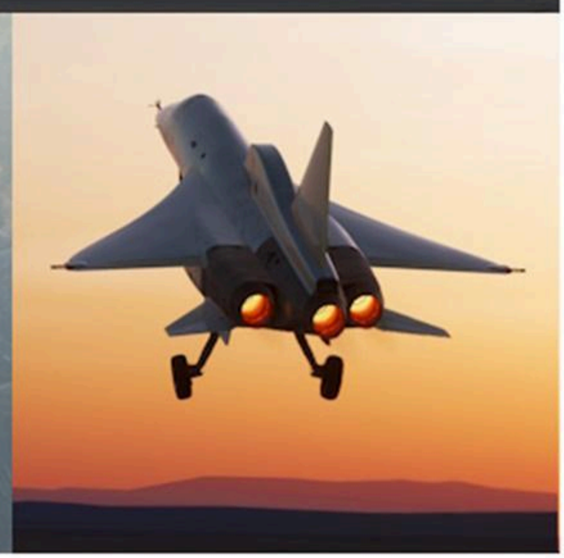

BOOM XB-1

AIRCRAFT MANUAL

Microsoft Flight Simulator 2024 MSFS FLIGHTFX WORKING TITLE

Special Thanks

A huge thank you to all the innovators of Boom Supersonic, a professional uniquely talented team dedicated to returning safe (supersonic) passenger flight to the world. Without their unwavering support and transparency, this project would not be possible.

[9]

Preface

FOR SIMULATION USE ONLY - DESIGNED FOR SINGLE-PILOT OPERATIONS

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

PHOTOSENSITIVE SEIZURE WARNING

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

To minimize the risk of photosensitive seizures:

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

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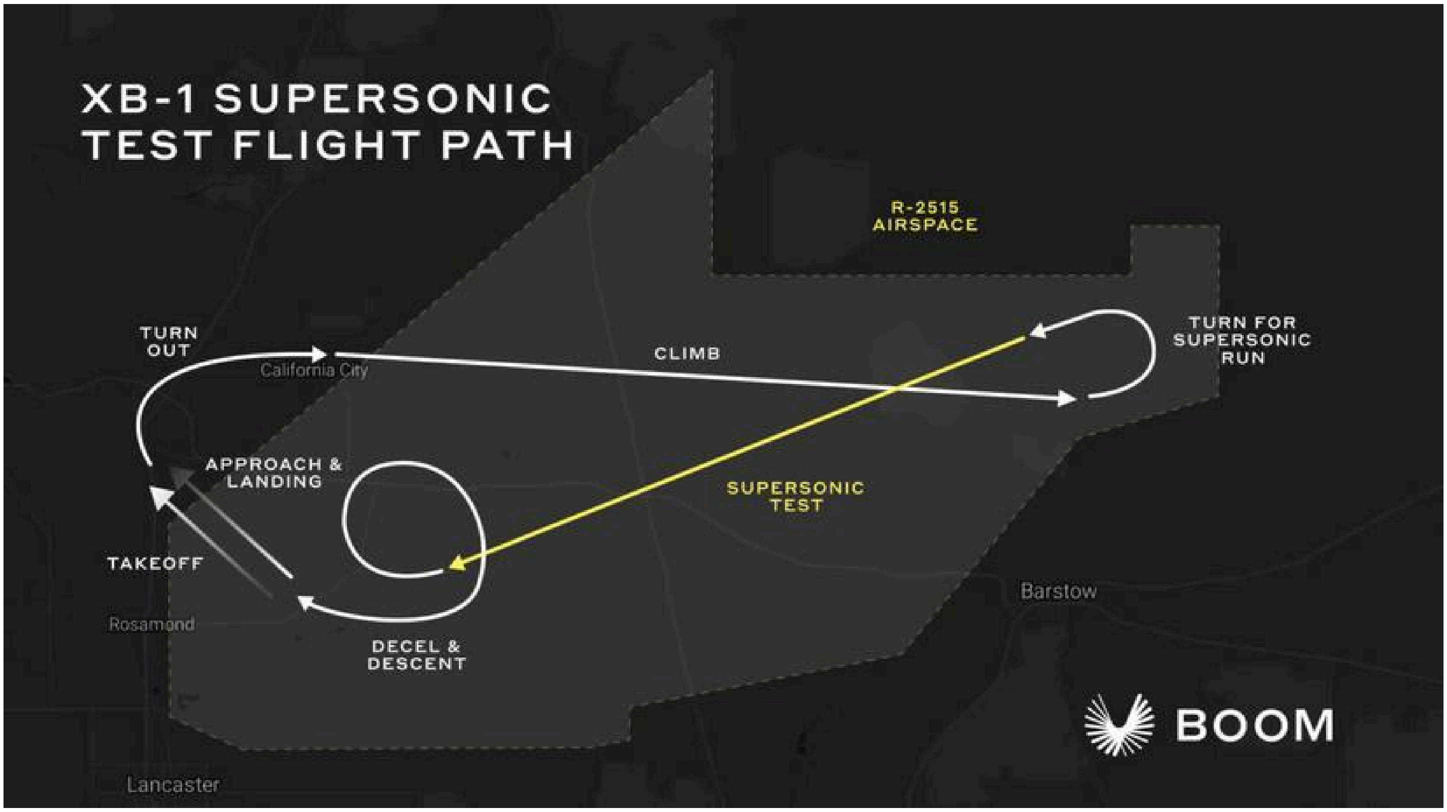
IMPORTANT INFORMATION DO NOT SKIP

- **The XB-1 was a unique experimental aircraft only operated in clear daytime conditions. A chase aircraft (usually a T-38) served as its spotter. It was only operated in restricted test flight corridors such as those surrounding Edwards Air Force Base, California. Because of this, certain systems that come standard on most aircraft ARE NOT present on the real XB-1 *or in this representation*. Some of these "missing" items include But are not limited to:**
  - **Autopilot, Autothrottle, FADEC controlled engines**
  - **Taxi, Landing, Navigation, and Recognition Lights**
  - **Flaps, slats, or spoilers/airbrakes of any kind**
  - **Fly-by-wire control systems**
  - **De-ice Systems**
  - **Weather Radar**
  - **(An ejection seat)**
- **Furthermore, the XB-1 also has some unique operational characteristics. Here are some important examples:**
  - **The XB-1 uses an Ogival shaped wing specially suited to minimizing drag at supersonic speed. Like true Delta wings, this also means it has poor low speed handling characteristics.**
    - **Similar to Concorde, the XB-1's Ogive wing has a high angle angle of attack. The XB-1 has no flaps which means it lands at an incredible 12 degrees nose up. Concorde pilots used its unique tilting nose to correct the lack of forward sight at these high angles during approach. The XB-1 pilot uses the Forward Looking Vision System (FLVS). This consists of two cameras on the nose gear one which sends a live video feed to the Multifunction Flight Display (MFD) and a redundant which sent its feed to the right Avidyne IFD backup display.**
    - **With no Flaps expect landing speeds around 160-175kts**
    - **The XB1 is capable of rolling at up to 120°/sec. Users may notice vastly inconsistent roll rates as the aircraft rolls either direction. This may be more pronounced at slower airspeeds as the roll rate may appear to slow, then speed up, then slow once again. This is all an expected behavior modeled after the real aircraft roll inconsistencies.**

A Historic Flight



Minutes

- **T-10 Engine Start:** Three engines are started followed by pre-taxi checks
- **T-0 Mission start:** The crew chief pulls the chocks and completed
- **T+2 Taxi to Runway:** XB-1 proceeds to the runway

Takeoