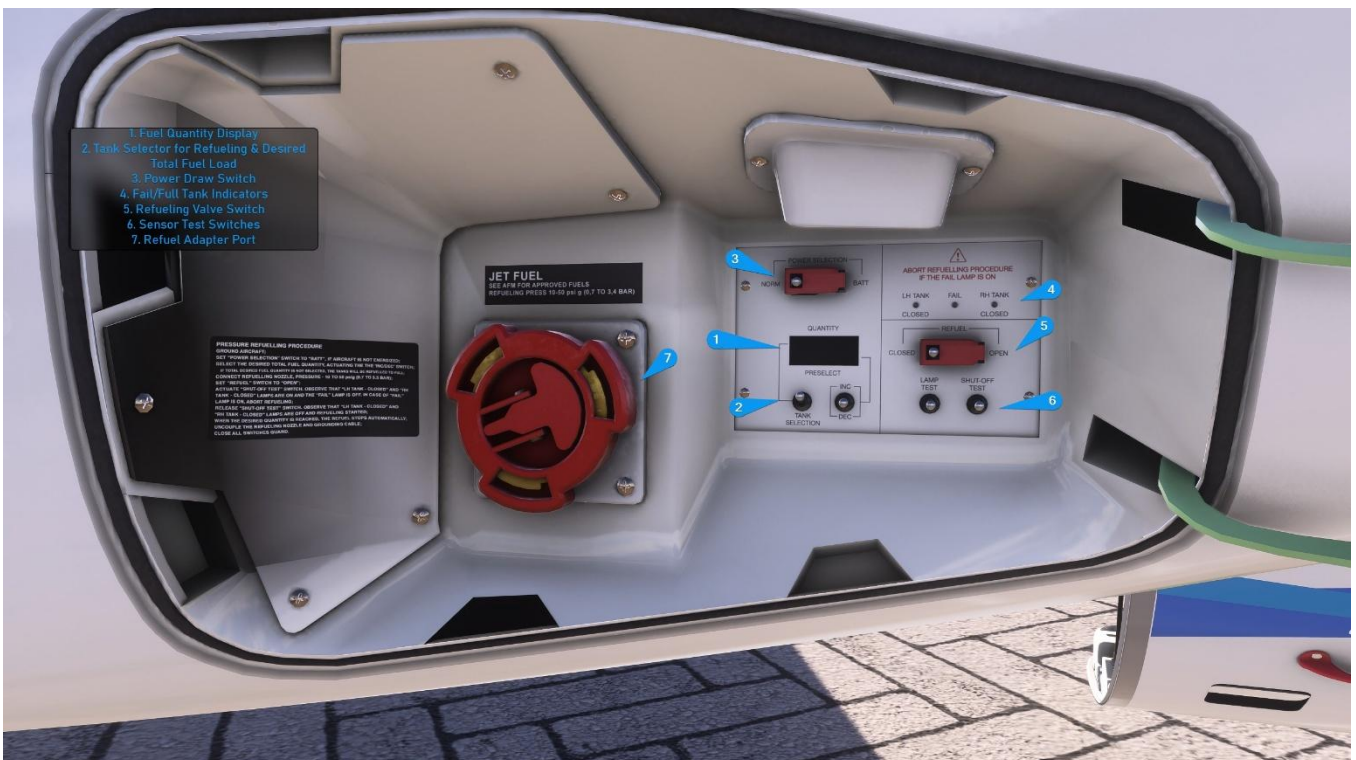
Ground Operations Manual Refueling

For pilots who want the most immersive refuelling experience, the Realism settings page includes a 'Fuel Aircraft Manually' toggle. When this setting is enabled, the refuelling process changes significantly:



In auto mode (default), the fuel truck arrives, connects, and the EFB handles the entire fuelling process automatically — the correct quantity is pumped and the truck disconnects when finished.

In manual mode, the fuel truck still arrives and connects the hose, but then it waits for you to operate the external refuelling control panel yourself. You must exit the cockpit and walk to the right side of the aircraft where the refuelling panel is located. The process requires you to:



1: Ensure the refuelling panel has power: select NORM or BATT on the POWER SELECTION switch.

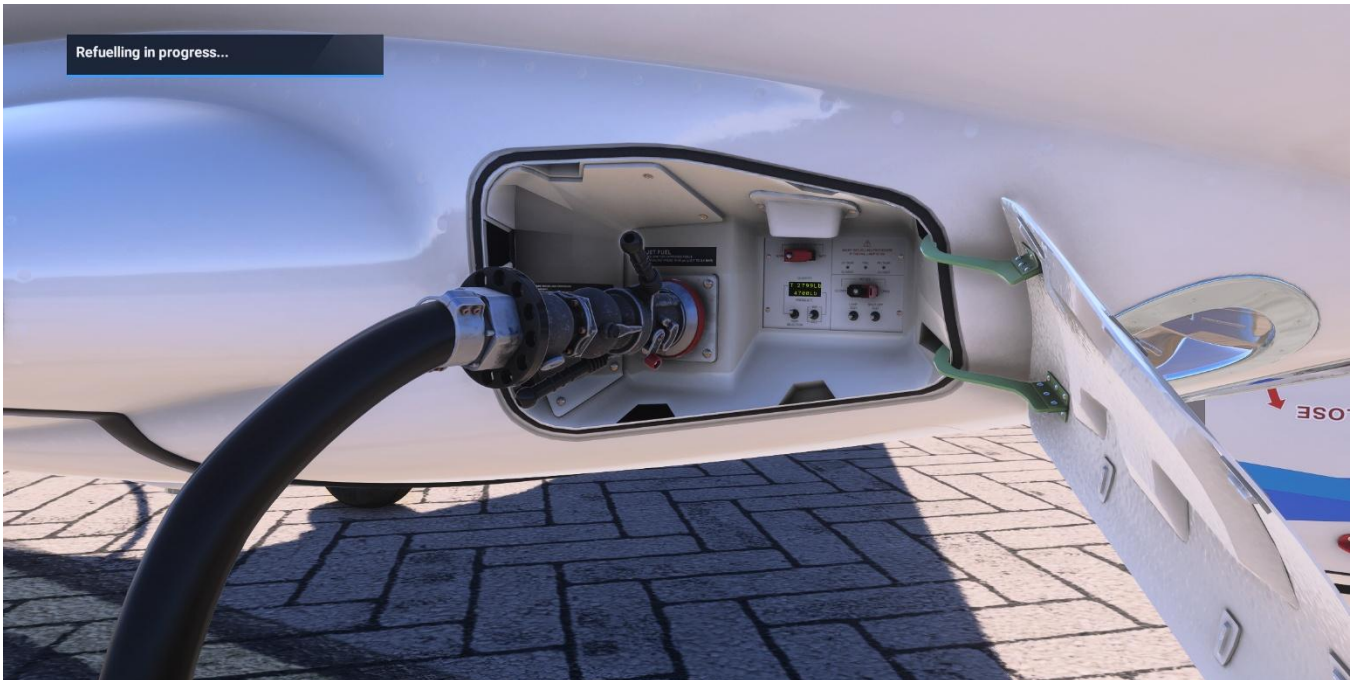
2: Use the INC/DEC switch to set your desired fuel quantity on the repeater indicator display. The TANK SELECTION switch toggles between total and individual tank quantity views.

3: Open the REFUEL switch to begin fuel flow into the tanks.

4: Monitor the repeater display as fuel is pumped. The fuel quantity will increment in real time.

5: When the desired quantity is reached, close the REFUEL switch to stop fuel flow.

If you forget to open the valve or power the panel, the EFB will display 'Fuel paused. Open valve and power on.' The fuel truck will wait indefinitely until you complete the operation.



The SHUTOFF TEST switch can be used to test the refuelling shutoff system — activating it temporarily pauses fuel flow and the EFB displays 'Shut-off test in progress. Fuel paused.'

Once fuelling is complete, the EFB displays 'Fuel order complete. Close fuel valve.' You must close the REFUEL switch to allow the fuel truck to disconnect and depart.

This manual refuelling mode provides a highly realistic experience that mirrors the actual process on the real Phenom 300E, where a ground crew member operates the refuelling panel while monitoring quantities on the repeater display.

Cabin Comfort Passenger Simulation Overview

The Cabin Comfort page is the heart of the FSReborn passenger simulation system. Every passenger aboard your aircraft is a simulated individual with their own personality, needs, and reactions. Your goal as pilot is to keep your passengers comfortable and satisfied throughout the flight.

Passenger satisfaction is measured on a 0-100 scale. When passengers board, they start with a satisfaction level influenced by the cabin's first impression. A pristine cabin (cleanliness above 90%) gives a +5 bonus, while a dirty cabin (below 40%) imposes a -15 penalty. Throughout the flight, satisfaction rises and falls based on how well you manage cabin conditions, service, and flight quality.

The Cabin Comfort page displays individual status cards for each passenger, showing their name, personality type (with icon), current satisfaction level, and their top concern. You can serve coffee, serve snacks, clean the cabin, and make captain PA announcements to manage their experience.

In order to visually see Passengers in the cabin being seated, the in sim graphics options: Character Variety & Quantity MUST be selected to High or Ultra else you will not see any.

Cabin Comfort Personality Types

Each passenger is randomly assigned one of 12 personality types when they board. Each personality has unique sensitivity multipliers that affect how they respond to conditions. A 5% chance exists for any passenger to be assigned the VIP Celebrity type, regardless of other probability weights.



The personality types and their key characteristics are:

1. Executive - High standards. Very sensitive to temperature (1.3x), highly dependent on wifi (1.5x), and reacts strongly to service cancellations (1.2x). Expects prompt, professional cabin service.
2. VIP Celebrity - Similar to Executive but with even higher expectations. Rarely appears (5% chance). Expects premium treatment.
3. Nervous Flyer - Extremely sensitive to turbulence (2.0x) and cabin pressure changes (1.8x). Landing quality heavily affects them (1.8x). Captain PA announcements during turbulence are particularly effective for calming this personality.
4. Frequent Flyer - Experienced and hard to impress. Lower sensitivity to most conditions but notices when things are not up to standard. Moderate across all factors.
5. First Timer - Excited and easily impressed. High turbulence sensitivity (1.6x) and landing impact (1.7x), but also very grateful for good service. Strong reaction to cancelled services (1.3x).
6. Elderly - Higher temperature sensitivity (1.6x) and pressure sensitivity (1.5x). More affected by turbulence (1.4x). Appreciates a comfortable, stable cabin environment.
7. Health-Conscious - Very hydration-focused (thirst rate 1.5x). Sensitive to temperature (1.2x) and pressure (1.5x). Drinks water frequently.
8. Jet-Lagged - Exhausted and sleepy. Falls asleep 50% longer than other types. Once asleep, reduced need rates. Waking up from turbulence is particularly unpleasant (-10 satisfaction).
9. Young Professional - Moderate across all factors. Wifi-dependent (1.4x). Good overall passenger with no extreme reactions.
10. Parent with Child - High hunger rate (1.3x), high thirst (1.4x), very frequent toilet needs (1.8x). Very sensitive to turbulence (1.8x) and service cancellations (1.6x). One of the most demanding personality types.
11. Anxious Connector - Focused entirely on arriving on time. Wifi-dependent (1.8x). Less concerned about cabin comfort, more stressed about delays.

12. Laid-Back Traveller - The easiest passenger. Low sensitivity across all factors (turbulence 0.5x, temperature 0.5x, landing 0.4x). Almost impossible to upset. Service cancellations barely register (0.4x).

Cabin Comfort Satisfaction Mechanics

Passenger satisfaction is affected by multiple factors that are continuously evaluated during flight:

Hunger - Builds gradually over approximately 90 minutes from zero to full hunger. When hunger exceeds 30%, a mild satisfaction penalty begins. Above 70%, the penalty becomes severe (up to 20 points/minute). Serving snacks immediately resets hunger to zero.

Thirst - Builds faster than hunger, reaching full in approximately 60 minutes. Similar penalty thresholds to hunger. Serving coffee immediately resets thirst to zero. Different personalities have different thirst rates — Health-Conscious passengers get thirsty 1.5x faster than normal.

Temperature - Each personality has an ideal temperature comfort band (e.g., Executive male: 18-22.5°C, Executive female: 22.5-24.5°C). When cabin temperature falls outside this band, satisfaction loss scales with how far outside the band and the personality's temperature sensitivity multiplier. Female passengers generally prefer slightly warmer temperatures and have higher temperature sensitivity.

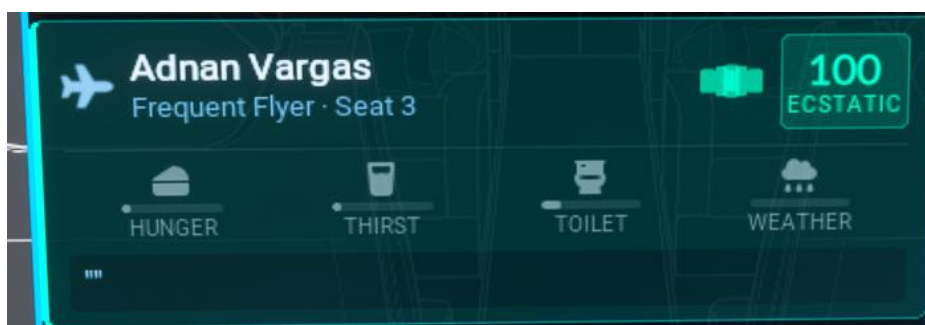
Turbulence - Satisfaction loss during turbulence varies dramatically by personality. Nervous Flyers lose satisfaction at 2.0x the normal rate, while Laid-Back Travellers barely notice (0.5x). Making a Captain PA announcement during turbulence ('turbulence' PA button) mitigates the impact by 50% for all passengers.

Cabin Pressure - Rapid altitude changes or poor pressurization cause discomfort. Nervous Flyers and Elderly passengers are most sensitive (1.8x and 1.5x respectively).

Landing Quality - A smooth landing gives passengers a satisfaction bonus, while a hard landing imposes a penalty scaled by personality. Nervous Flyers are most affected (1.8x), while Laid-Back Travellers barely care (0.4x). A good landing in bad weather triggers a special 'storm relief' bonus where passengers who were stressed by weather conditions receive extra satisfaction from the safe arrival.

Service Cancellation - If you start serving coffee or snacks but cancel mid-service, every passenger receives a -8 satisfaction penalty, multiplied by their service abort sensitivity. Parents with Children react worst (1.6x), while Laid-Back Travelers shrug it off (0.4x).

Satisfaction Recovery - When all conditions are good, satisfaction passively recovers. Very unhappy passengers (<30) recover slowly at 1.5 points/minute, while moderately unhappy passengers (<60) recover at 2.5 points/minute. Full recovery from 0 to 100 takes approximately 35-40 minutes of perfect conditions.



Cabin Comfort: Sleep System

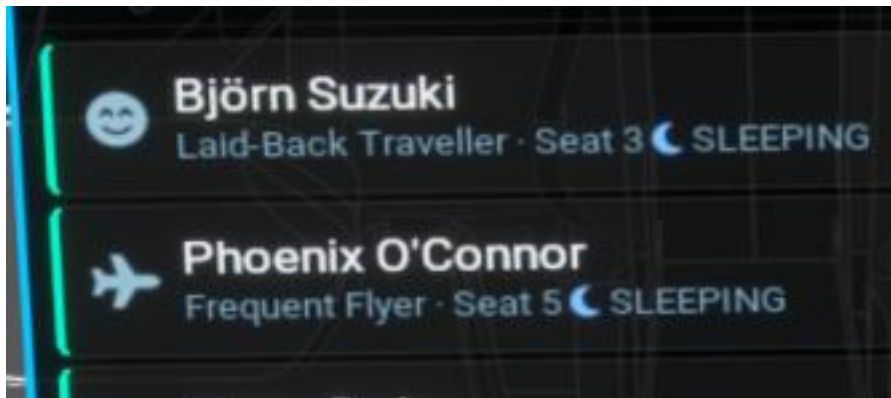
Passengers can fall asleep during longer flights, which adds a realistic touch to the cabin simulation.

Sleep Entry Conditions - A passenger may fall asleep if all of the following are true: the flight has been airborne for at least 28 minutes, their satisfaction is above 60, there is no significant turbulence (G-force below 1.3), the seatbelt sign is off, cabin lights are not at maximum brightness, and during daytime the passenger's window shade must be closed.

While Sleeping - Sleeping passengers have significantly reduced need rates: hunger builds at only 25% of normal speed, thirst at 30%, and toilet need at 40%. They do not notice lighting or wifi issues. Satisfaction slowly recovers at +0.5 points per minute. Sleeping passengers are skipped by cabin service — the crew would not wake them for coffee or snacks.

Jet-Lagged passengers sleep 50% longer than other types (45-90 minutes versus the normal 30-60 minutes). Night flights increase sleep probability by 1.6x for all personality types.

Wake-Up Triggers - Passengers can be woken by turbulence (G-force above 1.3, causing -8 to -12 satisfaction penalty), the seatbelt sign turning on (-3 satisfaction), maximum cabin lighting (-1 satisfaction), or urgent toilet need (above 80%, no penalty). Passengers who wake up naturally after their full sleep duration receive a +3 satisfaction bonus.



Sleeping passenger status card

Cabin Comfort: Cleanliness, Interactions, and Engine Failure

Cabin Cleanliness - The cabin starts at a cleanliness level that persists between flights if you have persistence enabled. During flight, cleanliness degrades at a rate proportional to the number of passengers aboard. Serving coffee and snacks accelerates degradation slightly. You can clean the cabin at any time using the 'Clean Cabin' button on the Cabin Comfort page. A pristine cabin (90%+) at boarding gives all passengers a +5 first impression bonus. A dirty cabin (below 40%) imposes a -15 penalty that is very difficult to overcome.

Passenger make interactions every 3-8 minutes, they may interact with each other socially if there are at least 2 passengers aboard. The content and tone of these interactions depends on passenger mood: happy passengers chat pleasantly, while unhappy passengers go quiet. These interactions appear as messages in the cabin message feed, adding life and atmosphere to the flight.

Engine Failure Panic - If an engine failure occurs in flight, passengers will experience growing panic. Panic builds over time as a per-passenger stress value (similar to weather stress). Without a Captain emergency PA announcement, panic builds at full rate, causing heavy satisfaction loss. Making an emergency PA announcement halves the panic builds up rate. If an engine fire is detected (not just a shutdown), the panic rate doubles further especially if passengers can hear and smell fire, making it significantly worse than a simple engine shutdown. Sleeping passengers are immediately woken by engine failure.

Captain PA System - Automatic PA announcements are triggered at key flight phases: welcome (after engine start), cruise (reaching cruise altitude), descent, landing (final approach), and deboarding (after stopping). You can also manually trigger turbulence and emergency PA announcements using dedicated buttons. Turbulence PA mitigates turbulence satisfaction loss by 50%, and emergency PA halves engine failure panic build up.



Cabin cleanliness indicator across different flights



Captain PA buttons

Cabin Comfort Flight Report

After landing, the Cabin Comfort page automatically displays a comprehensive Flight Report that scores your performance as a cabin service provider. The report appears once the aircraft has come to a stop and the deboarding PA has been made.

Overall Score - A ring display shows your overall score (0-100) with a letter grade. The score is calculated from multiple components weighted together.

Score Breakdown - The report breaks down your total score into individual components:



Average Satisfaction - The mean satisfaction level across all passengers at the end of the flight. This is the primary component of your score.

Landing Bonus/Penalty - A smooth landing adds points, while a hard landing subtracts them. The bonus or penalty is scaled by the touchdown rate (feet per minute).

Cabin Preparation Bonus - Points awarded for having a clean, well-prepared cabin at boarding time.

Turbulence Penalty - Points deducted for turbulence-induced discomfort during the flight, reduced if you made captain PA announcements.

Max G-Force - The maximum G-force experienced during the flight, shown as context for the turbulence penalty.

Landing Statistics - The report displays precise landing data including touchdown rate (feet per minute), G-force at touchdown, and centreline deviation.

Individual Passenger Reports - Each passenger's final satisfaction score and their top concern throughout the flight is listed. This allows you to identify which passengers were unhappy and why — was it temperature, hunger, turbulence, or the landing quality?

Flight Events Log - A timeline of good and bad events tracked throughout the flight. Examples include: 'Passengers loved the smooth landing', 'The hard landing shocked the passengers', 'Passengers appreciated the captain PA during turbulence'. This log helps you understand what went well and what can be improved on your next flight.

Maintenance Page: Overview

The Maintenance page is one of the most distinctive features of any FSReborn product. Every major component of the aircraft has a simulated service life, and just like a real aircraft, neglecting maintenance has real consequences.

The philosophy is simple: treat the aircraft well and it will treat you well. Perform regular maintenance and your aircraft will operate reliably for thousands of hours. Skip maintenance, push components beyond their limits, or fly aggressively, and you will eventually experience failures be it some minor, some potentially flight-critical.

Each maintainable component has its own dedicated page in the EFB, showing current condition, hours since last maintenance, and available actions (service, replace, overhaul, or request a mechanic). Component hours accumulate across flights and persist between sessions, so your aircraft builds a genuine service history over time.

The Maintenance page main menu shows all components at a glance with status indicators. Components approaching their service interval will show warnings, and components that have failed are clearly

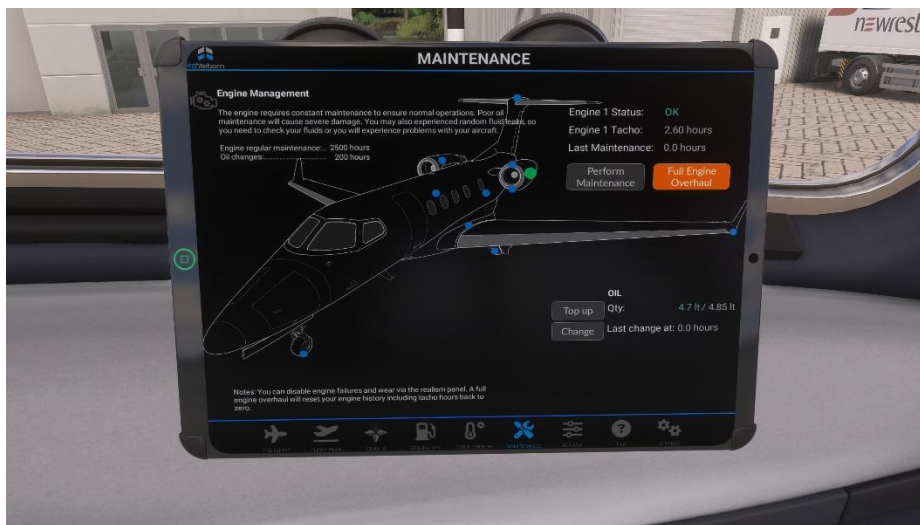


Maintenance Page: Components

The following components are tracked by the maintenance system:

Engines (1 & 2) - The PW535E1 engines require scheduled maintenance every 2,500 hours, with oil changes recommended every 200 hours. Oil is consumed during normal operation, and the quantity gradually decreases. If oil changes are neglected, leaks can develop, accelerating oil loss. Running an engine with critically low oil will eventually cause seizure and catastrophic failure. A full engine overhaul resets the tachometer to zero, the closest thing to a brand new engine. Overhauls are only needed after very high cumulative hours and represent a major maintenance event, just as they do in the real world.

Batteries (1 & 2) - Aircraft batteries are not like car batteries. They have a finite lifespan of approximately 600 hours and their capacity degrades over time. As batteries age, you may notice slower engine starts, dimmer cockpit lighting, or reduced emergency bus endurance. Batteries can be recharged (if they still have life in them) or replaced entirely. When a new battery is installed, the system performs a conditioning cycle meaning a full discharge followed by a full recharge to ensure the battery is holding proper charge, just as a real maintenance crew would.



Tyres (Left, Right, Nose) - Tyre condition degrades with every landing, and harder landings cause significantly more wear. Tyre pressure is simulated with nitrogen-filled characteristics and varies with ambient temperature. For example a cold morning will show lower pressures than a hot afternoon. Over-inflated tyres are at risk of blowing out on hard landings. Under-inflated tyres wear faster and degrade handling. The recommended pressures are 180 PSI for the main gear and 150 PSI for the nose gear.

Brake Pads (Left, Right) - Brake pads wear down with every landing and taxi. Heavy braking wears them faster. As pads wear thin, braking effectiveness gradually decreases. If you ignore worn brake pads entirely, you will eventually have no braking capability at all.

Hydraulic Pumps (1 & 2) - The engine-driven hydraulic pumps require maintenance approximately every 200 hours. The hydraulic system powers the landing gear, spoilers, brakes, stick pusher, and rudder booster. A hydraulic pump failure can have cascading effects on multiple systems. How you operate the landing gear also matters, cycling the gear handle while the gear is still in transit puts mechanical stress on the system and increases the risk of damage.

Generators (1 & 2) - The starter-generators serve a dual role: they crank the engine during start, then switch to generator mode once the engine is running. They require maintenance every 250 hours. A neglected generator can fail in flight, requiring the remaining generator to pick up all electrical loads. Losing both generators puts you on battery power only which is a serious emergency.

The starter-generators are subject to strict duty cycle limitations during engine start and dry motoring. Each motoring must not exceed 60 seconds, and the cool-down periods must be observed: Motoring 1→2: 60 seconds, Motoring 2→3: 60 seconds, Motoring 3→4: 15 minutes, After Motoring 4: 30 minutes. Exceeding these limits will overheat and damage the starter-generator, requiring repair or replacement through the EFB Maintenance page. If you find yourself needing multiple start attempts, be patient and respect the cool-down periods — a few minutes of waiting is far better than a broken starter.

Flaps - The flap system tracks operating hours and can fail if maintenance is neglected. A flap failure requires landing at a higher reference speed ($V_{ref} = 100$ KIAS) per the emergency procedures.

Bird Strike - Windshield damage from bird strikes can occur during flight. The risk varies with location and conditions. A damaged windshield can be repaired through the maintenance page.

Wear and Tear Speed - All maintenance intervals listed above are the base values at the default 1x wear speed. The Realism settings page includes a Wear and Tear Speed multiplier that can be set from 1x (realistic) up to 16x (heavily accelerated). This multiplier divides all maintenance intervals proportionally, allowing you to experience the full maintenance lifecycle in a fraction of the real time.

For example, at 1x speed, the engine scheduled maintenance interval is 2,500 hours — you could fly for months of real-world sessions before maintenance is due. At 4x speed, that same interval becomes 625 hours of sim time. At 8x, it becomes approximately 312 hours. At 16x, it drops to just 156 hours, meaning you will encounter maintenance needs much more frequently and experience the full range of wear-related issues in a more compact timeframe.

The same multiplier applies to oil changes, battery degradation, hydraulic pump wear, generator maintenance, and all other tracked components. If you want to explore the full depth of the maintenance system without waiting hundreds of hours, increasing the wear speed is the way to do it. If you prefer a low-maintenance experience that closely mirrors real-world timescales, keep it at 1x.



EFB Maintenance - Tyre Page

Maintenance Page: What Can Go Wrong

The FSReborn Phenom 300E simulates a wide range of failure scenarios that can occur during normal operations. Failures are not scripted events instead they emerge organically from how you operate and maintain the aircraft. Here are some of the situations you may encounter:

Engine Troubles - Running the engines above maximum takeoff power for longer than the rated time limits can cause damage. Hot starts from restarting an engine before it has cooled can spike ITT into the danger zone. The FADEC will protect the engine where it can, but there are limits to what it can save. Neglected oil changes lead to increased consumption and eventually to engine seizure.

Electrical Gremlins - An ageing battery may not have enough voltage to start the engines. A failed generator forces the remaining generator to carry all loads, shedding the non-essential buses. Lose both generators and you are on emergency bus power with a 45-minute battery countdown. A failed inverter can affect cockpit lighting in unexpected ways.

Hydraulic Issues - A failed hydraulic pump means no powered gear extension, reduced braking capability, and no spoiler deployment. The emergency landing gear extension procedure becomes very real when the hydraulic system lets go.

Tyre Dramas - A tyre blowout on landing from over-inflation or excessive wear is one of those moments that gets your heart racing. Properly maintaining tyre pressures and replacing worn tyres before they reach critical condition is the key to avoiding surprises on the runway.

Brake Fade - Landing at a short field with worn brake pads and discovering they do not have the stopping power you expected is a lesson you only need to learn once.

Flap System Failure - Losing flaps means a faster approach, a longer landing distance, and a very different energy management challenge.

Windshield Damage - A bird strike can crack your windshield at any time. While not immediately dangerous, it adds stress and should be repaired before the next flight.

Every failure in the simulation follows realistic principles. Components do not fail randomly for drama — they fail because they were not maintained, because they were operated outside their limits, or because they have simply reached the end of their service life. The EFB gives you all the tools to prevent these situations. The question is: will you use them?

Maintenance Page: Random Failures

In addition to the wear-based failures described above, the FSReborn Phenom 300E includes a sophisticated random failure system that simulates the unpredictable nature of real-world aircraft operations. Even a perfectly maintained aircraft can experience unexpected component failures and now, so can yours.



The random failure system draws from a pool of over 135 different failure targets, covering virtually every circuit-protected system on the aircraft. When a random failure event occurs, the system selects one or more circuit breakers to trip, instantly disabling the associated system. The failures are organised into four severity tiers:

Tier A Comfort and Nuisance:

The most common type (and the least dangerous). These affect cabin comfort systems like lighting, the hot beverage jug, toilet flush, water pump, USB charging ports, wifi, video monitors, passenger intercom, cockpit reading lights, and the magnetic compass. Annoying for passengers, but you can fly home safely.

Tier B Operational:

More significant. These can knock out windshield heaters, pitot tube heating, air data probes, roll and yaw trim actuators, weather radar, DME, transponders, COM radios, navigation receivers, the ice detector, radar altimeter, strobe lights, taxi lights, and navigation lights. Any of these demands a considered response and may require diverting or limiting your flight.

Tier C Flight-Critical:

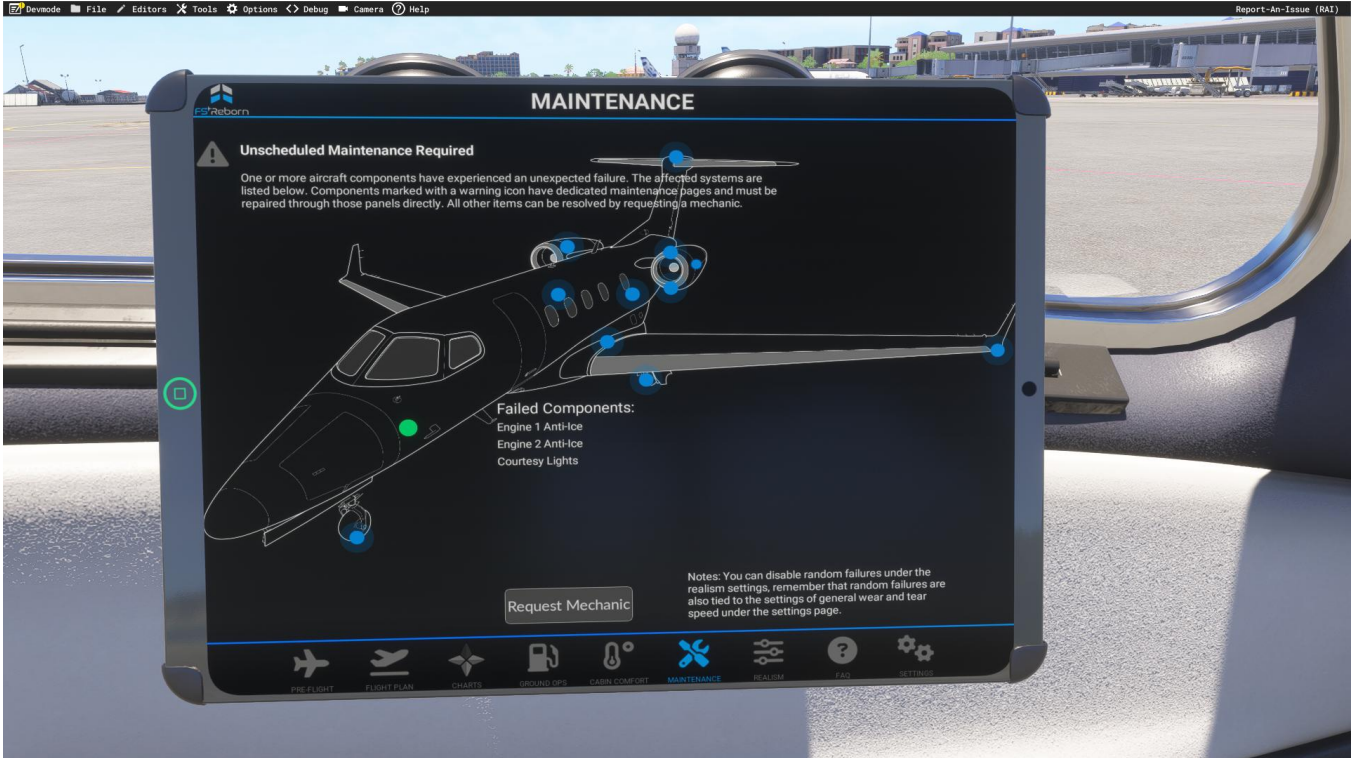
Serious failures that demand immediate attention. Pitch trim systems, generator control units, fuel pumps, the pressurization controller, temperature controller, FADEC channels, flight control electronics, landing lights, and the VCS compressor. These failures can significantly affect the safe operation of the aircraft and will test your emergency procedure knowledge.

Tier D Severe:

The rarest but most impactful. A flap system failure changes your entire approach and landing profile.

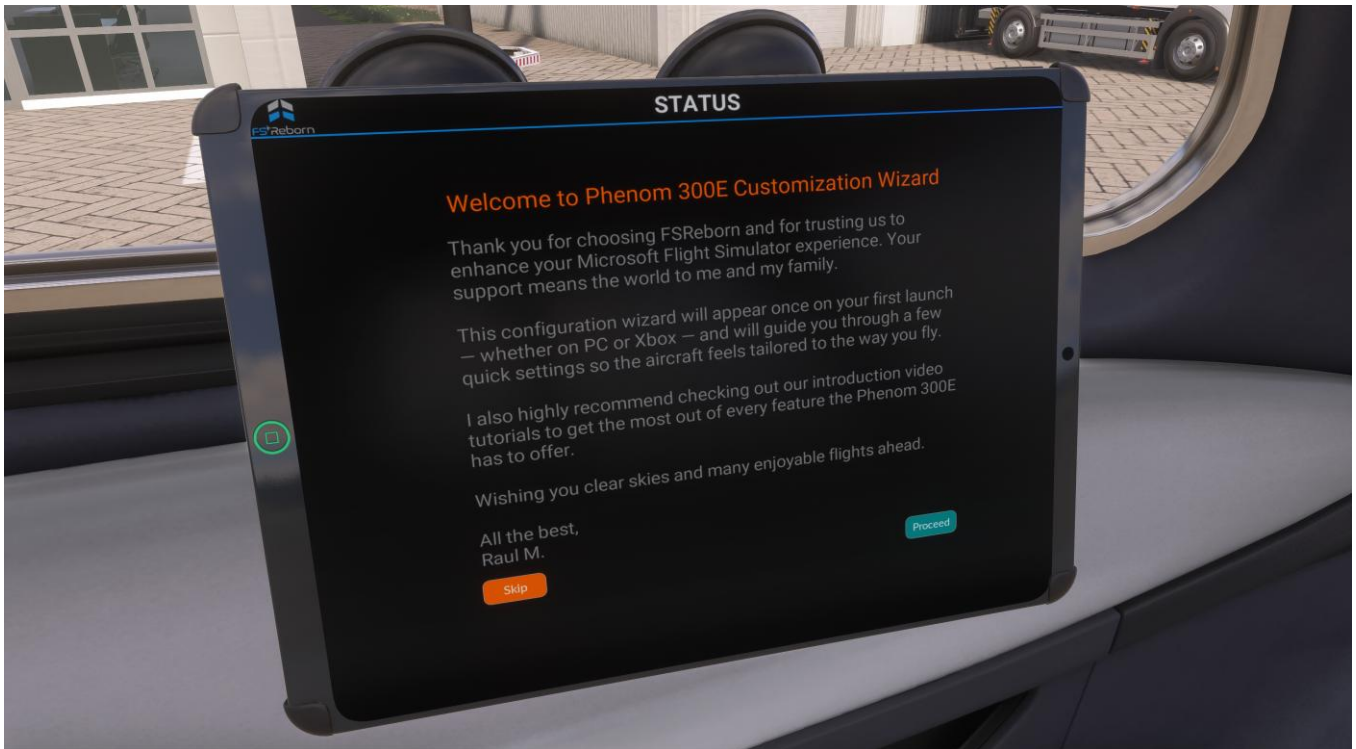
The beauty of the random failure system is that no two flights are ever quite the same. The failures can stack — you might experience a minor cabin lighting issue followed by a transponder failure on the same flight. The system is so organic that even we cannot predict what will go wrong on any given flight. Multiple failures can compound, creating complex scenarios that challenge you to prioritize, troubleshoot, and apply the correct emergency procedures.

When a random failure occurs, the failed components are listed in the Random Failures panel on the Maintenance page. A 'Request Mechanic' button sends a maintenance crew to repair the affected systems. Components with dedicated maintenance pages (like generators, flaps, and lights) must be repaired through their own panels.



Random failures are tied to the wear and tear speed setting — at accelerated wear rates, random failures also become more frequent. The entire system can be toggled on or off in the Realism settings. We recommend keeping it enabled for the most immersive experience, but we understand if you prefer a predictable flight from time to time.

Realism Page Philosophy



EFB initial setup wizard

The *Realism* page is arguably the most important page in the entire EFB, because it determines what kind of flying experience you will have with the Phenom 300E.

We designed this aircraft to serve two very different communities of flight simmers. On one side, there are pilots who want to jump in, fly a beautiful jet, enjoy the scenery, and land without worrying about whether they forgot an oil change 200 hours ago. On the other side, there are pilots who want the closest possible experience to operating a real aircraft where every checklist item matter, every maintenance schedule must be followed, and every shortcut has consequences.

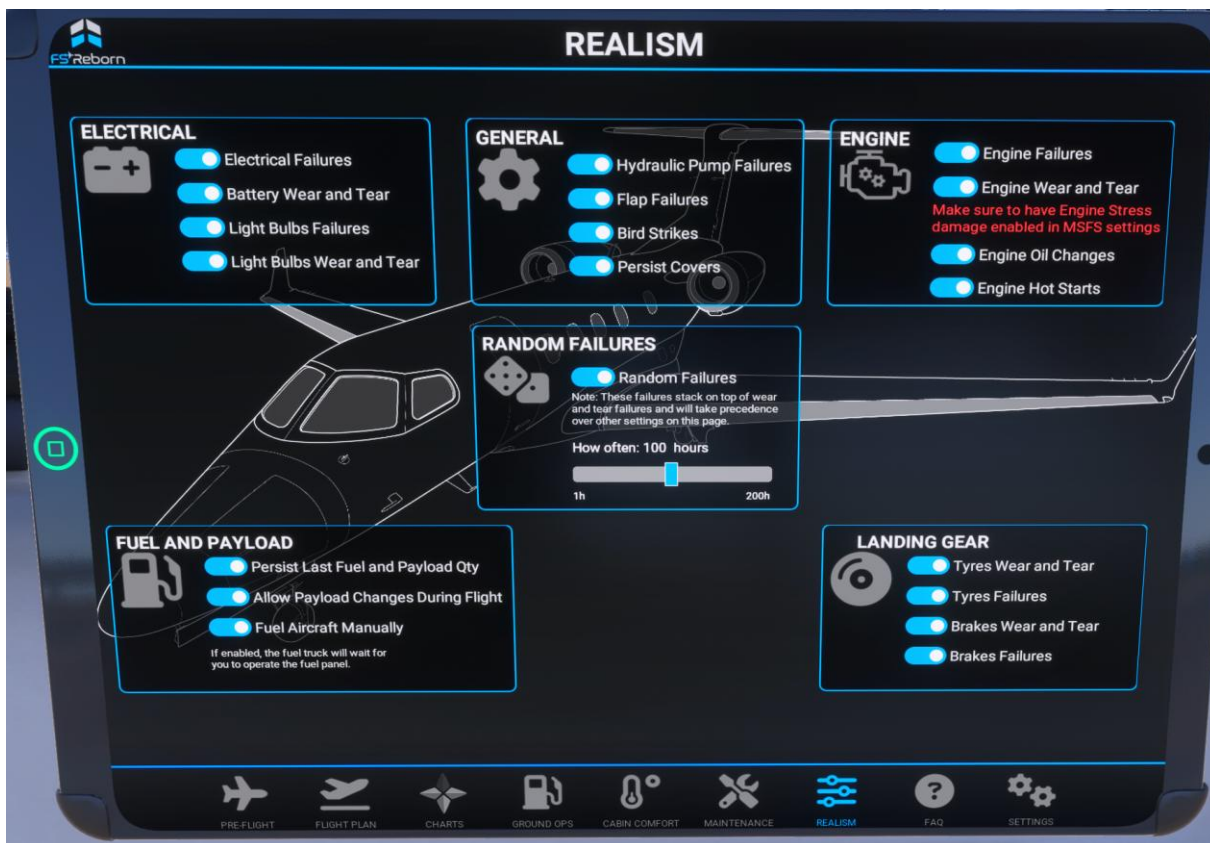
Both approaches are equally valid, and the *Realism* settings exist to let you choose exactly where on that spectrum you want to be. This is why the initial setup wizard that appears when you first load the aircraft is so important. The wizard asks you honest questions about how you want to fly, and configures the *Realism* settings accordingly.

We strongly recommend answering the wizard truthfully rather than enabling everything because it sounds impressive. If you enable all failures and wear systems but then do not follow the aircraft's operational procedures and checklists, you will experience failures, not because the simulation is broken, but because that is exactly what would happen to a real aircraft operated the same way.

The golden rule is simple: if failures are enabled, the aircraft expects to be operated by the book. Follow the checklists, perform your maintenance, respect the engine limitations, and the aircraft will reward you with reliable, trouble-free operation. Cut corners, skip procedures, or push components beyond their limits, and the aircraft will respond accordingly just as a real PW535E1-powered Phenom 300E would.

Conversely, if you want to fly in a more relaxed state, for instance perhaps you are still learning the aircraft and its systems, exploring scenery, or simply want a stress-free session, there is absolutely no shame in disabling some or all of the failure toggles. The aircraft flies beautifully either way. The *Realism* settings are not a difficulty selector with a 'correct' answer. They are a preference tool that lets you tailor the experience to what you enjoy most on any given day and the given challenge you seek.

Realism Page Settings



EFB Realism page

The Realism page provides granular control over every failure and wear system in the aircraft. Each system can be independently enabled or disabled:

Engine Failures - When enabled, the engines can fail if operated beyond their certified limits (exceeding maximum ITT, running at takeoff power beyond the rated time limits, hot starts from insufficient cooling) or if maintenance is neglected (overdue scheduled maintenance, low oil from skipped oil changes). When disabled, the engines will operate reliably regardless of how they are treated. We recommend keeping this enabled if you want to practice proper engine management and experience realistic consequences for exceeding limits.

Engine Wear and Tear - When enabled, engine components accumulate hours and degrade over time. Oil is consumed during operation, and oil leaks can develop if changes are overdue. This creates the need for regular maintenance via the EFB. When disabled, engine fluids remain constant and no wear accumulates.

Electrical Failures - When enabled, batteries degrade over their 600-hour lifespan and generators can fail if maintenance is neglected. A battery that has not been replaced after many hours of use may not have sufficient voltage to start the engines. When disabled, the electrical system operates perfectly regardless of component age.

Tyre Failures and Wear - When enabled, tyres degrade with use, pressure varies with temperature, and blowouts can occur from over-inflation or excessive wear on hard landings. When disabled, tyres remain in perfect condition.

Brakes Wear and Tear - When enabled, brake pads wear down with use and braking effectiveness decreases over time. When disabled, brakes maintain full effectiveness indefinitely.

Hydraulic Pump Failures - When enabled, the hydraulic pumps can fail from wear or from mishandling (cycling the gear handle while the gear is in transit). When disabled, the hydraulic system operates perfectly.

Flap Failures - When enabled, the flap system can fail if maintenance is overdue. When disabled, flaps operate normally at all times.

Bird Strikes - When enabled, bird strikes can damage the windshield during flight. When disabled, no bird strikes will occur.

Random Failures - When enabled, the random failure system can trip any of the 135 circuit breakers in the failure pool at unpredictable intervals, simulating the kind of unexpected issues that real aircraft experience. When disabled, no random failures

will occur. Random failure frequency is influenced by the wear and tear speed setting.

Wear and Tear Speed - This multiplier (1x to 16x) accelerates all maintenance intervals proportionally. At 1x, intervals match realistic timescales. At higher speeds, maintenance is needed sooner, allowing you to experience the full maintenance lifecycle more quickly. This setting affects all wear-based systems including random failure frequency.

Fuel and Payload Persistence - When enabled, fuel and payload quantities persist between sessions. The aircraft remembers how much fuel you had when you last shut down. When disabled, fuel and payload reset to default values each session.

Allow Payload Changes During Flight - When enabled, you can adjust fuel and payload via the EFB while airborne. When disabled, changes can only be made on the ground, enforcing realistic operational procedures.

Fuel Aircraft Manually - When enabled, the refuelling process requires you to physically operate the external fuel panel (as described in the Ground Operations: Manual refuelling section of the manual). When disabled, refuelling is handled automatically by the EFB.

All of these settings can be changed at any time. There is no penalty for adjusting them mid-session if you decide you want a different experience. The aircraft will immediately adapt to whatever configuration you choose.

Settings Page



The Settings page contains all the configuration options that personalize your Phenom 300E experience. These settings persist between sessions.

Unit Preferences - The EFB can display values in your preferred measurement system. Five-unit categories can be independently toggled:

Fuel Units - Switch between US Gallons (default) and Litres. This affects all fuel quantity displays on the Ground Ops page, fuel indications, and estimated range calculations.

Weight Units - Switch between Pounds/lbs (default) and Kilograms. This affects payload weights, fuel weight, empty weight, MTOW display, and all weight-related calculations shown on the EFB.

Distance Units - Switch between Nautical Miles/NM (default) and Kilometres. This affects estimated range and any distance displays.

Tyre Pressure Units - Switch between PSI (default) and BAR. This affects all tyre pressure readings on the Maintenance page.

Temperature Units - Switch between Celsius (default) and Fahrenheit. This affects temperature displays throughout the EFB including cabin temperature, oil temperature, and environmental readings.

All unit preferences are applied instantly across every page of the EFB. Choose whichever units you are most comfortable reading. The systems modelling accuracy is identical regardless of which unit system is displayed.

Settings Page: Action Cameras

One of the most visually rewarding features of the Phenom 300E is the Action Camera system. When enabled, these cameras automatically switch your view to a cinematic external perspective when certain aircraft operations are performed, then smoothly return you to the cockpit when the action is complete.

Auto Position EFB Camera - When enabled, taking the EFB tablet out of the left side pocket automatically moves your camera to a comfortable viewing position directly in front of the tablet. This is particularly useful because the EFB is positioned in the side pocket where it can be difficult to see from the default pilot view. Note: this feature does not work in VR mode. The EFB can also be accessed via the dedicated instrument camera (CTRL+4 on PC). You can drag the tablet to reposition it and adjust the viewing angle and your preferred position is always remembered between sessions.

Engine Startup Camera - When enabled, initiating an engine start triggers an exterior camera view showing the engine nacelle as the turbine spools up. You can watch the fan begin to rotate, see the exhaust shimmer as combustion begins, and hear the engine come to life from outside the aircraft. The camera returns to the cockpit once the engine stabilises at idle.

Landing Gear Camera - When enabled, extending or retracting the landing gear triggers an exterior view showing the gear doors opening and the gear swinging into position. This is especially satisfying during approach when you can watch the main gear and nose gear lock into place.

Flaps Operation Camera - When enabled, changing flap settings triggers an exterior view of the wing showing the flaps extending or retracting. Watching the flap surfaces deploy from an external perspective gives you a much better appreciation of how much the wing geometry changes at each flap setting.

Main Door Camera - When enabled, opening or closing the main cabin door triggers an exterior view of the airstair door. This is a lovely immersion touch during boarding and deboarding sequences.

GPU Door Camera - When enabled, opening or closing the GPU access door triggers an exterior camera view.

All action cameras can be individually enabled or disabled. If you find any of them distracting during normal operations, simply toggle that specific camera off while keeping the others active. Many pilots enjoy the engine startup and landing gear cameras but may prefer to disable the others, experiment and find what works for you.



Action camera example

Settings Page: Navigraph, Sound, and Other Settings

Navigraph - Enter your SimBrief username in the text field to enable flight plan import and Navigraph chart access. Once configured, the Flight Plan page can download your SimBrief OFP, and the Charts page can display approach plates and airport charts. Your username is stored and remembered between sessions.

Send SB Plan to G3000 - When enabled, importing a SimBrief flight plan via the EFB automatically programs the route into the Garmin G3000 FMS. This saves you from having to manually enter waypoints into the avionics. When disabled, the flight plan is only displayed on the EFB and you must program the FMS separately. Note that importing a plan mid-flight will replace your current FMS route and may require you to set a direct-to the nearest waypoint after import.

Sound Settings - Three individual volume sliders let you fine-tune the audio experience:

Engine Volume - Controls the volume of the custom PW535E1 engine sound set. Reduce this if you find the engines too loud relative to other simulator audio, or increase it for a more immersive turbine experience.

Environmental Volume - Controls ambient environmental sounds such as wind noise, rain, and atmospheric effects.

Cabin Rattles - Controls the volume of cabin rattle and vibration sounds that occur during turbulence, taxiing over rough surfaces, and at certain airspeeds. These sounds add significant immersion but can be reduced if you prefer a quieter cockpit.

Headset Simulation - When enabled, the audio is processed to simulate wearing a pilot headset. Frequencies are filtered and the sound profile changes to mimic the experience of hearing the aircraft through active noise-cancelling aviation headsets. When disabled, audio is presented naturally without headset processing.

Ground Operations - Passenger Vehicle Selection: Choose which ground vehicle is used for passenger boarding and deboarding during realistic loading sequences. The selected vehicle will physically drive to the aircraft when passengers are called. You can also send the vehicle to the aircraft or back to the parking position manually from this section.

Aircraft Stats - Reset All: This button restores the aircraft to factory-new condition. All maintenance histories, component wear, tachometer hours, exceedance counts, oil levels, tyre conditions, brake pad wear, battery capacity, and random failure states are reset to zero. This is a complete fresh start, use it if you have made too many maintenance mistakes and want to begin again from a fresh state. A confirmation dialog appears before the reset is applied to prevent accidental use.

CHAPTER 6

FSReborn FBO Utility

Overview

The FSReborn FBO Utility lets you place custom FBO buildings, hangars, and supporting structures anywhere in the simulator world — at any airport, in any livery configuration. Once placed, an FBO stays where you put it: it persists across flights, sessions, and sim restarts, and is ready for you whenever you arrive at that airport. The utility is split across two toolbar panels that work together:

FSReborn FBO Utility — the main panel with a map. Use this to place new FBOs and review what's already installed.

FSReborn FBO Control — the companion panel for adjusting a selected FBO. Use this to fine-tune position, rotation, height, and the building's open/closed state of doors, lights, blinds, and logos.

Both panels open from the MSFS toolbar.



Placing an FBO

Open the FSReborn FBO Utility panel from the toolbar. The map appears, centred on your aircraft.

Click the location on the map where you want to place the FBO. A small picker appears with the available structures:

Executive Small: Compact FBO with attached small hangar

Medium Base: Mid-size FBO building

Large Base: Full-size FBO complex

Aerolith: Standalone medium hangar



Click the structure you want. The FBO spawns at the clicked location, snapped to ground level, facing north by default.

The placement is automatically tagged with the nearest airport's ICAO code (e.g. KJFK, EGLL) and saved.

Your new FBO is now permanent. It will be there next time you fly into that airport, even after restarting the sim.

Reviewing your installed FBOs

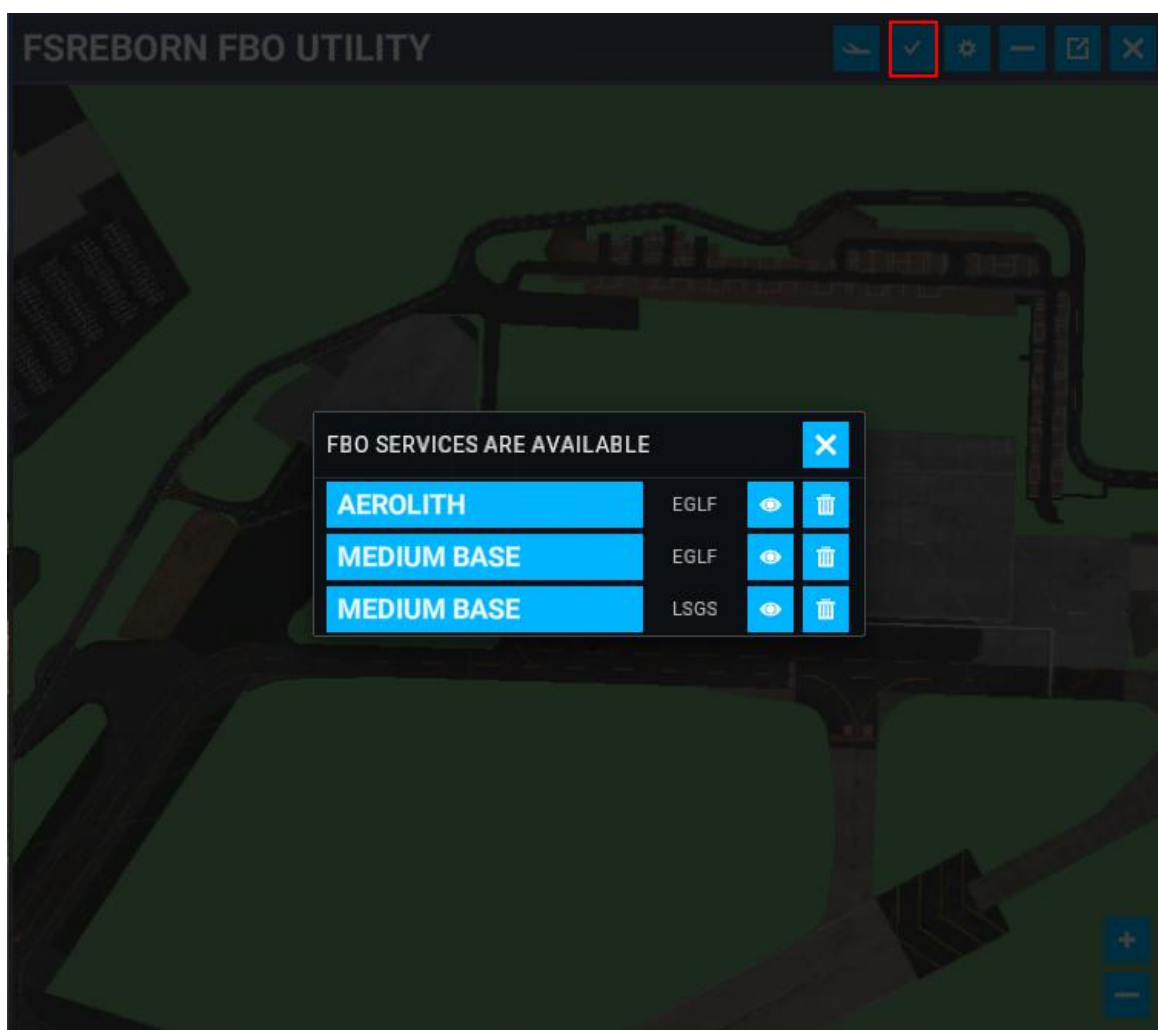
The main panel has an FBO Services available button (the checklist icon in the title bar) that opens a list of every FBO you've installed across the world.

Each row shows the structure type, the airport ICAO it was placed at, and two buttons:

Eye icon: selects the FBO and centres the map on it. Use this to find an FBO you placed earlier.

Trash icon: Permanently removes the FBO. There's no undo, so make sure you have the right one selected.

The list is sorted alphabetically by airport ICAO, so all your KJFK placements group together, all your EGLL placements group together, and so on.



Selecting an FBO to edit

You can edit any placed FBO at any time, but you have to be reasonably close to it for the controls to take effect. The simulator only loads FBOs within a few miles of your aircraft, so to adjust an FBO at KSFO, you need to be at or near KSFO (at least 10nm from the building you want to edit).

To select an FBO, either:

- Click its marker on the map, or
- Click the eye icon next to it in the FBO Services available button.

Once selected, the FSReborn FBO Control panel becomes active:



The header at the top shows the structure type currently selected (e.g. "OBJECT SELECTED: EXECUTIVE SMALL"). A small rubbish icon next to the header lets you delete the selection. To deselect, either click an empty area of the map or pick a different FBO.

The FBO Control panel

The Control panel has three collapsible sections: MOVE, ROTATE, and OPTIONS. Click any section header to fold or unfold it.

MOVE

Adjusts the FBO's position.

Nudge — four arrow buttons (left / right / up / down on the map) shift the FBO by a small distance. Use this for fine alignment after the initial placement.

Step Size — controls how far each nudge moves the FBO. Step left or right through the values: 0.1 m, 1 m, 5 m, 10 m. Start with larger steps for rough positioning, then drop to 0.1 m to dial in the final centimetres.

Feet Above Ground — a slider from 0 to 10 ft. Lifts the FBO off the ground when terrain is uneven or when MSFS's auto-ground-snap leaves the building clipping into the apron or hovering slightly above it. The slider moves in 0.1 ft increments for precise adjustment. Leave at 0 for normal "snap to ground" behaviour — only lift it if you see a height mismatch, grass, ground or snow bleeding in, etc.

ROTATE

Adjusts how the FBO is oriented.

Heading — a slider showing the current heading in degrees, draggable to set any value from 0° to 359.9°. Use this for large rotations.

Bank — a slider from -25° to +25°. Tilts the FBO sideways. Only works when Feet Above Ground is greater than 0 — when the FBO is on the ground, MSFS forces it level and the slider is greyed out.

Pitch — same as Bank but tilts the FBO forward or backward. Same behaviour: only adjustable when the FBO is lifted off the ground.

Rotate Left / Right — buttons that rotate the FBO by the current Rotation Step. Useful for fast 90° rotations or fine 1° tweaks.

Rotation Step — controls how much each Rotate button moves: 0.1°, 1°, 5°, 90°. Use 90° to spin the building around its corners; use 0.1° for final alignment with a runway or taxiway edge.

A typical workflow is:

Use the Heading slider for the rough rotation (e.g. drag to ~270° to face the building west).

Use Rotate Left / Right with a 1° or 0.1° step to fine-tune the final degree.

If the apron is sloped, lift the FBO a foot or two with Feet Above Ground and then use Bank and Pitch to match the slope visually.

OPTIONS

This is where you control the FBO's physical state — what's open, what's closed, what's lit, which logo to display.

The available options depend on which structure is selected: a Large Base has many more options than the Aerolith hangar.

Options are organized into two groups:

VISIBILITY

Controls what's visible on the building. Examples:

Logo — selectable between FSR, USER, and HIDDEN. Use FSR for the default FSReborn branding, USER for your own custom logo (if you've added one to the package), or HIDDEN for no logo at all.

Side Logo / Hangar Logo / Interior Logo — same FSR / USER / HIDDEN choice for each logo location on a building that has multiple.

Airside Canopy / Extended Apron / Central Lighting Feature — toggles individual structural elements between HIDDEN and SHOWN. Useful if your airport already has a canopy modelled, for example, or if you don't want a feature to overlap with existing scenery.

ANIMATIONS

Controls openable and switchable elements. Each row cycles between two states:

Hangar Doors / Main Entry / Balcony Door / Kitchen Door — CLOSED or OPEN.

Hangar Lights — OFF or ON.

Blinds 1–6 — RAISED or LOWERED.

Each option has left and right arrows. Click either arrow to cycle to the other state. The state is saved with the placement, so a hangar you set to OPEN stays OPEN across flights, or you can open them and close them as desired.

Remember the controls are MSFS panels, just like the weather, they will work even on Avatar mode, you can minimize the MAP, walk with your avatar and control any options of the FBO while you are inside, in front of doors, etc.

Tips

- **Place first, refine later.** Don't try to get the placement perfect on the first click. Place the FBO roughly where you want it, then use the Move and Rotate controls to dial it in.
- **The main FBO Map panel needs to be open in order for options and movements inside the FBO control panel to work.** This is an SDK limitation, remember you can minimize the map panel once you selected or placed a building. You can work in drone camera (recommended) and tweak your FBO position from it.
- **Use the largest reasonable step sizes for rough work.** Switching between 10 m steps for placement and 0.1 m steps for the final alignment is much faster than nudging 0.1 m at a time across the whole apron.
- **Keep Feet Above Ground at 0 unless you need it.** It's a corrective tool for terrain mismatches, not a default. A grounded FBO uses MSFS's automatic terrain snap, which is correct in most cases.
- **Bank and Pitch reset to 0 when you ground the FBO.** If you set a tilt and then drop Feet Above Ground back to 0, the tilt is cleared. This is intentional — buildings on the ground are level. If you want to preserve a tilt, keep the FBO at least 0.1 ft above ground.
- **Save happens automatically.** There's no save button. Any change you make is persisted to disk a couple of seconds after you make it. You can close the panels, restart the sim, and your placements will be exactly as you left them.
- **Removing an FBO is permanent.** The trash icon (in the Control panel header or in the Placed Objects list) deletes the placement immediately. If you want to relocate an FBO instead of deleting it, use the Move and Rotate controls — there's no need to remove and re-place it.

You can install as many buildings as you want per airport, make your own world, the power is in your hands:



Location: I installed these two at EGLF, next to Gulfstream hangars.

Installing your own logo:

To make the FBOs contain your own logo is very easy, follow the steps below 1 by 1:

Steps to use:

1. Download the custom logos MOD creator from:
https://fsr300e.fsreborn.com/Phenom300_FBO_CustomLogo.zip
2. Unzip the attachment "Outside of your Community Folder"
3. Enable MSFS Dev Mode
4. Open the Project on the folder you unzipped this.
5. Click Build for the 1st time.
6. Open the folder: PackageSources\SimObjects\Misc\FSR300E_FBOS\texture
7. Edit the Texture files as you please, do both textures, the wmissive and the color part. As long as you put the text and the shape of your logo in the textures, these will render exactly like this in your buildings.
8. After you save the textures, the system automatically will update the textures of your FBOs, provided you have set them to show USER LOGO.
9. Once you are happy, close the project. Find the folder \Phenom300_FBO_CustomLogo\Packages inside the project.
10. This is now your MOD, copy this to your Community folder, from this point onwards, your custom logos will be always in your FBOs. You can share this MOD with your friends or VA members, and everyone will see the same logo.



You can play with any colours, etc. Any logo shapes, once again, build your own world.

CHAPTER 7 PASSENGER CABIN CONTROL PANEL

Overview

Tucked beneath the armrest of Passenger Seat 5 is a small but surprisingly capable control panel that gives your passengers a degree of authority over their own comfort if you, as pilot in command, choose to grant it.

In the real Phenom 300E, this panel allows a designated passenger to adjust cabin lighting and temperature without needing to ask the flight crew. The FSReborn model faithfully reproduces this system, and it is fully functional.

The panel is only active when the pilot has transferred control to the passengers. For temperature, this is done by rotating the CABIN TEMP control knob on the cockpit air conditioning panel counter-clockwise past the first stop (past the detent click). For lighting, the cabin wash lights must be set to a position that allows passenger override. Until the pilot delegates control, the panel beneath the armrest remains inactive while the passengers can press buttons all they like, nothing will happen.

This is a deliberate design choice, both in the real aircraft and in the simulation. The pilot always retains ultimate authority over the cabin environment. Transferring control to the passengers is a courtesy, not a requirement.



Lighting Controls



The lighting section of the passenger panel provides a surprisingly rich set of options for setting the cabin mood. Rather than simple on/off switches, the panel offers a selection of carefully designed presets along with full manual control.

Lighting Presets - Ten preset buttons cover the most common cabin scenarios:

All Lights Off - Turns off all cabin lighting. Useful for passengers who want to sleep or simply enjoy the view out of the window on a night flight.

All Lights On - Maximum illumination throughout the cabin. Every light source is activated at full brightness.

Sleep - A minimal lighting configuration designed for rest. Overhead lights are dimmed or off, with only subtle ambient illumination to allow safe movement if needed.

Cinema - Reduced lighting optimized for watching content on the cabin monitors or personal devices. Enough light to find your drink, not enough to create screen glare.

Working - Bright, even illumination suitable for reading, working on a laptop, or reviewing documents. This is the default preset.

Custom 1 through Custom 5 - Five user-configurable presets that can be set up to any combination of light levels. These allow frequent passengers to save their personal preferences and recall them with a single tap.

Cabin Washlights - Below the presets, the panel provides direct control over the cabin washlight system. Washlights are the ambient lights that illuminate the cabin ceiling and walls, creating the overall mood of the space. The passenger can adjust their intensity to taste.

Switch Backlights - A simple on/off toggle that controls whether the panel's own buttons and switches are illuminated. Turning backlights off during a night flight prevents the panel from being a source of unwanted light in the cabin.

Audio - The panel includes audio controls that allow passengers to adjust cabin entertainment volume and audio settings from their seat.

Temperature Control



The temperature section of the passenger panel provides a straightforward warm/cool adjustment that lets passengers fine-tune the cabin temperature to their preference.

Once the pilot has transferred cabin temperature authority to the passenger panel (by rotating the CABIN TEMP knob past the detent), the panel's temperature controls become active. The passenger can then nudge the cabin temperature warmer or cooler using simple directional controls.

The adjustment range is bounded in such a way that the passengers cannot set the cabin to extreme temperatures. The system operates within a comfortable envelope, allowing small adjustments around the baseline temperature that the pilot originally set. Think of it as the passenger being able to adjust the thermostat by a few degrees in either direction, not reprogram the entire air conditioning system.

The cabin temperature simulation in the Phenom 300E is fully modelled (as described in the Cabin Temperature Simulation section of Chapter 3). Changes made from the passenger panel feed into the same thermal model, so the response is realistic meaning the cabin does not instantly jump to the new temperature. Instead, the air conditioning system gradually adjusts, and you will feel the temperature change develop over the course of a minute or two, just as it would in the real aircraft.

If the pilot reclaims temperature authority at any time (by rotating the CABIN TEMP knob back to a cockpit-controlled position), the passenger panel's temperature controls immediately becomes inactive and the cockpit commanded setting takes precedence.

CHAPTER 8 NORMAL PROCEDURES

The normal procedures in this chapter are sourced from the Embraer Phenom 300E Airplane Flight Manual (AFM-2664), Section 3. They cover all phases of flight from cockpit preparation through shutdown and leaving the aircraft.

For the complete checklist format, refer to the Quick Reference Handbook (QRH) which accompanies this manual. The QRH provides the same procedures in a condensed checklist format optimized for in-flight reference.

The procedures are presented in the order they are performed during a typical flight. All procedures assume normal system operation. For abnormal or emergency situations, refer to Chapter 6 (Emergency and Abnormal Procedures) or the QRH Emergency section.

N-1 COCKPIT / CABIN SAFETY INSPECTION

Emergency Door Locking Pin.....	REMOVE
Emergency Door.....	SECURED AND LOCKED
Documents, Manuals and Charts.....	CHECK ON BOARD
Maintenance Status.....	CHECK
Emergency Equipment.....	CHECK
Oxygen Bottle Valve Handle.....	PUSH TO RESTORE
SUPPLY CONTROL Knob.....	PAX AUTO
Oxygen Mask Regulator.....	CHECK 100%
ELECTRICAL Panel.....	CHECK
BLEED 1 & 2 Switches.....	AUTO
XBLEED Knob.....	AUTO
TEST Panel.....	OFF
Circuit Breakers.....	CHECK IN
FUEL PUMP 1 & 2 Switches.....	AUTO
XFEED Knob.....	OFF
HYD PUMP SOV 1 & 2 Switches.....	OPEN
ELT Switch.....	ARMED
PUSHER CUTOUT Button.....	PUSHED OUT
Gust Lock Pin.....	REMOVE
Rudder Pedals.....	CHECK UNLOCKED
HEATING Panel.....	CHECK
ICE PROTECTION Panel.....	CHECK
LDG GEAR Lever.....	DN
PRESSURIZATION Panel.....	CHECK
AIR CONDITIONING Panel.....	AS REQUIRED
ENG FIRE EXTINGUISHER Panel.....	CHECK
Start/Stop Knobs.....	STOP
Flap Lever.....	ZERO
SPEED BRAKE Switch.....	CLOSE
Parking Brake.....	SET
Seats and Belts.....	CONDITION

N-2 EXTERNAL INSPECTION

External Lights.....	CHECK
IASP.....	CONDITION, NO OBSTRUCTION
Oxygen Discharge Indicator.....	GREEN DISK IN PLACE
Ice Detector (if installed).....	CHECK
Antennas.....	CONDITION
Red Beacon Light.....	CONDITION
NLG Doors, Wheel and Tire.....	CONDITION
NLG Torque Link.....	CONNECTED AND SECURED
NLG Safety Pin.....	REMOVED
Fwd LH Baggage Compartment Door.....	LATCHED
Radome.....	CONDITION
Fwd RH Baggage Compartment Door.....	LATCHED
Stand-By Pitot Tube.....	CONDITION, NO OBSTRUCTION
Refueling Panel.....	CLOSED
LDG/Taxi Lights.....	CONDITION
Fuselage Air Inlet.....	NO OBSTRUCTION

Engine Fan	CONDITION
Engine Air Inlet.....	NO OBSTRUCTION
Starter/Generator Air Inlets	CLEAR
Fuel Drains	DRAIN AND CHECK
Right Wing Leading Edge	CONDITION
MLG Doors, Wheels, Brakes and Tires	CONDITION
MLG Safety Pin.....	REMOVED
Fuel Cap	CLOSED AND LOCKED
Navigation/Strobe Lights.....	CONDITION
Right Winglet	CONDITION
Right Aileron	CHECK FREE
Right Spoilers	CONDITION
Right Flap	CONDITION
Cowlings	LATCHED
Engine Exhausts	CLEAR
Engine Oil Level.....	CHECK
Vertical Stabilizer	CONDITION
Rudder	CONDITION
Horizontal Stabilizer	CONDITION
Elevator.....	CONDITION
Aft Baggage Compartment Door	LATCHED
Left Flap.....	CONDITION
Left Spoilers.....	CONDITION
Left Aileron.....	CHECK FREE
Left Winglet.....	CONDITION
Left Wing Leading Edge.....	CONDITION
Fuel Cap (Left).....	CLOSED AND LOCKED
MLG (Left).....	CONDITION

N-3 POWER UP

BATT 1 & 2 Switches	ON
GPU Button (if applicable).....	AS REQUIRED
CVDR Panel	CHECK (TEST HOLD 5 SEC)
Transponder / TCAS II (if applicable)	CHECK

N-4 BEFORE START

Oxygen Mask Flow and Microphone	CHECK
TEST Panel	TEST
SIGNS/OUTLET Switch	BELTS / ON
External Lights	AS REQUIRED
EMER LT Switch.....	ARM
Fuel Quantity and Balance.....	CHECK
Oxygen Pressure	CHECK MIN FOR DISPATCH
ENG IGNITION Switches	AUTO
Thrust Levers	IDLE
Parking Brake	SET
Doors	CLOSED

N-5 ENGINE START

Associated Start/Stop Knob	START, THEN RUN
Engine Parameters	MONITOR
.....	Check N2, ITT, N1 and oil pressure within limits.
Repeat for other engine	

NOTE: Allow minimum 2 minutes at or near IDLE before selecting higher thrust settings.

N-6 AFTER START

GPU (if applicable).....	DISCONNECT
ELEC EMER Button.....	PUSH IN
Battery 1 & 2 Voltage	CHECK (min 23.5V each)
ELEC EMER Button.....	PUSH OUT
Stall Protection System (TEST Panel)	TEST
AFCS Control Unit	SET

Engine Takeoff Data (OAT / ATR).....	SET
Landing Field Elevation.....	SET
Takeoff Speeds (V1, VR, V2, VFS).....	SET
Transponder / TCAS II (if applicable).....	SET
Altimeters (pilots and IESI).....	SET & X-CHECK
Flight Controls.....	CHECK FREE
Trims (Roll, Yaw, Pitch NORM & BKP).....	CHECK / SET
Flap.....	SET FOR TAKEOFF
External Lights.....	AS REQUIRED
Ice Protection.....	AS REQUIRED

N-7 BEFORE TAKEOFF

Takeoff Configuration.....	CHECK (T/O CONFIG Button)
CAS Messages.....	CHECK
SIGNS/OUTLET Switch.....	PED-BELTS / OFF
Yaw Damper.....	OFF

--- SHORTLY BEFORE TAKEOFF ---

Passengers.....	ADVISE
Lights.....	AS REQUIRED

CAUTION: Press T/O CONFIG button. Aural 'TAKEOFF OK' confirms correct configuration.

N-8 TAKEOFF

Thrust Levers.....	TO/GA
Engine Parameters.....	MONITOR
At VR: Rotate.....	Flap 1: 10.5° / Flap 2: 8°
With positive rate of climb:	
LDG GEAR Lever.....	UP
Airspeed.....	V2 + 10 KIAS MINIMUM

N-9 AFTER TAKEOFF / CLIMB

LDG GEAR Lever.....	CHECK UP
Flap.....	ZERO (on schedule at/below VFE)
Thrust Levers.....	CON / CLB
Altimeters (pilots and IESI).....	SET & X-CHECK
Yaw Damper.....	ON
Icing Conditions.....	VERIFY

--- ABOVE 10,000 ft ---

SIGNS/OUTLET Switch.....	AS REQUIRED
External Lights.....	AS REQUIRED
Weather Radar (if installed).....	AS REQUIRED
Airspeed.....	AS REQUIRED

N-10 DESCENT

Windshield Heating.....	ON
Pressurization.....	CHECK LFE
Landing Speeds (VREF, VAC, VFS).....	SET
Icing Conditions.....	VERIFY

--- BELOW 10,000 ft ---

SIGNS/OUTLET Switch.....	PED-BELTS / OFF
--------------------------	-----------------

N-11 APPROACH

External Lights.....	AS REQUIRED
Passengers.....	ADVISE
XFEED Knob.....	OFF
Altimeters (pilots and IESI).....	SET & X-CHECK
Icing Conditions.....	VERIFY

N-12 BEFORE LANDING

Yaw Damper.....	OFF
-----------------	-----

LDG GEAR Lever	DN AND CHECK
Flap	SET FOR LANDING
Airspeed	VREF

N-13 LANDING

Thrust Levers	IDLE
Brakes (after touchdown)	APPLY MAXIMUM

N-14 GO-AROUND

TO/GA Button	PRESS
Thrust Levers	TO/GA
Rotate	Flap 3: 8° / Flap FULL: 6°
Flap	Flap 3→1 / Flap FULL→2
With positive rate of climb:	
LDG GEAR Lever	UP
Minimum Airspeed	VAC
At acceleration altitude	Proceed as normal takeoff

N-15 AFTER LANDING

Flap	ZERO
Lights	AS REQUIRED
Transponder	AS REQUIRED

N-16 SHUTDOWN

Thrust Levers	IDLE
Emergency/Parking Brake	APPLY
HEATING Panel	CHECK (WSHLD OFF, ADS AUTO)
ICE PROTECTION Panel	CHECK (all OFF)
Start/Stop Knobs	STOP
MFD Status Pages	CHECK
SIGNS/OUTLET Switch	OFF / ON

CAUTION: Maintain IDLE for at least 2 minutes prior to engine shutdown.

N-17 LEAVING THE AIRPLANE

Oxygen Bottle Valve Handle	PULL TO CUTOUT
EMER LT Switch	OFF
BATT 1 & 2 Switches	OFF
Gust Lock Pin	INSTALL
Rudder Pedals	LOCK
Lights	OFF

N-18 OPERATION IN ICING CONDITIONS

BEFORE START:	
ADS PROBES Knob	ON
BEFORE TAKEOFF (SAT 5-10°C with moisture):	
ENG 1 and ENG 2 Switches	ON
WINGSTAB Switch	OFF
WSHLD 1 and WSHLD 2 Switches	OFF
BEFORE TAKEOFF (SAT below 5°C with moisture):	
ENG 1 and ENG 2 Switches	ON
WINGSTAB Switch	ON
WSHLD 1 and WSHLD 2 Switches	ON
ADS PROBES Switch	AUTO
IN FLIGHT (TAT 5-10°C with moisture):	
ENG 1 and ENG 2 Switches	ON
IN FLIGHT (TAT below 5°C or ice accretion):	
ENG 1 and ENG 2 Switches	ON
WINGSTAB Switch	ON
WSHLD 1 and WSHLD 2 Switches	ON
AFTER LEAVING ICING (no ice on airplane):	

ENG 1 and ENG 2 Switches **OFF**
WINGSTAB Switch **OFF, THEN ICE SPEED RESET**
WSHLD 1 and WSHLD 2 Switches **OFF**

***WARNING:** Takeoff must NOT be performed with A-I WINGSTB INHB CAS message presented. Ice protection must be kept ON until crew is certain all ice has been removed.*

CHAPTER 9 EMERGENCY AND ABNORMAL PROCEDURES

The emergency and abnormal procedures in this chapter are sourced from the Embraer Phenom 300E AFM, Section 4. They provide the procedural steps required to resolve non-normal situations on the ground or in flight.

Procedures marked with the phi symbol (ϕ) are memory/recall items that must be performed immediately from memory before consulting the QRH or this manual.

The procedures assume that normal procedures have been properly accomplished, system controls are in normal condition prior to the failure, and airplane systems are operating normally prior to the failure.

For the condensed checklist format, refer to the QRH Emergency Procedures section.

LEGEND: ϕ = Memory / Recall Item. Must be performed immediately from memory before referring to the QRH.

E-1 REJECTED TAKEOFF (AT OR BELOW V1)

ϕ Thrust Levers	.....	IDLE
ϕ Brakes	.....	APPLY MAXIMUM
ϕ Directional Control	.....	MAINTAIN
Immediately after stopping:		
ENGINE SHUTDOWN or FIRE Procedure	.....	AS REQUIRED

E-2 TAKEOFF WITH ENGINE FAILURE AT OR ABOVE V1

ϕ At VR: Rotate	.....	Flap 1: 10.5° / Flap 2: 8°
ϕ With positive rate of climb:		
ϕ LDG GEAR Lever	.....	UP
ϕ Airspeed	.....	V2
Maintain V2 to acceleration altitude		
Retract flap, accelerate to VFS		
After retracting flap:		
ENGINE 1(2) FAILURE Procedure	.....	ACCOMPLISH

E-3 EMERGENCY DESCENT

ϕ SIGNS/OUTLET Switch	.....	PED-BELTS / OFF
ϕ Altitude	.....	10,000 ft OR MEA (higher)
ϕ Thrust Levers	.....	IDLE
ϕ SPEED BRAKE Switch	.....	OPEN
ϕ Airspeed	.....	250 KIAS / MMO MAXIMUM
ϕ LDG GEAR Lever	.....	DN
ϕ Transponder	.....	7700
ϕ ATC	.....	NOTIFY
At 10,000 ft or MEA:		
SPEED BRAKE Switch	.....	CLOSE

E-4 EMERGENCY EVACUATION

ϕ Thrust Levers	.....	IDLE
ϕ Emergency/Parking Brake	.....	ON
ϕ Start/Stop Knobs	.....	STOP
ϕ Fire Shutoff Button	.....	PUSH IN
ϕ PRESN MODE Switch	.....	MAN
ϕ Pressurization DUMP Button	.....	PUSH IN
ϕ ATC	.....	NOTIFY
ϕ Evacuation	.....	PERFORM
ϕ BATT 1 & 2 Switches	.....	OFF

E-5 ENGINE FIRE, SEVERE DAMAGE OR SEPARATION

ϕ Thrust Lever (affected engine)	.....	IDLE
ϕ Start/Stop Knob (affected engine)	.....	STOP
ϕ Fire Shutoff Button (affected engine)	.....	PUSH IN

LAND AS SOON AS POSSIBLE.

Wait 30 seconds, if fire persists:

BOTTLE Switch	DISCH
Altitude	36,000 ft MAXIMUM
ECS Knob	UNAFFECTED SIDE
Thrust Lever (operative engine)	AS REQUIRED
If high vibration:	
Airspeed.....	REDUCE (140 KIAS MIN)

E-6 DUAL ENGINE FAILURE

LAND AS SOON AS POSSIBLE.

φ Thrust Levers	IDLE
φ Crew Oxygen Masks	DON, 100%
φ Communication	ESTABLISH
If both engines restarted via autorelight:	
Engine Parameters	MONITOR
If no autorelight:	
Altitude	30,000 ft MAXIMUM
Airspeed.....	250 KIAS MAXIMUM
XFEED Knob	LO2
Attempt windmilling or assisted start	

E-7 ENGINE ABNORMAL START

φ Start/Stop Knob (affected engine)	STOP
On ground, if dry motoring considered:	
ENGINE DRY MOTORING Procedure	ACCOMPLISH

E-8 FORCED LANDING

Passengers	PREPARE
ATC	NOTIFY
Transponder	7700
SIGNS/OUTLET Switch	PED-BELTS / OFF
ELT	ON
Landing Data	SET
At 10,000 ft: DUMP Button	PUSH IN
LDG GEAR Lever	AS REQUIRED
Flap.....	MAXIMUM AVAILABLE
Oxygen Bottle Valve Handle	PULL TO CUTOFF
Just before touchdown: Passengers	ANNOUNCE IMPACT
After landing:	
Thrust Levers	IDLE
Start/Stop Knobs	STOP
Fire Shutoff Buttons	PUSH IN
EMERGENCY EVACUATION	ACCOMPLISH

E-9 CABIN ALTITUDE HIGH

φ Crew Oxygen Masks	DON, 100%
φ Communication	ESTABLISH
φ SIGNS/OUTLET Switch	PED-BELTS / OFF
φ Altitude	10,000 ft OR MEA (higher)
φ Thrust Levers	IDLE
φ SPEED BRAKE Switch	OPEN
φ Airspeed	250 KIAS / MMO MAXIMUM
φ LDG GEAR Lever	DN
φ Transponder	7700
φ ATC	NOTIFY
If pax masks not deployed:	
Oxygen SUPPLY CONTROL Knob	PAX OVRD
At 10,000 ft or MEA:	
Pressurization DUMP Button	PUSH IN
ECS Knob	OFF VENT
SPEED BRAKE Switch	CLOSE

LDG GEAR Lever AS REQUIRED

E-10 ENGINE 1(2) FIRE

φ Thrust Lever (affected engine) IDLE
 φ Start/Stop Knob (affected engine) STOP
 φ Fire Shutoff Button (affected engine) PUSH IN
 LAND AS SOON AS POSSIBLE.
 Wait 30 sec, if fire persists:
 BOTTLE Switch DISCH
 Altitude 36,000 ft MAXIMUM
 ECS Knob UNAFFECTED SIDE
 Thrust Lever (operative engine) AS REQUIRED
 If high vibration: Airspeed REDUCE (140 KIAS MIN)

E-11 ENGINE 1(2) FAILURE

LAND AS SOON AS POSSIBLE.
 Associated Thrust Lever IDLE
 If not restarted via autorelight:
 Start/Stop Knob STOP
 If not accomplishing takeoff:
 Thrust Lever (operative engine) CON / CLB
 If fuel leak suspected:
 FUEL LEAKAGE Procedure ACCOMPLISH
 If restart considered:
 ENGINE IN-FLIGHT START ACCOMPLISH

E-12 ENGINE 1(2) OIL LOW PRESSURE

If oil pressure indication abnormal:
 ENGINE SHUTDOWN Procedure ACCOMPLISH

E-13 ELECTRICAL EMERGENCY

φ PRESN MODE Switch MAN
 φ CABIN ALT Switch HOLD DN 10 SEC
 If above 10,000 ft:
 CABIN ALTITUDE HIGH Procedure ACCOMPLISH
 At 10,000 ft or MEA:
 Pressurization DUMP Button PUSH IN
 ECS Knob OFF VENT
 Reset both generators.
 If message persists:
 LAND AS SOON AS POSSIBLE.
 EMER LT Switch OFF
 Airplane FLY MANUALLY
 Icing Conditions EXIT / AVOID

CAUTION: Battery duration is 45 minutes maximum.

E-14 BATTERY DISCHARGE

LAND AS SOON AS PRACTICAL.
 Check BATT 1 & 2 voltage on MFD.
 If voltage out of range (yellow):
 Associated GEN Switch OFF
 Associated Thrust Lever IDLE
 If message persists:
 LAND AS SOON AS POSSIBLE.
 ELEC EMER Button PUSH IN

CAUTION: Battery duration is 45 minutes.

E-15 GENERATOR 1(2) OFF BUS

Associated GEN Switch OFF, THEN AUTO

If message persists:

LAND AS SOON AS PRACTICAL.

Associated GEN Switch **OFF**
Associated Thrust Lever **IDLE**

E-16 FLAP FAILURE

Flap Lever **CYCLE (up to 3 attempts)**

If failure persists:

Altitude **18,000 ft MAXIMUM**

Icing Conditions **EXIT / AVOID**

For landing, maintain airspeed:

Flap 0: VREF FULL + 27 KIAS

Flap 1: VREF FULL + 19 KIAS

Flap 2/3: VREF FULL + 6 KIAS

Flap FULL: VREF FULL

E-17 HYDRAULIC LOW PRESSURE

Expect lower roll rates, no speedbrake.

Avoid side slip and high AOA.

For landing:

ABNORMAL LDG GEAR EXTENSION **ACCOMPLISH**

Flap **MAXIMUM AVAILABLE**

Airspeed **VREF FULL + 17 KIAS**

During landing run:

EMERGENCY BRAKING TECHNIQUE **ACCOMPLISH**

CAUTION: Multiply flap FULL unfactored landing distance by 2.70.

E-18 HYDRAULIC HIGH TEMPERATURE

HYD PUMP SOV 1 & 2 Switches **CLOSED**

Wait 7 minutes.

If HYD HI TEMP extinguishes:

HYD PUMP SOV 2 Switch **OPEN**

Monitor system.

If HYD HI TEMP persists with SOV FAIL:

LAND AS SOON AS POSSIBLE.

Thrust Lever (associated engine) **IDLE**

Start/Stop Knob (associated engine) **STOP**

E-19 ABNORMAL LANDING GEAR EXTENSION

LDG GEAR Lever **DN**

Free Fall Handle **PULL**

If gear does not lock down:

Airspeed **140 KIAS MINIMUM**

Slip airplane to attempt to lock gear

Check landing gear indications.

E-20 LANDING GEAR LEVER DISAGREE

Airspeed **250 KIAS MAXIMUM**

LDG GEAR Lever **CYCLE**

If persists after extension:

ABNORMAL LDG GEAR EXTENSION **ACCOMPLISH**

If persists after retraction:

LDG GEAR Lever **DN**

Icing Conditions **EXIT / AVOID**

LAND AS SOON AS PRACTICAL.

E-21 FUEL IMBALANCE

If fuel leak suspected:

FUEL LEAKAGE Procedure **ACCOMPLISH**

If fuel leak NOT suspected:

Attitude **WINGS LEVEL**

Right wing low: XFEED Knob.....	LO2
Left wing low: XFEED Knob.....	LO1
Fuel Quantity.....	MONITOR
When balance achieved:	
XFEED Knob.....	OFF
FUEL PUMP Switches.....	AUTO

E-22 FUEL 1(2) LOW LEVEL

Associated FUEL PUMP Switch.....	ON
Thrust Levers.....	REDUCE TO LONG RANGE
Level airplane, check fuel quantities.	
If fuel not sufficient:	
LAND AS SOON AS POSSIBLE.	
If fuel leak suspected:	
FUEL LEAKAGE Procedure.....	ACCOMPLISH
If no fuel leak:	
XFEED Knob.....	AS REQUIRED

E-23 ENGINE SHUTDOWN (IN FLIGHT)

LAND AS SOON AS POSSIBLE.	
Thrust Lever (affected engine).....	IDLE
Start/Stop Knob (affected engine).....	STOP
Thrust Lever (operative engine).....	AS REQUIRED
Fuel.....	BALANCE
Airspeed.....	140 KIAS MINIMUM

E-24 AUTOPILOT FAILURE

Autopilot.....	DISCONNECT
Fly airplane manually.	
If in RVSM airspace:	
ATC.....	NOTIFY

E-25 YAW DAMPER FAILURE

If in icing conditions:	
Airspeed.....	180 KIAS MAXIMUM
If with VENTRAL RUD FAIL:	
Rudder Pedals.....	FIXED
Altitude.....	25,000 ft MAXIMUM

E-26 BAGGAGE SMOKE

LAND AS SOON AS POSSIBLE.

E-27 SMOKE EVACUATION

φ Crew Oxygen Masks.....	DON, EMERGENCY THEN 100%
φ Auto Dilution Valve.....	CLOSED
φ Smoke Goggles (if available).....	DON
φ Communication.....	ESTABLISH
CKPT FAN Switch.....	HI
ECS Knob.....	OFF VENT
Pressurization DUMP Button.....	PUSH IN
If smoke persists: Identify source	
LAND AS SOON AS POSSIBLE.	

E-28 ENGINE DRY MOTORING

Associated Thrust Lever.....	IDLE
Associated Start/Stop Knob.....	STOP
Associated Ignition Switch.....	OFF
Associated Start/Stop Knob.....	START, THEN RUN
After 30 seconds:	

Associated Start/Stop Knob	STOP
Associated Ignition Switch	AUTO

CHAPTER 10

CAS MESSAGES REFERENCE

This chapter provides a complete reference of all Crew Alerting System (CAS) messages implemented in the FSReborn Phenom 300E. Messages are organized by priority level: Warning (Red), Caution (Amber), and Advisory (White).

Warning messages require immediate action. Caution messages require immediate crew awareness and subsequent action. Advisory messages require crew awareness only.

For the associated emergency or abnormal procedure for each CAS message, refer to Chapter 6 or the QRH.

CAS MESSAGES — WARNING (RED)

DOOR PAX OPEN	Passenger/crew door is open.
E1 FIRE	Engine 1 fire detected.
E2 FIRE	Engine 2 fire detected.
E1 OIL LO PRES	Engine 1 oil pressure critically low (below 24 PSI) with engine running.
E2 OIL LO PRES	Engine 2 oil pressure critically low (below 24 PSI) with engine running.
CAB ALTITUDE HI	Cabin altitude exceeds 10,000 ft.
BAG SMK	Smoke detected in baggage compartment.
LG LEVER DISAG	Landing gear lever position disagrees with actual gear position.
NO TO CONFIG	Takeoff configuration incorrect (flaps, trim, or parking brake).
ELEC EMERGENCY	Both DC buses de-energized with batteries providing power. Electrical emergency mode active.

CAS MESSAGES — CAUTION (AMBER)

E1 FAIL	Engine 1 failure detected.
E2 FAIL	Engine 2 failure detected.
ENG NO TO DATA	Engine takeoff data not entered or OAT mismatch exceeds 5°C.
ADS 1 FAIL	Air Data System 1 failure.
ADS 2 FAIL	Air Data System 2 failure.
ADS 1 HTR FAIL	Air Data System 1 probe heater failure or ADS PROBES knob OFF with engine running.
ADS 2 HTR FAIL	Air Data System 2 probe heater failure or ADS PROBES knob OFF with engine running.
AHRS 1 FAIL	Attitude and Heading Reference System 1 failure.
AHRS 2 FAIL	Attitude and Heading Reference System 2 failure.
AUDIO PNL 1 FAIL	Audio Panel 1 failure.
AUDIO PNL 2 FAIL	Audio Panel 2 failure.
BARO MISCOMP	Barometric altimeter settings miscompare between PFDs.
XPDR FAIL	Transponder 1 failure.
XPDR IN STBY	Transponder in standby mode during flight.

TCAS FAIL	Traffic Collision Avoidance System failure.
A-I WINGSTB INHB	Wing/stabilizer anti-ice inhibited — outside operational envelope.
A-I E1 FAIL	Engine 1 anti-ice valve commanded open but failed, or duct leak detected.
A-I E2 FAIL	Engine 2 anti-ice valve commanded open but failed, or duct leak detected.
A-I WINGSTB FAIL	Wing/stabilizer anti-ice system component failure (AIV or pressure transducer).
ICE CONDITION	Structural ice detected (>5%). Aircraft is in icing conditions.
WSHLD 1 HTR FAIL	Windshield 1 heater failure or overheat.
WSHLD 2 HTR FAIL	Windshield 2 heater failure or overheat.
HYD HI TEMP	Hydraulic fluid temperature over operating limit (112.7°C).
HYD LO PRES	Hydraulic system pressure below 1,800 PSI.
HYD SOV 1 FAIL	Hydraulic EDP 1 fire shutoff valve disagrees with command.
HYD SOV 2 FAIL	Hydraulic EDP 2 fire shutoff valve disagrees with command.
DUCT 1 OVERTEMP	ECS duct 1 overtemperature.
DUCT 2 OVERTEMP	ECS duct 2 overtemperature.
CAB DELTA-P FAIL	Cabin differential pressure exceeds limits (>9.55 psid or <-0.3 psid).
AMS CTRL FAIL	Both AMS Controller channels failed — bleed temp/pressure control unavailable.
BLEED 1 FAIL	Bleed system 1 PRSOV failure — valve commanded open but did not open.
BLEED 2 FAIL	Bleed system 2 PRSOV failure — valve commanded open but did not open.
ECS 1 VALVE FAIL	ECS 1 FC SOV failed — commanded open but did not open.
ECS 2 VALVE FAIL	ECS 2 FC SOV failed — commanded open but did not open.
DOORBAG LH OPEN	Forward (left) baggage compartment door open.
DOORBAG RH OPEN	Crew (right) baggage compartment door open.
DOORBAG AFT OPEN	Aft baggage compartment door open.
E1 FIREX FAIL	Engine 1 fire extinguisher system failure.
E2 FIREX FAIL	Engine 2 fire extinguisher system failure.
FUEL IMBALANCE	Lateral fuel imbalance exceeds 220 lbs.
FUEL 1 LO LEVEL	Left wing tank fuel level below 310 lbs.
FUEL 2 LO LEVEL	Right wing tank fuel level below 310 lbs.
FUEL 1 LO PRES	Left engine fuel pressure below 6 PSI with engine running.
FUEL 2 LO PRES	Right engine fuel pressure below 6 PSI with engine running.
FUEL 1 SOV FAIL	Fuel shutoff valve 1 failure.
FUEL 2 SOV FAIL	Fuel shutoff valve 2 failure.
FUEL XFEED FAIL	Crossfeed valve failure.
FUEL PUMP 1 FAIL	DC fuel pump 1 failure.
FUEL PUMP 2 FAIL	DC fuel pump 2 failure.

BATT 1 OFF BUS	Battery 1 disconnected from bus.
BATT 2 OFF BUS	Battery 2 disconnected from bus.
BATT DISCHARGE	At least one battery discharging during normal operation.
BATT EXCEEDANCE	Battery voltage exceeds 29V.
GEN 1 OFF BUS	Generator 1 off bus or GEN 1 switch OFF.
GEN 2 OFF BUS	Generator 2 off bus or GEN 2 switch OFF.
GEN OVLD	Generator overload — output above 330 A for more than 8 seconds.
GEN START FAULT	Starter-generator fault detected during engine start.
OXY LO PRES	Oxygen supply pressure below 600 PSI.
YD MISTRIM	Yaw damper mistrim — turn coordinator ball deflection exceeds ± 12 with AP/YD engaged.
AP FAIL	Autopilot system failure.
YD FAIL	Yaw damper failure.
PUSHER OFF	Stall protection stick pusher cut out.
FLAP FAIL	Flap control system failure or jam.
GND SPLR FAIL	Ground spoiler function not available — spoilers did not deploy on ground above 50 kt.
PTRIM NML FAIL	Pitch trim normal channel inoperative — autopilot pitch trim unavailable.
PTRIM BKP FAIL	Pitch trim backup channel inoperative — manual backup trim unavailable.
EMER BRK LO PRES	Emergency brake accumulator pressure below 1,550 PSI.
PARK BRK NOT REL	Parking brake not released (in flight).
BRK FAIL	Brake control unit failure — normal braking unavailable.
ANTI-SKID FAIL	Anti-skid braking system failure.
EMER LT NOT ARM	Emergency lights switch not in ARM position.

CAS MESSAGES — ADVISORY (WHITE)

A-I WINGSTB ARM	Wing/stabilizer anti-ice armed but not yet active (conditions not met).
A-I WINGSTB ON	Wing/stabilizer anti-ice system active.
A-I E1 ON	Engine 1 anti-ice system operating normally.
A-I E2 ON	Engine 2 anti-ice system operating normally.
ADS HTR SW ON	ADS probe heat switch manually set to ON (normally in AUTO on the ground).
AHRS 1 FAULT	Attitude and Heading Reference System 1 degraded.
AHRS 2 FAULT	Attitude and Heading Reference System 2 degraded.
AUDIO PNL1 FAULT	Audio Panel 1 degraded.
AUDIO PNL2 FAULT	Audio Panel 2 degraded.
FANS FAIL	Avionics cooling blower failure.
NAV 1 FAIL	Navigation radio 1 failure.
NAV 2 FAIL	Navigation radio 2 failure.
VHF 3 FAIL	VHF radio 3 failure.
XPDR 1 FAIL	Transponder 1 failure.
XPDR 2 FAIL	Transponder 2 failure.
XPDR FAULT	Transponder system fault.
ADS-B NOT AVAIL	ADS-B surveillance not available.
ADS-B OUT NOT AVAIL	ADS-B Out transmit not available.
RALT FAIL	Radar altimeter failure.
E1 CHIP DETECTED	Engine 1 chip detector triggered.
E2 CHIP DETECTED	Engine 2 chip detector triggered.
E1 FADEC FAULT	Engine 1 FADEC fault detected.
E2 FADEC FAULT	Engine 2 FADEC fault detected.
ENG EXCEEDANCE	Engine exceedance condition recorded.
ENG NO DISPATCH	Engine not cleared for dispatch.
ENG FIREX DISCH	Engine fire extinguisher bottle discharged.
HYD SYS FAULT	Hydraulic system degraded — single pump operation.
BLEED 1 OFF	BLEED 1 switch OFF — pneumatic system 1 depressurized.
BLEED 2 OFF	BLEED 2 switch OFF — pneumatic system 2 depressurized.
ECS 1 OFF	Environmental Control System pack 1 off.
ECS 2 OFF	Environmental Control System pack 2 off.
RAM AIR FAIL	Ram air valve failure.
XBLEED FAIL	Crossbleed valve failure.

XBLEED SW OFF	Crossbleed switch in OFF position.
AMS CTRL FAULT	One AMS controller channel inoperative — system degraded.
FUEL EQUAL	Fuel tanks balanced — crossfeed may be closed.
DC BUS 1 OFF	DC Bus 1 de-energized.
DC BUS 2 OFF	DC Bus 2 de-energized.
EMER BUS OFF	Emergency bus de-energized.
SHED BUS OFF	Shed bus de-energized.
SPDBRK SW DISAG	Speed brake switch disagrees with spoiler position — surfaces retracted automatically.
SPOILER FAULT	Speed brake and/or roll spoiler function not available.
SWPS ICE SPEED	Stall warning speeds adjusted for icing conditions.
OXY SW NOT AUTO	Oxygen SUPPLY CONTROL knob not in AUTO position.
DOOR REFUEL OPEN	Refueling door open.

CHAPTER 11 PERFORMANCE DATA

This chapter provides key performance data for the Phenom 300E with PW535E1 engines, sourced from the Pilot's Operating Handbook (POH Rev 16). Data includes approach and landing reference speeds, takeoff N1 thrust settings, maximum speed cruise with all engines operating, and maximum speed cruise with one engine inoperative.

All cruise tables assume bleed open and ice protection (WINGSTAB+ENG) OFF unless otherwise noted. Ice protection correction factors are provided where applicable. A dash (-) indicates the condition is not achievable at that weight/altitude combination.

For complete takeoff and landing field length calculations, obstacle clearance analysis, and climb/descent gradients, refer to the AFM or the OPERA performance software.

APPROACH & LANDING REFERENCE SPEEDS

Approach Flap 1, Landing Flap 3 (No Icing)

Weight (kg)	VAC (KIAS)	VREF (KIAS)	VFS (KIAS)
5,600	104	101	127
6,000	107	104	125
6,400	110	107	122
6,800	114	111	126
7,200	117	114	129
7,600	120	117	132
7,730 (MLW)	121	118	134
8,340 (MTOW)	125	122	138

Approach Flap 2, Landing Flap FULL (No Icing)

Weight (kg)	VAC (KIAS)	VREF (KIAS)	VFS (KIAS)
5,600	100	100	127
6,000	103	103	125
6,400	106	106	122
6,800	110	110	126
7,200	113	113	129
7,600	115	115	132
7,730 (MLW)	117	117	134
8,340 (MTOW)	121	121	138

TAKEOFF N1 SETTING TABLES — PW535E1

N1 (%) T/O — Ice Protection OFF (temps -40°C to 0°C)

Alt (ft)	-40°C	-35°C	-30°C	-25°C	-20°C	-15°C	-10°C	-5°C	0°C
-1000	78.1	78.9	79.7	80.5	81.3	82.1	82.9	83.7	84.5
0	79.2	80.0	80.8	81.6	82.4	83.2	84.1	84.9	85.6
1000	80.2	81.1	81.9	82.7	83.5	84.4	85.2	86.0	86.8
2000	81.4	82.2	83.0	83.9	84.7	85.6	86.4	87.2	88.0
3000	82.4	83.3	84.1	85.0	85.8	86.7	87.5	88.4	89.2
4000	83.5	84.4	85.2	86.1	87.0	87.8	88.6	89.4	90.2
5000	84.6	85.5	86.4	87.3	88.1	89.0	89.8	90.6	91.5
6000	84.7	85.6	86.5	87.4	88.3	89.2	90.1	91.0	91.8
7000	85.4	86.4	87.3	88.2	89.0	89.9	90.7	91.6	92.2
8000	86.0	86.9	87.8	88.7	89.7	90.6	91.4	92.2	92.0
9000	86.3	87.3	88.2	89.1	90.0	90.9	91.8	92.4	92.0
10000	86.7	87.7	88.6	89.4	90.3	91.2	92.1	92.3	91.8
11000	87.2	88.1	89.0	89.9	90.8	91.7	92.4	91.9	91.4
12000	87.6	88.5	89.5	90.4	91.4	92.2	92.3	91.7	91.1
13000	88.2	89.2	90.2	91.0	91.9	92.6	92.1	91.5	90.8
14000	88.9	89.9	90.8	91.7	92.5	92.8	92.0	91.3	90.6

N1 (%) T/O — Ice Protection OFF (temps +5°C to +45°C)

Alt (ft)	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C	45°C
-1000	85.3	86.0	86.8	87.5	88.2	88.9	89.5	87.7	85.6
0	86.4	87.2	87.9	88.7	89.4	90.2	89.2	87.5	85.4
1000	87.6	88.3	89.1	89.8	90.6	90.2	88.7	86.6	85.0
2000	88.8	89.5	90.3	91.1	91.0	89.9	88.3	86.2	84.7
3000	90.0	90.8	91.5	91.6	90.7	89.6	87.6	85.9	-
4000	91.0	91.8	92.1	91.4	90.6	89.3	87.3	85.6	-
5000	92.3	92.1	91.5	90.9	89.9	88.6	87.0	85.5	-
6000	92.1	91.5	90.9	90.3	89.4	88.0	86.5	-	-
7000	91.7	91.2	90.7	90.2	89.0	87.5	86.0	-	-
8000	91.6	91.1	90.7	90.0	88.5	86.9	-	-	-
9000	91.5	91.0	90.8	89.7	88.2	86.5	-	-	-
10000	91.4	91.0	90.5	89.5	87.9	86.3	-	-	-
11000	90.9	90.3	89.6	88.5	86.9	-	-	-	-
12000	90.5	89.8	88.9	87.6	85.9	-	-	-	-
13000	90.1	89.3	88.3	86.8	-	-	-	-	-
14000	89.8	89.0	87.8	86.2	-	-	-	-	-

N1 (%) T/O — Ice Protection ON (max 10,000 ft)

Alt (ft)	-35°C	-30°C	-25°C	-20°C	-15°C	-10°C	-5°C	0°C	5°C
-1000	79.0	79.8	80.6	81.4	82.2	83.0	83.8	84.6	85.3
0	80.1	80.9	81.7	82.5	83.3	84.2	85.0	85.8	86.5
1000	81.1	82.0	82.8	83.6	84.5	85.3	86.1	86.9	87.6
2000	82.3	83.1	83.9	84.8	85.6	86.5	87.3	88.1	88.9
3000	83.4	84.3	85.2	86.1	86.9	87.7	88.5	89.3	90.1
4000	84.4	85.2	86.1	87.0	87.8	88.7	89.5	90.3	89.8
5000	85.6	86.5	87.4	88.2	89.1	89.9	90.7	90.3	89.4
6000	85.7	86.6	87.5	88.4	89.3	90.2	90.6	89.8	88.9
7000	86.5	87.4	88.3	89.1	90.0	90.5	89.7	88.8	87.8
8000	87.1	88.0	88.9	89.8	90.4	89.6	88.7	87.7	86.5
9000	87.4	88.3	89.2	90.1	90.2	89.3	88.3	87.3	86.0
10000	87.8	88.7	89.6	90.5	90.2	89.3	88.3	87.3	86.0

MAXIMUM SPEED CRUISE — ALL ENGINES OPERATING

ISA – 20°C — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200
13,200	N1	%	72.7	75.3	78.1	78.6
	FF	LB/H/ENG	991	957	916	817
	IAS	KT	320	320	320	304
	TAS	KT	330	354	380	388
	Mach		0.53	0.58	0.63	0.66
13,600	N1	%	72.7	75.3	78.1	78.6
	FF	LB/H/ENG	992	959	918	817
	IAS	KT	320	320	320	303
	TAS	KT	330	354	380	387
	Mach		0.53	0.58	0.63	0.66
14,200	N1	%	72.8	75.4	78.2	78.6
	FF	LB/H/ENG	994	961	920	817
	IAS	KT	320	320	320	303
	TAS	KT	330	354	380	387
	Mach		0.53	0.58	0.63	0.66
14,400	N1	%	72.8	75.4	78.2	78.6
	FF	LB/H/ENG	996	963	923	816
	IAS	KT	320	320	320	302
	TAS	KT	330	354	380	386
	Mach		0.53	0.58	0.63	0.66
14,800	N1	%	72.9	75.5	78.3	78.7
	FF	LB/H/ENG	998	965	925	817
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–
15,200	N1	%	72.9	75.6	78.4	78.7
	FF	LB/H/ENG	999	967	928	816
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–
15,600	N1	%	73.0	75.6	78.4	78.7
	FF	LB/H/ENG	1001	969	930	816
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–
16,000	N1	%	73.0	75.7	78.5	78.7
	FF	LB/H/ENG	1003	971	931	816
	IAS	KT	–	–	–	–

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200
	TAS	KT	-	-	-	-
	Mach		-	-	-	-
16,400	N1	%	73.1	75.7	78.5	78.7
	FF	LB/H/ENG	1004	973	932	816
	IAS	KT	320	320	319	300
	TAS	KT	330	354	379	383
	Mach		0.53	0.58	0.63	0.65
16,800	N1	%	73.1	75.8	78.5	78.7
	FF	LB/H/ENG	1006	975	931	816
	IAS	KT	320	320	319	299
	TAS	KT	330	354	378	383
	Mach		0.53	0.58	0.63	0.65
17,200	N1	%	73.2	75.8	78.5	78.7
	FF	LB/H/ENG	1008	977	931	816
	IAS	KT	320	320	318	299
	TAS	KT	330	354	378	382
	Mach		0.53	0.58	0.63	0.65
17,600	N1	%	73.2	75.9	78.5	78.7
	FF	LB/H/ENG	1010	979	931	816
	IAS	KT	320	320	318	298
	TAS	KT	330	354	377	381
	Mach		0.53	0.58	0.63	0.65
18,000	N1	%	73.3	75.9	78.5	78.7
	FF	LB/H/ENG	1012	981	931	815
	IAS	KT	320	320	318	298
	TAS	KT	330	354	377	381
	Mach		0.53	0.58	0.63	0.65
18,551	N1	%	73.3	76.0	78.5	78.7
	FF	LB/H/ENG	1014	984	931	815
	IAS	KT	320	320	317	297
	TAS	KT	330	354	376	380
	Mach		0.53	0.58	0.63	0.64

ISA – 10°C — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
13,200	N1	%	74.1	76.7	79.6	80.2	83.8	85.1	86.7	87.5
	FF	LB/H/ENG	1010	978	936	834	848	850	862	873
	IAS	KT	320	320	320	303	305	305	304	304
	TAS	KT	336	361	388	396	429	441	454	461
	Mach		0.53	0.58	0.63	0.66	0.73	0.76	0.78	0.80
13,600	N1	%	74.1	76.8	79.7	80.2	83.8	85.1	86.7	87.6
	FF	LB/H/ENG	1012	980	938	834	847	850	862	875
	IAS	KT	320	320	320	303	305	304	304	304
	TAS	KT	336	361	388	396	429	441	454	461
	Mach		0.53	0.58	0.63	0.66	0.73	0.76	0.78	0.80
14,000	N1	%	74.2	76.8	79.7	80.2	83.8	85.2	86.7	87.6
	FF	LB/H/ENG	1014	983	940	834	847	851	862	875
	IAS	KT	320	320	320	302	304	304	304	303
	TAS	KT	336	361	388	395	428	441	454	460
	Mach		0.53	0.58	0.63	0.66	0.73	0.75	0.78	0.80
14,400	N1	%	74.2	76.9	79.8	80.3	83.8	85.2	86.7	87.6
	FF	LB/H/ENG	1016	985	943	833	847	850	862	874
	IAS	KT	320	320	320	302	304	304	303	303
	TAS	KT	336	361	388	394	428	440	453	460
	Mach		0.53	0.58	0.63	0.66	0.73	0.75	0.78	0.80
14,800	N1	%	74.3	76.9	79.9	80.3	83.8	85.2	86.7	87.6
	FF	LB/H/ENG	1018	987	945	833	848	850	862	874
	IAS	KT	–	–	–	–	–	–	–	–
	TAS	KT	–	–	–	–	–	–	–	–
	Mach		–	–	–	–	–	–	–	–
15,200	N1	%	74.3	77.0	79.9	80.3	83.8	85.2	86.7	87.6
	FF	LB/H/ENG	1020	989	947	833	847	850	862	874
	IAS	KT	–	–	–	–	–	–	–	–
	TAS	KT	–	–	–	–	–	–	–	–
	Mach		–	–	–	–	–	–	–	–
15,600	N1	%	74.4	77.1	80.0	80.3	83.8	85.2	86.7	87.6
	FF	LB/H/ENG	1021	991	949	833	847	850	862	874
	IAS	KT	–	–	–	–	–	–	–	–

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	74.4	77.1	80.0	80.3	83.8	85.2	86.7	87.6
	FF	LB/H/ENG	1023	992	950	833	847	850	862	874
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,400	N1	%	74.5	77.2	80.0	80.3	83.8	85.2	86.8	87.7
	FF	LB/H/ENG	1025	994	949	833	847	850	862	874
	IAS	KT	320	320	319	299	302	302	302	301
	TAS	KT	336	361	386	391	425	438	451	458
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.78	0.79
16,800	N1	%	74.5	77.2	80.0	80.3	83.9	85.2	86.8	87.7
	FF	LB/H/ENG	1027	996	949	832	847	849	862	874
	IAS	KT	320	320	319	299	302	301	301	301
	TAS	KT	336	361	386	391	425	437	450	457
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.78	0.79
17,200	N1	%	74.6	77.3	80.0	80.3	83.9	85.2	86.8	87.7
	FF	LB/H/ENG	1028	998	949	832	847	849	861	874
	IAS	KT	320	320	318	298	301	301	301	301
	TAS	KT	336	361	385	390	424	436	450	457
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.78	0.79
17,600	N1	%	74.6	77.4	80.1	80.3	83.9	85.2	86.8	87.7
	FF	LB/H/ENG	1030	999	949	832	847	849	861	874
	IAS	KT	320	320	318	298	301	300	300	300
	TAS	KT	336	361	385	389	423	436	449	456
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.78	0.79
18,000	N1	%	74.7	77.4	80.1	80.3	83.9	85.3	86.8	87.7
	FF	LB/H/ENG	1032	1001	949	832	846	849	861	873
	IAS	KT	320	320	317	297	300	300	300	300
	TAS	KT	336	361	384	389	423	435	449	456
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.77	0.79
18,551	N1	%	74.7	77.5	80.1	80.4	83.9	85.3	86.8	87.7
	FF	LB/H/ENG	1035	1003	949	832	846	849	861	873
	IAS	KT	320	320	317	297	300	299	299	300

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
	TAS	KT	336	361	384	388	422	435	448	455
	Mach		0.53	0.58	0.62	0.64	0.72	0.74	0.77	0.79

ISA - 10°C — ALTITUDE: 31,000 TO 45,000 FT

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370	FL390	FL410	FL430	FL450
13,200	N1	%	87.3	86.7	86.1	85.9	86.3	86.5	86.5	87.0
	FF	LB/H/ENG	835	763	696	640	593	546	496	462
	IAS	KT	297	284	272	260	248	235	221	210
	TAS	KT	459	455	450	448	448	446	440	438
	Mach		0.80	0.80	0.80	0.80	0.80	0.80	0.79	0.78
13,600	N1	%	87.3	86.7	86.1	86.0	86.4	86.5	86.5	87.1
	FF	LB/H/ENG	838	765	698	643	597	545	496	461
	IAS	KT	297	284	272	260	248	234	220	209
	TAS	KT	459	455	450	448	448	444	439	436
	Mach		0.80	0.80	0.80	0.80	0.80	0.79	0.78	0.78
14,000	N1	%	87.4	86.8	86.2	86.1	86.6	86.6	86.6	87.1
	FF	LB/H/ENG	839	767	701	646	601	545	495	461
	IAS	KT	297	284	272	260	248	233	220	208
	TAS	KT	459	455	450	448	448	442	437	435
	Mach		0.80	0.80	0.80	0.80	0.80	0.79	0.78	0.78
14,400	N1	%	87.4	86.9	86.3	86.3	86.7	86.6	86.6	87.1
	FF	LB/H/ENG	839	769	704	649	601	545	495	460
	IAS	KT	297	284	272	260	247	232	219	207
	TAS	KT	458	455	450	448	447	441	435	433
	Mach		0.80	0.80	0.80	0.80	0.80	0.79	0.78	0.77
14,800	N1	%	87.4	86.9	86.4	86.4	86.7	86.7	86.6	87.2
	FF	LB/H/ENG	839	771	707	653	600	544	495	459
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	87.4	86.9	86.5	86.6	86.7	86.7	86.7	87.2
	FF	LB/H/ENG	839	770	710	657	600	544	494	458
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	87.4	86.9	86.6	86.8	86.7	86.7	86.7	87.3
	FF	LB/H/ENG	839	771	713	661	599	544	493	457
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370	FL390	FL410	FL430	FL450
16,000	N1	%	87.4	86.9	86.8	86.8	86.8	86.7	86.7	87.4
	FF	LB/H/ENG	839	770	717	662	599	543	493	455
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,400	N1	%	87.4	87.0	86.8	86.8	86.8	86.8	86.8	87.4
	FF	LB/H/ENG	839	770	718	661	598	543	492	454
	IAS	KT	295	283	272	258	243	228	214	198
	TAS	KT	456	452	450	446	439	434	427	416
	Mach		0.80	0.80	0.80	0.80	0.78	0.77	0.76	0.74
16,800	N1	%	87.4	87.0	86.8	86.9	86.8	86.8	86.8	87.5
	FF	LB/H/ENG	838	770	718	660	598	542	491	452
	IAS	KT	295	282	271	257	242	227	212	196
	TAS	KT	456	451	449	444	438	432	423	412
	Mach		0.79	0.79	0.80	0.79	0.78	0.77	0.76	0.74
17,200	N1	%	87.5	87.0	86.9	86.9	86.8	86.8	86.9	87.6
	FF	LB/H/ENG	839	770	718	660	597	542	490	451
	IAS	KT	295	282	270	256	241	227	210	194
	TAS	KT	455	451	448	443	437	431	419	408
	Mach		0.79	0.79	0.80	0.79	0.78	0.77	0.75	0.73
17,600	N1	%	87.5	87.0	86.9	86.9	86.9	86.9	87.0	87.6
	FF	LB/H/ENG	838	770	718	659	597	541	489	450
	IAS	KT	294	281	270	255	240	226	208	192
	TAS	KT	455	450	447	441	436	429	416	404
	Mach		0.79	0.79	0.79	0.79	0.78	0.77	0.74	0.72
18,000	N1	%	87.5	87.0	86.9	86.9	86.9	86.9	87.1	87.7
	FF	LB/H/ENG	838	769	717	658	596	540	488	448
	IAS	KT	294	280	269	255	239	224	206	189
	TAS	KT	454	449	445	440	434	427	412	398
	Mach		0.79	0.79	0.79	0.79	0.78	0.76	0.74	0.71
18,551	N1	%	87.5	87.0	86.9	87.0	86.9	87.0	87.2	87.8
	FF	LB/H/ENG	838	769	716	657	596	539	486	444
	IAS	KT	293	280	267	253	238	222	203	184
	TAS	KT	453	448	444	438	433	423	407	389
	Mach		0.79	0.79	0.79	0.78	0.77	0.76	0.73	0.69

ISA — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
13,200	N1	%	75.4	78.2	81.1	81.8	85.5	86.9	88.5	89.4
	FF	LB/H/ENG	1031	999	956	851	867	871	884	895
	IAS	KT	320	320	320	303	305	305	304	304
	TAS	KT	343	368	395	404	438	451	465	471
	Mach		0.53	0.58	0.63	0.66	0.73	0.76	0.78	0.80
13,600	N1	%	75.5	78.2	81.2	81.8	85.5	86.9	88.5	89.5
	FF	LB/H/ENG	1033	1001	958	851	867	871	884	896
	IAS	KT	320	320	320	303	305	304	304	304
	TAS	KT	343	368	395	403	438	451	464	471
	Mach		0.53	0.58	0.63	0.66	0.73	0.76	0.78	0.80
14,000	N1	%	75.5	78.3	81.3	81.8	85.5	86.9	88.5	89.5
	FF	LB/H/ENG	1035	1003	961	851	867	870	884	896
	IAS	KT	320	320	320	302	304	304	304	303
	TAS	KT	343	368	395	403	437	450	464	471
	Mach		0.53	0.58	0.63	0.66	0.73	0.75	0.78	0.80
14,400	N1	%	75.6	78.4	81.3	81.8	85.5	86.9	88.5	89.5
	FF	LB/H/ENG	1037	1005	963	851	867	870	883	895
	IAS	KT	320	320	320	302	304	304	303	303
	TAS	KT	343	368	395	402	437	450	463	470
	Mach		0.53	0.58	0.63	0.65	0.73	0.75	0.78	0.80
14,800	N1	%	75.7	78.4	81.4	81.9	85.5	86.9	88.5	89.5
	FF	LB/H/ENG	1039	1007	966	850	866	870	883	896
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	75.7	78.5	81.5	81.9	85.5	87.0	88.5	89.5
	FF	LB/H/ENG	1040	1009	968	850	867	870	883	895
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	75.8	78.5	81.5	81.9	85.6	87.0	88.6	89.5
	FF	LB/H/ENG	1042	1011	969	850	866	870	883	896
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	75.8	78.6	81.5	81.9	85.6	87.0	88.6	89.5

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
	FF	LB/H/ENG	1044	1013	969	850	866	869	883	895
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,400	N1	%	75.9	78.6	81.5	81.9	85.6	87.0	88.6	89.5
	FF	LB/H/ENG	1045	1016	969	850	866	869	883	895
	IAS	KT	320	320	319	299	302	302	301	301
	TAS	KT	343	368	394	399	434	447	461	468
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.78	0.79
16,800	N1	%	75.9	78.7	81.5	81.9	85.6	87.0	88.6	89.5
	FF	LB/H/ENG	1047	1018	969	850	866	869	882	895
	IAS	KT	320	320	318	299	302	301	301	301
	TAS	KT	343	368	393	399	434	447	460	467
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.78	0.79
17,200	N1	%	76.0	78.8	81.5	81.9	85.6	87.0	88.6	89.5
	FF	LB/H/ENG	1049	1020	969	850	866	869	882	895
	IAS	KT	320	320	318	298	301	301	301	301
	TAS	KT	343	368	393	398	433	446	460	467
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.78	0.79
17,600	N1	%	76.0	78.8	81.6	81.9	85.6	87.0	88.6	89.5
	FF	LB/H/ENG	1051	1022	968	849	866	869	882	895
	IAS	KT	320	320	317	298	301	300	300	300
	TAS	KT	343	368	392	397	432	445	459	466
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.78	0.79
18,000	N1	%	76.1	78.9	81.6	81.9	85.6	87.0	88.6	89.5
	FF	LB/H/ENG	1053	1024	969	849	866	868	882	894
	IAS	KT	320	320	317	297	300	300	300	300
	TAS	KT	343	368	392	397	432	445	459	466
	Mach		0.53	0.58	0.63	0.65	0.72	0.75	0.77	0.79
18,551	N1	%	76.1	79.0	81.6	82.0	85.6	87.0	88.6	89.6
	FF	LB/H/ENG	1056	1027	969	849	866	868	881	895
	IAS	KT	320	320	316	297	300	299	299	300
	TAS	KT	343	368	391	396	431	444	458	465
	Mach		0.53	0.58	0.62	0.64	0.72	0.74	0.77	0.79

ISA — ALTITUDE: 31,000 TO 45,000 FT

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370	FL390	FL410	FL430	FL450
13,200	N1	%	89.1	88.6	88.0	87.8	88.2	88.5	88.4	88.9
	FF	LB/H/ENG	857	782	714	656	609	561	510	475
	IAS	KT	297	284	272	260	248	235	221	210
	TAS	KT	469	465	461	459	459	457	451	448
	Mach		0.80	0.80	0.80	0.80	0.80	0.80	0.79	0.78
13,600	N1	%	89.2	88.6	88.1	88.0	88.3	88.5	88.5	89.0
	FF	LB/H/ENG	859	785	716	659	612	560	509	475
	IAS	KT	297	284	272	260	248	234	220	209
	TAS	KT	469	465	461	459	459	455	449	447
	Mach		0.80	0.80	0.80	0.80	0.80	0.80	0.79	0.78
14,000	N1	%	89.2	88.7	88.2	88.1	88.5	88.5	88.5	89.0
	FF	LB/H/ENG	860	787	719	662	617	560	509	474
	IAS	KT	297	284	272	260	248	233	220	208
	TAS	KT	469	465	461	459	459	453	447	445
	Mach		0.80	0.80	0.80	0.80	0.80	0.80	0.79	0.78
14,400	N1	%	89.2	88.8	88.3	88.2	88.6	88.6	88.5	89.1
	FF	LB/H/ENG	860	789	722	666	617	560	509	473
	IAS	KT	297	284	272	260	247	232	219	208
	TAS	KT	469	465	461	459	458	452	446	444
	Mach		0.80	0.80	0.80	0.80	0.80	0.80	0.79	0.78	0.77
14,800	N1	%	89.3	88.8	88.4	88.4	88.6	88.6	88.5	89.1
	FF	LB/H/ENG	860	790	725	669	617	559	508	473
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	89.3	88.8	88.5	88.5	88.7	88.6	88.6	89.2
	FF	LB/H/ENG	860	790	728	673	616	559	508	472
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	89.3	88.8	88.6	88.7	88.7	88.6	88.6	89.2
	FF	LB/H/ENG	860	790	731	678	616	558	507	471
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	89.3	88.8	88.7	88.8	88.7	88.7	88.7	89.3
	FF	LB/H/ENG	860	789	735	680	615	558	507	469
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370	FL390	FL410	FL430	FL450
16,400	N1	%	89.3	88.9	88.8	88.8	88.8	88.7	88.7	89.3
	FF	LB/H/ENG	860	789	737	679	615	558	506	468
	IAS	KT	295	283	272	258	243	228	214	199
	TAS	KT	466	463	461	457	450	444	437	427
	Mach		0.79	0.80	0.80	0.80	0.78	0.77	0.76	0.74
16,800	N1	%	89.3	88.9	88.8	88.8	88.8	88.7	88.8	89.4
	FF	LB/H/ENG	859	789	736	678	614	557	506	465
	IAS	KT	295	282	271	257	242	228	212	196
	TAS	KT	466	462	460	455	449	443	434	422
	Mach		0.79	0.79	0.80	0.79	0.78	0.77	0.76	0.74
17,200	N1	%	89.3	88.9	88.8	88.8	88.8	88.7	88.8	89.4
	FF	LB/H/ENG	859	789	736	677	614	556	504	463
	IAS	KT	294	282	270	256	241	227	210	194
	TAS	KT	465	461	458	453	447	442	430	418
	Mach		0.79	0.79	0.80	0.79	0.78	0.77	0.75	0.73
17,600	N1	%	89.3	88.9	88.8	88.9	88.8	88.8	88.9	89.5
	FF	LB/H/ENG	859	789	736	677	613	556	503	462
	IAS	KT	294	281	269	255	240	226	208	192
	TAS	KT	465	460	457	452	446	440	426	414
	Mach		0.79	0.79	0.79	0.79	0.78	0.77	0.74	0.72
18,000	N1	%	89.3	88.9	88.8	88.9	88.9	88.8	89.0	89.6
	FF	LB/H/ENG	859	788	735	676	613	555	502	459
	IAS	KT	294	280	269	255	240	225	206	189
	TAS	KT	464	459	456	451	445	438	422	409
	Mach		0.79	0.79	0.79	0.79	0.78	0.76	0.74	0.71
18,551	N1	%	89.4	88.9	88.9	88.9	88.9	88.9	89.1	89.6
	FF	LB/H/ENG	859	788	734	675	612	554	500	455
	IAS	KT	293	279	267	253	239	222	203	184
	TAS	KT	463	458	454	449	443	434	417	399
	Mach		0.79	0.79	0.79	0.78	0.77	0.76	0.73	0.70

ISA + 10°C — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
13,200	N1	%	76.8	79.6	81.2	81.4	85.2	86.8	88.3	89.1
	FF	LB/H/ENG	1052	1020	926	795	811	821	822	827
	IAS	KT	320	320	310	289	292	294	292	292
	TAS	KT	349	375	390	394	430	445	458	464
	Mach		0.53	0.58	0.61	0.63	0.70	0.73	0.76	0.77
13,600	N1	%	76.9	79.7	81.2	81.4	85.2	86.8	88.3	89.1
	FF	LB/H/ENG	1054	1022	926	795	811	820	823	827
	IAS	KT	320	320	309	288	292	293	292	292
	TAS	KT	349	375	390	393	429	445	457	464
	Mach		0.53	0.58	0.61	0.63	0.70	0.73	0.76	0.77
14,000	N1	%	76.9	79.8	81.2	81.4	85.2	86.9	88.3	89.1
	FF	LB/H/ENG	1056	1024	925	795	811	820	822	827
	IAS	KT	320	320	309	288	291	293	292	291
	TAS	KT	349	375	389	392	429	444	457	463
	Mach		0.53	0.58	0.61	0.63	0.70	0.73	0.76	0.77
14,400	N1	%	77.0	79.8	81.2	81.4	85.3	86.9	88.3	89.1
	FF	LB/H/ENG	1058	1027	925	795	811	820	822	827
	IAS	KT	320	320	308	287	291	292	291	291
	TAS	KT	349	375	389	392	428	444	456	463
	Mach		0.53	0.58	0.61	0.63	0.70	0.73	0.75	0.77
14,800	N1	%	77.0	79.9	81.2	81.4	85.3	86.9	88.3	89.1
	FF	LB/H/ENG	1060	1029	924	795	811	820	822	827
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	77.1	79.9	81.2	81.5	85.3	86.9	88.3	89.1
	FF	LB/H/ENG	1062	1031	924	795	811	820	822	827
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	77.1	80.0	81.2	81.5	85.3	86.9	88.3	89.1
	FF	LB/H/ENG	1063	1033	924	795	811	820	822	827
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	77.2	80.0	81.3	81.5	85.3	86.9	88.3	89.1
	FF	LB/H/ENG	1065	1035	923	795	810	820	822	826
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
16,400	N1	%	77.2	80.1	81.3	81.5	85.3	86.9	88.3	89.1
	FF	LB/H/ENG	1067	1037	923	795	810	819	821	827
	IAS	KT	320	320	306	285	289	290	289	289
	TAS	KT	349	375	386	388	425	441	453	460
	Mach		0.53	0.58	0.60	0.62	0.69	0.72	0.75	0.76
16,800	N1	%	77.3	80.2	81.3	81.5	85.3	86.9	88.4	89.2
	FF	LB/H/ENG	1069	1039	923	795	810	819	821	826
	IAS	KT	320	320	305	284	289	290	289	289
	TAS	KT	349	375	385	388	425	440	453	460
	Mach		0.53	0.58	0.60	0.62	0.69	0.72	0.75	0.76
17,200	N1	%	77.3	80.2	81.3	81.5	85.3	86.9	88.4	89.2
	FF	LB/H/ENG	1071	1041	922	795	810	819	821	826
	IAS	KT	320	320	305	284	288	289	289	289
	TAS	KT	349	375	384	387	424	439	452	459
	Mach		0.53	0.58	0.60	0.62	0.69	0.72	0.75	0.76
17,600	N1	%	77.4	80.3	81.3	81.6	85.4	87.0	88.4	89.2
	FF	LB/H/ENG	1073	1043	922	795	810	819	821	826
	IAS	KT	320	320	304	283	288	289	288	288
	TAS	KT	349	375	384	386	423	439	451	459
	Mach		0.53	0.58	0.60	0.62	0.69	0.72	0.75	0.76
18,000	N1	%	77.4	80.3	81.3	81.6	85.4	87.0	88.4	89.2
	FF	LB/H/ENG	1075	1045	922	795	810	819	821	826
	IAS	KT	320	320	304	283	287	288	288	287
	TAS	KT	349	375	383	386	423	438	451	458
	Mach		0.53	0.58	0.60	0.62	0.69	0.72	0.75	0.76
18,551	N1	%	77.5	80.4	81.3	81.6	85.4	87.0	88.4	89.2
	FF	LB/H/ENG	1078	1047	921	795	810	818	821	826
	IAS	KT	320	320	303	282	286	288	287	287
	TAS	KT	349	375	382	385	422	437	450	457
	Mach		0.53	0.58	0.60	0.61	0.69	0.72	0.74	0.76

ISA + 10°C — ALTITUDE: 31,000 TO 45,000 FT

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370	FL390	FL410	FL430	FL450
13,200	N1	%	89.0	88.7	88.5	88.4	88.3	88.1	87.9	88.5
	FF	LB/H/ENG	799	739	685	632	573	520	471	441
	IAS	KT	287	276	265	253	239	225	211	201
	TAS	KT	464	463	461	459	454	449	442	442
	Mach		0.77	0.78	0.78	0.78	0.77	0.77	0.75	0.75
13,600	N1	%	89.0	88.7	88.5	88.4	88.3	88.1	88.0	88.5
	FF	LB/H/ENG	799	739	685	632	573	520	471	440
	IAS	KT	287	275	264	253	239	225	211	200
	TAS	KT	464	462	460	458	453	448	441	439
	Mach		0.77	0.78	0.78	0.78	0.77	0.76	0.75	0.75
14,000	N1	%	89.0	88.7	88.5	88.4	88.3	88.2	88.0	88.6
	FF	LB/H/ENG	799	739	685	631	573	519	470	440
	IAS	KT	286	275	264	252	238	224	210	199
	TAS	KT	463	461	459	457	452	446	439	436
	Mach		0.77	0.78	0.78	0.78	0.77	0.76	0.75	0.74
14,400	N1	%	89.0	88.7	88.5	88.4	88.3	88.2	88.0	88.6
	FF	LB/H/ENG	799	739	684	631	572	519	470	439
	IAS	KT	286	275	263	251	237	223	209	196
	TAS	KT	463	460	458	456	451	445	437	431
	Mach		0.77	0.77	0.78	0.78	0.77	0.76	0.75	0.73
14,800	N1	%	89.1	88.8	88.5	88.5	88.3	88.2	88.1	88.7
	FF	LB/H/ENG	799	739	684	631	572	519	470	438
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	89.1	88.8	88.5	88.5	88.4	88.3	88.1	88.8
	FF	LB/H/ENG	799	739	684	631	572	518	470	438
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	89.1	88.8	88.6	88.5	88.4	88.3	88.2	88.9
	FF	LB/H/ENG	799	738	684	631	572	518	469	437
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	89.1	88.8	88.6	88.5	88.4	88.3	88.3	88.9
	FF	LB/H/ENG	799	738	683	630	572	518	468	437
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370	FL390	FL410	FL430	FL450
16,400	N1	%	89.1	88.8	88.6	88.5	88.4	88.4	88.3	89.0
	FF	LB/H/ENG	799	738	683	630	572	518	468	436
	IAS	KT	284	272	260	248	233	218	199	186
	TAS	KT	460	457	453	450	444	436	419	410
	Mach		0.77	0.77	0.77	0.77	0.76	0.74	0.71	0.70
16,800	N1	%	89.1	88.8	88.6	88.6	88.5	88.4	88.4	89.1
	FF	LB/H/ENG	799	738	683	630	572	518	467	436
	IAS	KT	284	272	260	247	233	217	197	184
	TAS	KT	460	456	453	449	443	434	415	406
	Mach		0.77	0.77	0.77	0.77	0.76	0.74	0.71	0.69
17,200	N1	%	89.1	88.8	88.6	88.6	88.5	88.5	88.4	89.1
	FF	LB/H/ENG	799	738	683	630	572	517	466	435
	IAS	KT	283	271	259	246	232	214	195	181
	TAS	KT	459	455	452	448	442	429	412	402
	Mach		0.77	0.77	0.77	0.76	0.75	0.73	0.70	0.68
17,600	N1	%	89.2	88.9	88.7	88.6	88.5	88.6	88.5	89.3
	FF	LB/H/ENG	799	738	683	629	571	517	465	433
	IAS	KT	283	270	259	246	231	212	193	178
	TAS	KT	458	454	451	447	440	425	408	394
	Mach		0.76	0.76	0.76	0.76	0.75	0.72	0.69	0.67
18,000	N1	%	89.2	88.9	88.7	88.6	88.6	88.6	88.5	89.5
	FF	LB/H/ENG	798	738	682	629	571	516	464	428
	IAS	KT	282	270	258	245	230	210	191	168
	TAS	KT	457	454	449	445	438	421	404	374
	Mach		0.76	0.76	0.76	0.76	0.75	0.72	0.69	0.64
18,551	N1	%	89.2	88.9	88.7	88.7	88.6	88.7	88.6	-
	FF	LB/H/ENG	798	738	682	629	571	515	463	-
	IAS	KT	281	269	257	244	228	208	188	-
	TAS	KT	456	452	448	444	435	417	398	-
	Mach		0.76	0.76	0.76	0.76	0.74	0.71	0.68	-

ISA + 20°C — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
13,200	N1	%	78.2	78.9	79.2	79.2	82.8	84.4	85.9	86.7
	FF	LB/H/ENG	1074	952	826	709	692	700	701	704
	IAS	KT	320	304	285	265	266	269	269	269
	TAS	KT	355	362	367	370	402	418	432	440
	Mach		0.53	0.55	0.56	0.58	0.64	0.67	0.70	0.72
13,600	N1	%	78.2	78.9	79.2	79.2	82.8	84.4	85.9	86.7
	FF	LB/H/ENG	1076	952	826	709	691	700	701	704
	IAS	KT	320	303	285	265	266	268	268	269
	TAS	KT	355	362	366	369	401	417	432	439
	Mach		0.53	0.55	0.56	0.58	0.64	0.67	0.70	0.71
14,000	N1	%	78.3	78.9	79.2	79.3	82.8	84.4	85.9	86.8
	FF	LB/H/ENG	1078	952	826	709	691	700	701	703
	IAS	KT	320	303	284	264	265	268	268	268
	TAS	KT	355	361	366	368	400	417	431	438
	Mach		0.53	0.55	0.56	0.58	0.64	0.67	0.70	0.71
14,400	N1	%	78.3	78.9	79.2	79.3	82.9	84.4	86.0	86.8
	FF	LB/H/ENG	1080	951	826	709	691	700	701	703
	IAS	KT	–	303	284	264	265	267	268	268
	TAS	KT	355	361	365	368	399	416	430	438
	Mach		0.53	0.55	0.56	0.58	0.64	0.67	0.70	0.71
14,800	N1	%	78.4	78.9	79.2	79.3	82.9	84.5	86.0	86.8
	FF	LB/H/ENG	1082	951	826	709	691	699	700	703
	IAS	KT	–	–	–	–	–	–	–	–
	TAS	KT	–	–	–	–	–	–	–	–
	Mach		–	–	–	–	–	–	–	–
15,200	N1	%	78.4	78.9	79.2	79.3	82.9	84.5	86.0	86.8
	FF	LB/H/ENG	1084	951	826	709	691	699	700	703
	IAS	KT	–	–	–	–	–	–	–	–
	TAS	KT	–	–	–	–	–	–	–	–
	Mach		–	–	–	–	–	–	–	–
15,600	N1	%	78.5	78.9	79.2	79.3	82.9	84.5	86.0	86.8
	FF	LB/H/ENG	1086	951	826	708	691	699	700	702
	IAS	KT	–	–	–	–	–	–	–	–
	TAS	KT	–	–	–	–	–	–	–	–
	Mach		–	–	–	–	–	–	–	–
16,000	N1	%	78.5	78.9	79.2	79.3	82.9	84.5	86.0	86.8
	FF	LB/H/ENG	1087	951	826	708	691	699	700	702
	IAS	KT	–	–	–	–	–	–	–	–
	TAS	KT	–	–	–	–	–	–	–	–
	Mach		–	–	–	–	–	–	–	–

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
16,400	N1	%	78.6	78.9	79.2	79.3	82.9	84.5	86.0	86.8
	FF	LB/H/ENG	1089	951	826	708	691	699	699	702
	IAS	KT	320	301	282	260	261	264	265	265
	TAS	KT	355	359	363	363	395	411	426	433
	Mach		0.53	0.54	0.56	0.57	0.63	0.66	0.69	0.70
16,800	N1	%	78.6	78.9	79.2	79.3	83.0	84.5	86.0	86.8
	FF	LB/H/ENG	1089	951	826	708	690	698	699	701
	IAS	KT	319	300	281	260	261	263	264	264
	TAS	KT	354	359	362	362	394	410	424	432
	Mach		0.53	0.54	0.56	0.57	0.63	0.66	0.69	0.70
17,200	N1	%	78.6	79.0	79.2	79.3	83.0	84.5	86.1	86.9
	FF	LB/H/ENG	1089	951	826	707	690	698	699	701
	IAS	KT	319	300	281	259	260	263	263	263
	TAS	KT	354	358	362	361	393	409	423	431
	Mach		0.53	0.54	0.56	0.57	0.63	0.66	0.69	0.70
17,600	N1	%	78.6	79.0	79.2	79.3	83.0	84.6	86.1	86.9
	FF	LB/H/ENG	1088	951	826	707	690	698	698	700
	IAS	KT	319	300	280	258	259	262	262	262
	TAS	KT	354	358	361	360	392	408	422	429
	Mach		0.53	0.54	0.56	0.56	0.63	0.66	0.68	0.70
18,000	N1	%	78.6	79.0	79.2	79.4	83.0	84.6	86.1	86.9
	FF	LB/H/ENG	1088	951	825	707	690	698	698	700
	IAS	KT	318	299	280	258	259	261	261	261
	TAS	KT	353	357	360	359	391	407	421	428
	Mach		0.52	0.54	0.55	0.56	0.62	0.65	0.68	0.70
18,551	N1	%	78.6	79.0	79.3	79.4	83.0	84.6	86.1	86.9
	FF	LB/H/ENG	1088	951	825	706	690	697	698	699
	IAS	KT	318	299	279	256	258	260	260	260
	TAS	KT	353	357	359	358	389	406	419	426
	Mach		0.52	0.54	0.55	0.56	0.62	0.65	0.68	0.69

ISA + 20°C — ALTITUDE: 31,000 TO 45,000 FT

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370	FL390	FL410	FL430	FL450
13,200	N1	%	86.6	86.4	86.1	85.9	85.7	85.5	85.3	85.9
	FF	LB/H/ENG	679	626	577	529	478	431	389	365
	IAS	KT	264	253	242	230	215	200	184	173
	TAS	KT	439	437	434	429	422	412	399	393
	Mach		0.72	0.72	0.72	0.72	0.70	0.69	0.67	0.66
13,600	N1	%	86.7	86.4	86.1	85.9	85.7	85.5	85.3	86.0
	FF	LB/H/ENG	678	626	577	529	478	431	388	364
	IAS	KT	264	253	241	229	214	198	182	171
	TAS	KT	439	436	432	428	419	409	395	388
	Mach		0.72	0.72	0.72	0.71	0.70	0.68	0.66	0.65
14,000	N1	%	86.7	86.4	86.1	86.0	85.8	85.5	85.4	86.0
	FF	LB/H/ENG	678	626	577	529	478	430	388	363
	IAS	KT	263	252	241	228	213	197	180	168
	TAS	KT	438	435	431	426	417	406	391	383
	Mach		0.72	0.72	0.72	0.71	0.70	0.68	0.65	0.64
14,400	N1	%	86.7	86.4	86.1	86.0	85.8	85.6	85.4	86.1
	FF	LB/H/ENG	678	626	576	529	477	430	387	363
	IAS	KT	263	251	240	227	212	195	178	166
	TAS	KT	437	434	430	425	415	403	387	377
	Mach		0.71	0.71	0.71	0.71	0.69	0.67	0.65	0.63
14,800	N1	%	86.7	86.4	86.2	86.0	85.9	85.6	85.5	86.2
	FF	LB/H/ENG	677	625	576	528	477	429	387	361
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	86.7	86.5	86.2	86.1	85.9	85.7	85.6	86.4
	FF	LB/H/ENG	677	625	576	528	476	429	386	359
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	86.7	86.5	86.2	86.1	85.9	85.7	85.7	86.6
	FF	LB/H/ENG	677	625	575	528	476	428	385	357
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	86.8	86.5	86.2	86.1	86.0	85.8	85.8	-
	FF	LB/H/ENG	677	624	575	528	476	428	384	-
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370	FL390	FL410	FL430	FL450
16,400	N1	%	86.8	86.5	86.3	86.2	86.0	85.9	85.9	-
	FF	LB/H/ENG	676	624	574	527	475	427	381	-
	IAS	KT	259	247	235	222	205	186	158	-
	TAS	KT	432	427	421	416	403	385	345	-
	Mach		0.71	0.70	0.70	0.69	0.67	0.64	0.58	-
16,800	N1	%	86.8	86.5	86.3	86.2	86.1	85.9	86.0	-
	FF	LB/H/ENG	676	624	574	527	474	426	377	-
	IAS	KT	258	246	234	221	203	184	148	-
	TAS	KT	430	426	420	414	399	381	325	-
	Mach		0.70	0.70	0.70	0.69	0.67	0.64	0.54	-
17,200	N1	%	86.8	86.6	86.3	86.3	86.1	86.0	-	-
	FF	LB/H/ENG	676	624	574	527	474	426	-	-
	IAS	KT	258	245	233	219	201	181	-	-
	TAS	KT	429	424	418	411	396	376	-	-
	Mach		0.70	0.70	0.69	0.69	0.66	0.63	-	-
17,600	N1	%	86.8	86.6	86.3	86.3	86.2	86.1	-	-
	FF	LB/H/ENG	676	623	573	526	473	425	-	-
	IAS	KT	257	244	232	218	199	178	-	-
	TAS	KT	428	423	417	409	393	370	-	-
	Mach		0.70	0.70	0.69	0.68	0.66	0.62	-	-
18,000	N1	%	86.8	86.6	86.4	86.3	86.2	86.2	-	-
	FF	LB/H/ENG	675	623	573	526	473	423	-	-
	IAS	KT	256	243	231	217	197	174	-	-
	TAS	KT	427	421	415	406	389	361	-	-
	Mach		0.70	0.69	0.69	0.68	0.65	0.60	-	-
18,551	N1	%	86.9	86.7	86.4	86.4	86.3	86.4	-	-
	FF	LB/H/ENG	675	623	572	525	472	420	-	-
	IAS	KT	254	242	229	214	195	161	-	-
	TAS	KT	424	419	412	402	384	336	-	-
	Mach		0.69	0.69	0.68	0.67	0.64	0.56	-	-

MAXIMUM SPEED CRUISE — ONE ENGINE INOPERATIVE

ISA – 20°C — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200
13,200	N1	%	83.8	85.3	86.2	87.1
	FF	LB/H/ENG	1423	1314	1186	1071
	IAS	KT	272	262	249	235
	TAS	KT	281	291	297	304
	Mach		0.45	0.47	0.49	0.52
13,600	N1	%	83.8	85.3	86.2	87.1
	FF	LB/H/ENG	1423	1314	1186	1070
	IAS	KT	272	261	248	235
	TAS	KT	281	290	297	303
	Mach		0.45	0.47	0.49	0.51
14,000	N1	%	83.8	85.3	86.2	87.1
	FF	LB/H/ENG	1423	1313	1185	1070
	IAS	KT	271	261	248	234
	TAS	KT	280	290	296	302
	Mach		0.45	0.47	0.49	0.51
14,400	N1	%	83.8	85.3	86.2	87.1
	FF	LB/H/ENG	1423	1313	1185	1070
	IAS	KT	271	260	247	233
	TAS	KT	280	289	296	301
	Mach		0.45	0.47	0.49	0.51
14,800	N1	%	83.8	85.3	86.2	87.1
	FF	LB/H/ENG	1423	1313	1185	1069
	IAS	KT	-	-	-	-
	TAS	KT	-	-	-	-
	Mach		-	-	-	-
15,200	N1	%	83.8	85.3	86.2	87.1
	FF	LB/H/ENG	1422	1313	1185	1068
	IAS	KT	-	-	-	-
	TAS	KT	-	-	-	-
	Mach		-	-	-	-
15,600	N1	%	83.8	85.3	86.2	87.1
	FF	LB/H/ENG	1423	1313	1184	1068
	IAS	KT	-	-	-	-
	TAS	KT	-	-	-	-
	Mach		-	-	-	-
16,000	N1	%	83.8	85.3	86.2	87.2
	FF	LB/H/ENG	1422	1312	1183	1068
	IAS	KT	-	-	-	-
	TAS	KT	-	-	-	-

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200
	Mach		-	-	-	-
16,400	N1	%	83.8	85.3	86.3	87.2
	FF	LB/H/ENG	1423	1312	1183	1067
	IAS	KT	269	258	244	228
	TAS	KT	278	287	291	295
	Mach		0.44	0.47	0.48	0.50
16,800	N1	%	83.8	85.3	86.3	87.2
	FF	LB/H/ENG	1423	1312	1183	1067
	IAS	KT	268	257	243	227
	TAS	KT	277	286	290	294
	Mach		0.44	0.47	0.48	0.50
17,200	N1	%	83.8	85.3	86.3	87.2
	FF	LB/H/ENG	1423	1311	1182	1066
	IAS	KT	268	257	242	226
	TAS	KT	277	285	290	293
	Mach		0.44	0.46	0.48	0.50
17,600	N1	%	83.8	85.3	86.3	87.2
	FF	LB/H/ENG	1422	1311	1182	1066
	IAS	KT	267	256	241	225
	TAS	KT	276	284	289	291
	Mach		0.44	0.46	0.48	0.49
18,000	N1	%	83.8	85.3	86.3	87.2
	FF	LB/H/ENG	1423	1311	1181	1065
	IAS	KT	267	255	240	224
	TAS	KT	276	283	287	290
	Mach		0.44	0.46	0.48	0.49
18,551	N1	%	83.9	85.3	86.3	87.2
	FF	LB/H/ENG	1423	1310	1181	1065
	IAS	KT	266	254	239	223
	TAS	KT	275	282	286	288
	Mach		0.44	0.46	0.47	0.49

ISA – 10°C — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
13,200	N1	%	85.3	86.9	87.9	88.9	89.2	89.9	91.1	91.9
	FF	LB/H/ENG	1451	1342	1212	1097	944	900	866	851
	IAS	KT	272	262	248	235	215	209	202	199
	TAS	KT	286	296	303	310	308	309	310	310
	Mach		0.45	0.47	0.49	0.52	0.52	0.53	0.53	0.54
13,600	N1	%	85.3	86.9	87.9	88.9	89.2	89.9	91.1	91.9
	FF	LB/H/ENG	1452	1342	1211	1096	943	898	865	850
	IAS	KT	271	261	248	234	214	207	201	197
	TAS	KT	286	296	303	309	307	307	308	308
	Mach		0.45	0.47	0.49	0.51	0.52	0.53	0.53	0.53
14,000	N1	%	85.3	86.9	87.9	88.9	89.2	89.9	91.1	91.9
	FF	LB/H/ENG	1452	1342	1211	1096	942	898	864	848
	IAS	KT	271	261	247	233	213	206	199	196
	TAS	KT	285	295	302	308	305	305	306	306
	Mach		0.45	0.47	0.49	0.51	0.52	0.52	0.53	0.53
14,400	N1	%	85.3	86.9	87.9	88.9	89.2	89.9	91.2	91.9
	FF	LB/H/ENG	1451	1341	1211	1095	941	897	863	846
	IAS	KT	270	260	247	233	212	205	198	195
	TAS	KT	285	295	301	307	303	304	304	304
	Mach		0.45	0.47	0.49	0.51	0.51	0.52	0.53	0.53
14,800	N1	%	85.3	86.9	87.9	88.9	89.3	89.9	91.2	92.0
	FF	LB/H/ENG	1451	1341	1210	1095	940	896	862	844
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	85.4	86.9	88.0	88.9	89.3	90.0	91.2	92.0
	FF	LB/H/ENG	1452	1341	1210	1095	939	895	860	842
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	85.4	86.9	88.0	88.9	89.3	90.0	91.3	92.0
	FF	LB/H/ENG	1451	1341	1210	1094	938	894	859	839
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	85.4	86.9	88.0	89.0	89.3	90.0	91.3	92.0
	FF	LB/H/ENG	1452	1340	1210	1094	937	893	858	837
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
16,400	N1	%	85.4	86.9	88.0	89.0	89.3	90.1	91.4	92.0
	FF	LB/H/ENG	1451	1340	1209	1093	936	892	856	835
	IAS	KT	268	258	243	228	206	198	190	185
	TAS	KT	283	292	297	301	295	294	291	289
	Mach		0.44	0.47	0.48	0.50	0.50	0.50	0.50	0.50
16,800	N1	%	85.4	86.9	88.0	89.0	89.3	90.1	91.4	92.0
	FF	LB/H/ENG	1451	1339	1209	1092	934	890	855	832
	IAS	KT	268	257	242	227	204	196	188	182
	TAS	KT	282	291	296	300	293	291	289	285
	Mach		0.44	0.46	0.48	0.50	0.50	0.50	0.50	0.49
17,200	N1	%	85.4	87.0	88.0	89.0	89.3	90.1	91.4	92.0
	FF	LB/H/ENG	1452	1339	1208	1091	933	889	853	829
	IAS	KT	268	256	242	226	202	194	185	179
	TAS	KT	282	290	295	299	290	288	285	280
	Mach		0.44	0.46	0.48	0.50	0.49	0.49	0.49	0.49
17,600	N1	%	85.4	87.0	88.0	89.0	89.4	90.1	91.5	92.1
	FF	LB/H/ENG	1451	1339	1208	1091	931	887	852	827
	IAS	KT	267	256	241	225	200	192	183	176
	TAS	KT	281	289	294	297	288	286	281	275
	Mach		0.44	0.46	0.48	0.49	0.49	0.49	0.49	0.48
18,000	N1	%	85.4	87.0	88.0	89.0	89.4	90.2	91.5	92.1
	FF	LB/H/ENG	1452	1339	1207	1090	930	886	849	824
	IAS	KT	266	255	240	224	198	190	180	171
	TAS	KT	281	289	293	296	285	283	277	269
	Mach		0.44	0.46	0.48	0.49	0.48	0.48	0.48	0.47
18,551	N1	%	85.4	87.0	88.0	89.0	89.4	90.2	91.6	92.2
	FF	LB/H/ENG	1452	1338	1206	1089	928	883	844	820
	IAS	KT	266	254	239	223	196	187	174	164
	TAS	KT	280	288	291	294	282	278	268	258
	Mach		0.44	0.46	0.47	0.49	0.48	0.48	0.46	0.45

ISA – 10°C — ALTITUDE: 31,000 TO 45,000 FT

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370
13,200	N1	%	91.6	90.9	90.4	90.6
	FF	LB/H/ENG	810	731	662	607
	IAS	KT	193	179	165	149
	TAS	KT	306	296	283	268
	Mach		0.53	0.52	0.50	0.48
13,600	N1	%	91.6	91.0	90.4	90.7
	FF	LB/H/ENG	808	730	661	604
	IAS	KT	191	177	162	144
	TAS	KT	304	292	279	258
	Mach		0.53	0.51	0.49	0.46
14,000	N1	%	91.6	91.0	90.5	90.7
	FF	LB/H/ENG	806	729	659	595
	IAS	KT	189	175	159	133
	TAS	KT	301	289	273	240
	Mach		0.52	0.51	0.49	0.43
14,400	N1	%	91.6	91.1	90.6	–
	FF	LB/H/ENG	804	727	657	–
	IAS	KT	187	173	155	–
	TAS	KT	298	285	266	–
	Mach		0.52	0.50	0.47	–
14,800	N1	%	91.6	91.1	90.7	–
	FF	LB/H/ENG	802	726	655	–
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–
15,200	N1	%	91.6	91.2	90.8	–
	FF	LB/H/ENG	800	724	651	–
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–
15,600	N1	%	91.6	91.2	–	–
	FF	LB/H/ENG	798	722	–	–
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–
16,000	N1	%	91.7	91.3	–	–
	FF	LB/H/ENG	796	719	–	–
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370
16,400	N1	%	91.7	91.4	-	-
	FF	LB/H/ENG	794	716	-	-
	IAS	KT	176	152	-	-
	TAS	KT	281	252	-	-
	Mach		0.49	0.44	-	-
16,800	N1	%	91.8	91.5	-	-
	FF	LB/H/ENG	792	712	-	-
	IAS	KT	173	144	-	-
	TAS	KT	275	239	-	-
	Mach		0.48	0.42	-	-
17,200	N1	%	91.9	-	-	-
	FF	LB/H/ENG	789	-	-	-
	IAS	KT	168	-	-	-
	TAS	KT	269	-	-	-
	Mach		0.47	-	-	-
17,600	N1	%	91.9	-	-	-
	FF	LB/H/ENG	786	-	-	-
	IAS	KT	163	-	-	-
	TAS	KT	261	-	-	-
	Mach		0.45	-	-	-
18,000	N1	%	92.0	-	-	-
	FF	LB/H/ENG	782	-	-	-
	IAS	KT	156	-	-	-
	TAS	KT	250	-	-	-
	Mach		0.44	-	-	-

ISA — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
13,200	N1	%	86.9	88.5	89.6	90.7	90.6	91.1	92.0	92.6
	FF	LB/H/ENG	1479	1370	1239	1122	953	906	864	846
	IAS	KT	271	261	248	235	213	207	199	196
	TAS	KT	291	301	309	316	312	313	312	313
	Mach		0.45	0.47	0.49	0.51	0.52	0.52	0.53	0.53
13,600	N1	%	86.9	88.5	89.6	90.7	90.6	91.1	92.1	92.7
	FF	LB/H/ENG	1478	1369	1239	1122	952	905	863	845
	IAS	KT	271	261	248	234	212	205	198	195
	TAS	KT	291	301	308	315	311	311	311	311
	Mach		0.45	0.47	0.49	0.51	0.52	0.52	0.52	0.53
14,000	N1	%	86.9	88.5	89.6	90.7	90.6	91.1	92.1	92.7
	FF	LB/H/ENG	1479	1370	1238	1121	951	904	862	845
	IAS	KT	270	260	247	233	211	204	197	193
	TAS	KT	290	300	308	314	309	309	309	309
	Mach		0.45	0.47	0.49	0.51	0.51	0.52	0.52	0.52
14,400	N1	%	86.9	88.5	89.6	90.7	90.6	91.2	92.1	92.8
	FF	LB/H/ENG	1479	1369	1238	1120	950	903	862	844
	IAS	KT	270	260	247	232	210	203	196	192
	TAS	KT	290	300	307	313	307	307	307	306
	Mach		0.45	0.47	0.49	0.51	0.51	0.52	0.52	0.52
14,800	N1	%	86.9	88.5	89.6	90.7	90.6	91.2	92.2	92.8
	FF	LB/H/ENG	1479	1369	1238	1120	949	902	860	843
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	86.9	88.5	89.6	90.7	90.6	91.2	92.2	92.8
	FF	LB/H/ENG	1478	1369	1238	1120	948	901	859	842
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	86.9	88.5	89.7	90.7	90.6	91.2	92.2	92.9
	FF	LB/H/ENG	1479	1368	1238	1119	947	899	857	841
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	86.9	88.6	89.7	90.7	90.6	91.2	92.3	92.9
	FF	LB/H/ENG	1479	1368	1237	1119	946	897	856	840
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
16,400	N1	%	86.9	88.6	89.7	90.8	90.7	91.2	92.3	93.0
	FF	LB/H/ENG	1479	1368	1237	1118	945	896	855	839
	IAS	KT	268	257	243	228	204	195	186	182
	TAS	KT	287	297	303	307	299	296	293	292
	Mach		0.44	0.47	0.48	0.50	0.50	0.50	0.50	0.50
16,800	N1	%	86.9	88.6	89.7	90.8	90.7	91.3	92.3	93.1
	FF	LB/H/ENG	1479	1368	1236	1117	943	894	854	838
	IAS	KT	267	257	242	227	202	193	184	180
	TAS	KT	287	296	302	306	296	293	290	288
	Mach		0.44	0.46	0.48	0.50	0.49	0.49	0.49	0.49
17,200	N1	%	86.9	88.6	89.7	90.8	90.7	91.3	92.4	93.1
	FF	LB/H/ENG	1479	1367	1236	1117	941	893	852	835
	IAS	KT	267	256	241	226	200	191	182	177
	TAS	KT	286	295	301	304	293	291	286	283
	Mach		0.44	0.46	0.48	0.50	0.49	0.49	0.48	0.48
17,600	N1	%	86.9	88.6	89.7	90.8	90.7	91.3	92.4	93.2
	FF	LB/H/ENG	1479	1367	1235	1116	939	891	850	832
	IAS	KT	266	255	241	225	198	189	179	173
	TAS	KT	286	294	300	303	290	288	282	277
	Mach		0.44	0.46	0.48	0.49	0.48	0.48	0.48	0.47
18,000	N1	%	86.9	88.6	89.7	90.8	90.7	91.3	92.5	93.3
	FF	LB/H/ENG	1479	1367	1235	1115	937	889	848	828
	IAS	KT	266	254	240	224	196	187	176	168
	TAS	KT	285	294	298	302	288	284	277	270
	Mach		0.44	0.46	0.48	0.49	0.48	0.48	0.47	0.46
18,551	N1	%	87.0	88.6	89.7	90.8	90.7	91.3	92.6	93.5
	FF	LB/H/ENG	1479	1366	1234	1115	934	886	845	822
	IAS	KT	265	253	238	223	193	183	170	158
	TAS	KT	284	293	297	300	284	279	267	255
	Mach		0.44	0.46	0.47	0.49	0.47	0.47	0.45	0.43

ISA — ALTITUDE: 31,000 TO 45,000 FT

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370
13,200	N1	%	92.7	92.9	92.3	92.5
	FF	LB/H/ENG	815	752	679	621
	IAS	KT	191	179	165	148
	TAS	KT	310	303	290	272
	Mach		0.53	0.52	0.50	0.48
13,600	N1	%	92.7	92.9	92.4	92.6
	FF	LB/H/ENG	814	750	677	618
	IAS	KT	190	177	162	143
	TAS	KT	308	299	285	263
	Mach		0.53	0.51	0.49	0.46
14,000	N1	%	92.8	93.0	92.4	92.7
	FF	LB/H/ENG	813	749	676	612
	IAS	KT	188	175	159	133
	TAS	KT	305	296	279	246
	Mach		0.52	0.51	0.48	0.43
14,400	N1	%	92.8	93.0	92.6	–
	FF	LB/H/ENG	812	747	674	–
	IAS	KT	186	173	155	–
	TAS	KT	303	292	272	–
	Mach		0.52	0.50	0.47	–
14,800	N1	%	92.9	93.1	92.7	–
	FF	LB/H/ENG	811	745	672	–
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–
15,200	N1	%	93.0	93.1	92.8	–
	FF	LB/H/ENG	810	743	669	–
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–
15,600	N1	%	93.0	93.2	–	–
	FF	LB/H/ENG	809	740	–	–
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–
16,000	N1	%	93.1	93.2	–	–
	FF	LB/H/ENG	807	737	–	–
	IAS	KT	–	–	–	–
	TAS	KT	–	–	–	–
	Mach		–	–	–	–

Weight (lb)	Param	Unit	FL310	FL330	FL350	FL370
16,400	N1	%	93.1	93.3	-	-
	FF	LB/H/ENG	805	734	-	-
	IAS	KT	174	151	-	-
	TAS	KT	285	257	-	-
	Mach		0.49	0.44	-	-
16,800	N1	%	93.2	93.5	-	-
	FF	LB/H/ENG	801	730	-	-
	IAS	KT	171	143	-	-
	TAS	KT	279	243	-	-
	Mach		0.47	0.42	-	-
17,200	N1	%	93.3	-	-	-
	FF	LB/H/ENG	798	-	-	-
	IAS	KT	166	-	-	-
	TAS	KT	272	-	-	-
	Mach		0.46	-	-	-
17,600	N1	%	93.3	-	-	-
	FF	LB/H/ENG	793	-	-	-
	IAS	KT	160	-	-	-
	TAS	KT	263	-	-	-
	Mach		0.45	-	-	-
18,000	N1	%	93.6	-	-	-
	FF	LB/H/ENG	793	-	-	-
	IAS	KT	153	-	-	-
	TAS	KT	251	-	-	-
	Mach		0.43	-	-	-

ISA + 10°C — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
13,200	N1	%	86.2	87.6	88.7	89.4	89.1	89.4	90.3	90.7
	FF	LB/H/ENG	1382	1263	1138	1005	849	811	790	772
	IAS	KT	259	248	235	219	197	192	188	184
	TAS	KT	283	291	298	301	295	297	301	301
	Mach		0.43	0.45	0.47	0.48	0.48	0.49	0.50	0.50
13,600	N1	%	86.2	87.6	88.7	89.4	89.1	89.4	90.3	90.7
	FF	LB/H/ENG	1383	1263	1138	1004	848	811	789	770
	IAS	KT	258	247	234	218	196	190	186	182
	TAS	KT	282	291	297	300	294	295	299	298
	Mach		0.43	0.45	0.47	0.48	0.48	0.48	0.49	0.49
14,000	N1	%	86.2	87.6	88.7	89.4	89.1	89.5	90.3	90.7
	FF	LB/H/ENG	1382	1263	1138	1003	848	810	787	769
	IAS	KT	258	247	233	217	195	189	184	180
	TAS	KT	282	290	296	298	292	293	296	295
	Mach		0.43	0.45	0.46	0.48	0.48	0.48	0.49	0.49
14,400	N1	%	86.2	87.6	88.7	89.4	89.1	89.5	90.3	90.8
	FF	LB/H/ENG	1383	1263	1138	1003	847	810	786	767
	IAS	KT	257	246	232	216	193	187	182	178
	TAS	KT	281	289	295	297	290	291	293	291
	Mach		0.43	0.45	0.46	0.47	0.47	0.48	0.48	0.48
14,800	N1	%	86.2	87.6	88.7	89.4	89.2	89.5	90.4	90.8
	FF	LB/H/ENG	1382	1264	1138	1003	846	809	785	766
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	86.2	87.6	88.8	89.4	89.2	89.5	90.4	90.8
	FF	LB/H/ENG	1383	1263	1138	1002	846	808	783	764
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	86.2	87.6	88.8	89.4	89.2	89.5	90.4	90.8
	FF	LB/H/ENG	1382	1263	1138	1001	845	808	781	762
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	86.2	87.6	88.8	89.4	89.2	89.6	90.4	90.9
	FF	LB/H/ENG	1382	1263	1138	1001	844	807	780	760
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
16,400	N1	%	86.2	87.6	88.8	89.4	89.2	89.6	90.4	90.9
	FF	LB/H/ENG	1382	1263	1137	1001	843	806	777	758
	IAS	KT	255	243	228	211	185	178	170	164
	TAS	KT	279	286	290	290	278	277	274	269
	Mach		0.42	0.44	0.45	0.46	0.45	0.45	0.45	0.45
16,800	N1	%	86.2	87.7	88.8	89.5	89.2	89.6	90.5	91.0
	FF	LB/H/ENG	1382	1263	1136	1000	842	806	775	756
	IAS	KT	254	242	227	209	183	175	166	159
	TAS	KT	278	285	289	289	275	273	268	262
	Mach		0.42	0.44	0.45	0.46	0.45	0.45	0.44	0.43
17,200	N1	%	86.3	87.7	88.8	89.5	89.2	89.6	90.5	91.2
	FF	LB/H/ENG	1382	1263	1136	1000	841	805	772	754
	IAS	KT	254	241	226	208	181	173	162	153
	TAS	KT	277	284	288	287	272	269	261	251
	Mach		0.42	0.44	0.45	0.46	0.44	0.44	0.43	0.42
17,600	N1	%	86.3	87.7	88.8	89.5	89.3	89.7	90.6	-
	FF	LB/H/ENG	1382	1263	1135	999	840	803	768	-
	IAS	KT	253	241	225	207	178	169	155	-
	TAS	KT	277	283	286	285	268	263	251	-
	Mach		0.42	0.44	0.45	0.45	0.44	0.43	0.41	-
18,000	N1	%	86.3	87.7	88.8	89.5	89.3	89.7	-	-
	FF	LB/H/ENG	1382	1263	1135	998	839	802	-	-
	IAS	KT	252	240	224	205	175	165	-	-
	TAS	KT	276	282	285	283	263	257	-	-
	Mach		0.42	0.43	0.45	0.45	0.43	0.42	-	-
18,551	N1	%	86.3	87.7	88.8	89.5	89.3	89.8	-	-
	FF	LB/H/ENG	1382	1263	1134	997	836	798	-	-
	IAS	KT	252	238	223	203	170	157	-	-
	TAS	KT	275	281	284	279	256	245	-	-
	Mach		0.42	0.43	0.44	0.45	0.42	0.40	-	-

ISA + 10°C — ALTITUDE: 31,000 TO 45,000 FT

Weight (lb)	Param	Unit	FL310	FL330	FL350
13,200	N1	%	90.7	90.7	90.9
	FF	LB/H/ENG	741	683	632
	IAS	KT	178	166	153
	TAS	KT	297	288	276
	Mach		0.50	0.48	0.47
13,600	N1	%	90.7	90.7	91.0
	FF	LB/H/ENG	739	681	630
	IAS	KT	176	164	149
	TAS	KT	293	284	268
	Mach		0.49	0.48	0.46
14,000	N1	%	90.7	90.7	91.1
	FF	LB/H/ENG	738	679	627
	IAS	KT	174	161	143
	TAS	KT	290	279	259
	Mach		0.48	0.47	0.44
14,400	N1	%	90.7	90.8	91.3
	FF	LB/H/ENG	737	677	623
	IAS	KT	172	157	134
	TAS	KT	287	273	243
	Mach		0.48	0.46	0.41
14,800	N1	%	90.8	90.9	–
	FF	LB/H/ENG	735	675	–
	IAS	KT	–	–	–
	TAS	KT	–	–	–
	Mach		–	–	–
15,200	N1	%	90.8	91.0	–
	FF	LB/H/ENG	733	672	–
	IAS	KT	–	–	–
	TAS	KT	–	–	–
	Mach		–	–	–
15,600	N1	%	90.9	–	–
	FF	LB/H/ENG	731	–	–
	IAS	KT	–	–	–
	TAS	KT	–	–	–
	Mach		–	–	–
16,000	N1	%	90.9	–	–
	FF	LB/H/ENG	729	–	–
	IAS	KT	–	–	–
	TAS	KT	–	–	–
	Mach		–	–	–

Weight (lb)	Param	Unit	FL310	FL330	FL350
16,400	N1	%	91.1	-	-
	FF	LB/H/ENG	726	-	-
	IAS	KT	153	-	-
	TAS	KT	256	-	-
	Mach		0.43	-	-
16,800	N1	%	91.2	-	-
	FF	LB/H/ENG	722	-	-
	IAS	KT	145	-	-
	TAS	KT	242	-	-
	Mach		0.40	-	-

ISA + 20°C — ALTITUDE: 5,000 TO 30,000 FT

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
13,200	N1	%	83.6	85.1	86.3	87.5	87.3	87.3	88.1	88.7
	FF	LB/H/ENG	1216	1102	994	889	749	703	680	674
	IAS	KT	238	227	214	200	179	171	166	164
	TAS	KT	265	272	278	282	274	271	273	275
	Mach		0.39	0.41	0.43	0.44	0.44	0.44	0.44	0.45
13,600	N1	%	83.6	85.1	86.3	87.5	87.3	87.3	88.1	88.7
	FF	LB/H/ENG	1216	1102	994	889	748	703	679	673
	IAS	KT	237	226	214	199	177	169	164	162
	TAS	KT	264	271	277	280	271	268	269	271
	Mach		0.39	0.41	0.43	0.44	0.43	0.43	0.44	0.44
14,000	N1	%	83.6	85.1	86.3	87.5	87.3	87.4	88.2	88.8
	FF	LB/H/ENG	1216	1102	994	889	747	702	679	674
	IAS	KT	237	226	213	198	175	167	161	159
	TAS	KT	263	270	276	279	268	265	265	267
	Mach		0.39	0.41	0.42	0.44	0.43	0.43	0.43	0.43
14,400	N1	%	83.6	85.1	86.4	87.6	87.3	87.4	88.2	88.9
	FF	LB/H/ENG	1215	1102	994	889	747	702	679	674
	IAS	KT	236	225	212	197	173	165	158	156
	TAS	KT	262	270	274	278	266	262	261	262
	Mach		0.39	0.41	0.42	0.43	0.42	0.42	0.42	0.43
14,800	N1	%	83.6	85.1	86.4	87.6	87.4	87.4	88.3	89.0
	FF	LB/H/ENG	1215	1102	993	889	746	701	679	674
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,200	N1	%	83.6	85.1	86.4	87.6	87.4	87.5	88.4	89.1
	FF	LB/H/ENG	1215	1102	993	889	745	700	678	674
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
15,600	N1	%	83.6	85.1	86.4	87.6	87.4	87.5	88.5	89.2
	FF	LB/H/ENG	1214	1102	993	889	744	699	678	675
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-
16,000	N1	%	83.6	85.1	86.4	87.7	87.4	87.6	88.6	-
	FF	LB/H/ENG	1214	1101	993	888	743	698	677	-
	IAS	KT	-	-	-	-	-	-	-	-
	TAS	KT	-	-	-	-	-	-	-	-
	Mach		-	-	-	-	-	-	-	-

Weight (lb)	Param	Unit	5000	FL100	FL150	FL200	FL250	FL270	FL290	FL300
16,400	N1	%	83.6	85.1	86.4	87.7	87.4	87.7	-	-
	FF	LB/H/ENG	1214	1102	993	888	741	697	-	-
	IAS	KT	232	220	207	190	159	143	-	-
	TAS	KT	259	264	268	267	245	229	-	-
	Mach		0.38	0.40	0.41	0.42	0.39	0.37	-	-
16,800	N1	%	83.6	85.2	86.4	87.7	87.5	-	-	-
	FF	LB/H/ENG	1214	1102	993	888	740	-	-	-
	IAS	KT	232	219	205	189	155	-	-	-
	TAS	KT	258	263	266	265	239	-	-	-
	Mach		0.38	0.40	0.41	0.42	0.38	-	-	-
17,200	N1	%	83.6	85.2	86.5	87.7	87.6	-	-	-
	FF	LB/H/ENG	1214	1101	993	888	738	-	-	-
	IAS	KT	231	219	204	187	149	-	-	-
	TAS	KT	257	262	265	263	230	-	-	-
	Mach		0.38	0.40	0.41	0.41	0.37	-	-	-
17,600	N1	%	83.6	85.2	86.5	87.8	-	-	-	-
	FF	LB/H/ENG	1213	1101	993	887	-	-	-	-
	IAS	KT	230	218	203	185	-	-	-	-
	TAS	KT	255	261	263	261	-	-	-	-
	Mach		0.38	0.39	0.40	0.41	-	-	-	-
18,000	N1	%	83.7	85.2	86.5	87.8	-	-	-	-
	FF	LB/H/ENG	1213	1101	993	887	-	-	-	-
	IAS	KT	229	217	201	183	-	-	-	-
	TAS	KT	255	260	261	258	-	-	-	-
	Mach		0.38	0.39	0.40	0.40	-	-	-	-
18,551	N1	%	83.7	85.2	86.5	87.8	-	-	-	-
	FF	LB/H/ENG	1212	1101	993	886	-	-	-	-
	IAS	KT	228	215	199	180	-	-	-	-
	TAS	KT	253	258	258	253	-	-	-	-
	Mach		0.38	0.39	0.40	0.40	-	-	-	-

ISA + 20°C — ALTITUDE: 31,000 TO 45,000 FT

Weight (lb)	Param	Unit	FL310	FL330	FL350
13,200	N1	%	88.7	88.8	89.2
	FF	LB/H/ENG	650	608	563
	IAS	KT	159	146	118
	TAS	KT	271	260	219
	Mach		0.44	0.43	0.36
13,600	N1	%	88.7	88.9	—
	FF	LB/H/ENG	650	608	—
	IAS	KT	156	142	—
	TAS	KT	267	253	—
	Mach		0.44	0.42	—
14,000	N1	%	88.8	89.0	—
	FF	LB/H/ENG	650	608	—
	IAS	KT	153	136	—
	TAS	KT	261	242	—
	Mach		0.43	0.40	—
14,400	N1	%	88.9	—	—
	FF	LB/H/ENG	650	—	—
	IAS	KT	149	—	—
	TAS	KT	255	—	—
	Mach		0.42	—	—
14,800	N1	%	89.0	—	—
	FF	LB/H/ENG	651	—	—
	IAS	KT	—	—	—
	TAS	KT	—	—	—
	Mach		—	—	—
15,200	N1	%	89.2	—	—
	FF	LB/H/ENG	651	—	—
	IAS	KT	—	—	—
	TAS	KT	—	—	—
	Mach		—	—	—

ANNEX A — EVENTS AND VARIABLES REFERENCE

Introduction

This annex provides a reference table of the main input events and local variables (L:VARs) used by the FSReborn Phenom 300E cockpit controls. These can be used by third-party peripheral driver software such as SPAD.next, Axis and Ohs, or similar tools to bind cockpit switches, knobs, and levers to hardware controllers.

All custom L:VARs begin with FSR_300E_ (or FSR300_ for some legacy controls). Standard MSFS events are used where applicable and are noted accordingly. Unless stated otherwise, for two-state switches 1 = ON and 0 = OFF. Three-state switches use 0, 1, and 2 for their respective positions.

Note: Circuit breakers are not listed in this table. L:VARs exist for all 135 circuit breakers but they are managed internally by the maintenance and random failure systems and are not intended for direct external control.

Electrical Panel

Battery 1	L:FSR_300E_BATTERY_1_SWITCH_ON (0=OFF, 1=ON)
Battery 2	L:FSR_300E_BATTERY_2_SWITCH_ON (0=OFF, 1=ON)
Generator 1	L:FSR_300E_Electrical_Switch_GEN_1 (0=OFF, 1=AUTO)
Generator 2	L:FSR_300E_Electrical_Switch_GEN_2 (0=OFF, 1=AUTO)
Bus Tie	L:FSR_300E_BUSTIE_KNOB_POS (0=OFF, 1=AUTO, 2=OVRD)
Emergency Power Cover	L:FSR_300E_Electrical_Switch_Emergency_Cover (0=Closed, 1=Open)
Emergency Power	L:FSR_300E_EMERGENCY_SWITCH_ON (0=OFF, 1=ON)
GPU	L:FSR_300E_GPU_SWITCH_ON (0=OFF, 1=ON)
GPU Available	L:FSR_300E_GPU_AVAILABLE (read-only, 0=No, 1=Yes)
GPU Connected	L:FSR_300E_GPU_CONNECTED (read-only, 0=No, 1=Yes)
IFE and Refreshments	L:FSR_300E_IFE_SWITCH (0=OFF, 1=ON)

Engines Panel

Engine 1 Start/Stop	L:FSR_300E_ENGINE1_KNOB_POS (0=STOP, 1=START, 2=RUN)
Engine 2 Start/Stop	L:FSR_300E_ENGINE2_KNOB_POS (0=STOP, 1=START, 2=RUN)
Ignition 1	B:ENGINE_Ignition_1_Off / B:ENGINE_Ignition_1_Auto / B:ENGINE_Ignition_1_On
Ignition 2	B:ENGINE_Ignition_2_Off / B:ENGINE_Ignition_2_Auto / B:ENGINE_Ignition_2_On

Fire Protection Panel

Engine 1 Shutoff Cover	L:FSR_300E_Electrical_Switch_SOV1_Cover (0=Closed, 1=Open)
Engine 1 Shutoff Valve	L:FSR_300E_ELECTRICAL_SWITCH_SOV1_ON (0=Normal, 1=Shutoff)
Engine 2 Shutoff Cover	L:FSR_300E_Electrical_Switch_SOV2_Cover (0=Closed, 1=Open)
Engine 2 Shutoff Valve	L:FSR_300E_ELECTRICAL_SWITCH_SOV2_ON (0=Normal, 1=Shutoff)
Fire Extinguisher Bottle	L:FSR_300E_ENGINE_FIRE_BOTTLE_SWITCH_ON (0=OFF, 1=Discharge)

Pneumatic and ECS Panel

Bleed 1	L:FSR_300E_SWITCH_BLEED1_ON (0=OFF, 1=AUTO)
Bleed 2	L:FSR_300E_SWITCH_BLEED2_ON (0=OFF, 1=AUTO)
XBleed	L:FSR_300E_XBLEED_KNOB_POS (0=OFF, 1=AUTO)
Pressurization Mode	L:FSR_300E_PRESSMODE_SWITCH (0=MAN, 1=AUTO)
ECS Knob	L:FSR_300E_ECS_KNOB_POS (0=OFF VENT, 1=ECS 1, 2=BOTH, 3=ECS 2)
Press Dump Cover	L:FSR_300E_Electrical_Switch_PressDump_Cover (0=Closed, 1=Open)
Press Dump Switch	L:FSR_300E_PRESSDUMP_SWITCH (momentary)
Cabin Altitude Switch	L:FSR_300E_CABIN_ALTITUDE_SET_SWITCH (momentary UP/DN)
Aircon Mode	L:FSR_300E_AIRCONMODE_SWITCH (0=OFF, 1=AUTO, 2=MAN)
Manual Temp (H/C)	L:FSR_300E_ECS_HX_DUCT_TEMP_1 (momentary)
Cockpit Fan Speed	L:FSR_300E_COCKPIT_AIRCON_SPEED (0=LO, 1=MED, 2=HI)
Cabin Fan Speed	L:FSR_300E_CABIN_AIRCON_SPEED (0=LO, 1=MED, 2=HI)
Cockpit Temp Knob	L:FSR_300E_Electrical_KnobInner_AirconTemp (rotary)
Cabin Temp Knob	L:FSR_300E_Electrical_KnobOuter_AirconTemp (rotary)

Fuel Panel

Fuel Pump 1	L:FSR_300E_FUEL_PUMP1_SWITCH (0=OFF, 1=ON, 2=AUTO)
Fuel Pump 2	L:FSR_300E_FUEL_PUMP2_SWITCH (0=OFF, 1=ON, 2=AUTO)
Fuel XFeed	L:FSR_300E_FUELXFEED_KNOB_POS (0=OFF, 1=ON)

Hydraulic Panel

HYD Pump SOV 1	L:FSR_300E_HYD_SOV1_SWITCH_ON (0=CLOSED, 1=OPEN)
HYD Pump SOV 2	L:FSR_300E_HYD_SOV2_SWITCH_ON (0=CLOSED, 1=OPEN)

Ice Protection Panel

Engine 1 Anti-Ice	L:FSR_300E_ENG_1_ICE_SWITCH_ON (0=OFF, 1=ON)
Engine 2 Anti-Ice	L:FSR_300E_ENG_2_ICE_SWITCH_ON (0=OFF, 1=ON)
Wing/Stab Anti-Ice	L:FSR_300E_WINGSTAB_SWITCH (0=OFF, 1=ON, with ICE SPEED RESET)
ADS Probes	L:FSR_300E_OADSPROBES_KNOB_POS (0=OFF, 1=AUTO, 2=ON)
Windshield Heat 1	L:FSR_300E_WSHIELD1_SWITCH_ON (0=OFF, 1=ON)
Windshield Heat 2	L:FSR_300E_WSHIELD2_SWITCH_ON (0=OFF, 1=ON)

Instrument Panel

Spoiler Switch	L:FSR_300E_SPOILERS_SWITCH (0=OFF, 1=ARMED)
	B:FSR_GENERIC_ELECTRICAL_SWITCH_SPOILERS_ON / _OFF / _TOGGLE
Takeoff Config Test	L:FSR_300E_TOCONFIG_SWITCH (momentary)
Pusher Cutout	L:FSR_300E_PUSHER_CUTOUT_SWITCH_ON (0=Normal, 1=Cutout)
Pitch Backup Switch	L:FSR_300E_SWITCH_PITCHBACKUP (0=OFF, 1=ON)
Backup Pitch Trim	L:FSR_300E_SWITCH_TRIMPITCHBKP (momentary UP/DN)
FCE Reset Knob	L:FSR_300E_FCERESET_KNOB_POS (0=FCE1, 1=OFF, 2=FCE2)
FCE Reset Button	L:FSR_300E_FCERESET_BUTTON (momentary)
PFD 1 Reversionary	L:FSR_300E_SWITCH_PFD_1_MODE (0=Normal, 1=Rev, 2=Backup)
PFD 2 Reversionary	L:FSR_300E_SWITCH_PFD_2_MODE (0=Normal, 1=Rev, 2=Backup)

Landing Gear

Gear Lever	Standard MSFS: GEAR_UP / GEAR_DOWN
Gear Down Lock	L:FSR_300E_DNLock_SWITCH (momentary)
Gear Horn Inhibit	L:FSR_300E_GearHornInhib_SWITCH (momentary)
Emergency Gear Door	L:FSR_300E_Emergency_Landing_Gear_Door (0=Closed, 1=Open).
	B:FSR_GENERIC_Emergency_Landing_Gear_Door_ON
Emergency Gear Lever	L:FSR_300E_Emergency_Gear_Lever (0-100, lever position)

Lighting Controls

Panel LEDs	L:FSR_300E_PANELS_LED_ON (0=OFF, 1=ON)
Cockpit Panel Dimmer	L:FSR_300E_COCKPITPANEL_KNOB_POS (0-100)
Cabin Lights	L:FSR_300E_CABINLIGHTS_KNOB_POS (0=OFF, 1=DIM, 2=BRT)
Emergency Lights	L:FSR_300E_ELECTRICAL_EMERLIGHTS (0=OFF, 1=ARM, 2=ON)
Landing/Taxi Lights	L:FSR_300E_LANDING_SWITCH (0=OFF, 1=TAXI, 2=LDG).
	B:FSR_GENERIC_ELECTRICAL_SWITCH_LDGTAXI_LIGHT_Set
Navigation Lights	Standard MSFS: TOGGLE_NAV_LIGHTS
Strobe Lights	Standard MSFS: STROBES_TOGGLE
Wing Inspection Light	Standard MSFS: LIGHTING_WING_1_TOGGLE
Courtesy Lights	L:FSR_300E_Courtesy_Lights_ON (0=OFF, 1=ON)
Pilot Overhead Light	L:FSR_300E_PILOT_OVERHEAD_LIGHT_ON (0=OFF, 1=ON)
Copilot Overhead Light	L:FSR_300E_COPILOT_OVERHEAD_LIGHT_ON (0=OFF, 1=ON)
PAX Overhead Intensity	L:FSR_300E_OVERHEADLIGHTS_PAX_INTENSITY (0-100)
Standby Illumination	L:FSR_300E_Stndby_Illumination (0-100)

Test Panel

Test Selector Knob	L:FSR_300E_TESTPANEL_KNOB_POS (0-5, selects test type)
Test Start Button	L:FSR_300E_TESTPANEL_SWITCH_ON (momentary)

Oxygen and Safety

Oxygen Control	L:FSR_300E_OXYGEN_KNOB_POS (0=CREW ONLY, 1=PAX AUTO, 2=PAX OVRD)
Oxygen Cutout Lever	L:FSR_300E_LEVER_OXYGEN_CUTOUT (0-100, lever position)
ELT	L:FSR_300E_ELT_SWITCH_ON (0=OFF, 1=ARM, 2=ON).
	B:FSR_GENERIC_ELECTRICAL_SWITCH_ELT_Pos1
PAX Signs and Outlets	L:FSR_300E_PAX_SWITCH_SETTING (0=OFF/ON, 1=BELTS/ON, 2=PED-BELTS/OFF)
Pilot Mask MIC	L:FSR_300E_PILOT_MASKMIC_SWITCH (0=OFF, 1=ON)
Copilot Mask MIC	L:FSR_300E_COPILOT_MASKMIC_SWITCH (0=OFF, 1=ON)

Cabin and Miscellaneous

Main Cabin Door	L:FSR_300E_DOOR_ANIMATION (0=Closed, 1=Open)
EFB Tablet Visible	L:FSR_300E_SHOW_EFB (0=Hidden, 1=Visible)
EFB Position Up/Down	L:FSR_300E_EFB_DN_UP (position value)
EFB Position Left/Right	L:FSR_300E_EFB_L_R (position value)
EFB Rotation	L:FSR_300E_EFB_Rotate (position value)
Pilot Visor	L:FSR300_PILOTVISOR_UP (0=Down, 1=Up)
Copilot Visor	L:FSR300_COPILOTVISOR_UP (0=Down, 1=Up)
Left Lateral Visor	L:FSR300_LATERALVISORLEFT_UP (0=Down, 1=Up)
Right Lateral Visor	L:FSR300_LATERALVISORRIGHT_UP (0=Down, 1=Up)
Autopilot CSC	L:FSR_300E_PUSH_CSC (momentary)
Autopilot CPL	L:FSR_300E_PUSH_CPL (momentary)
Standby STD Baro	L:FSR_300E_PUSH_STD_3 (momentary)

END OF PILOT'S USER MANUAL

FOR SIMULATION USE ONLY. DO NOT USE FOR REAL-WORLD FLIGHT.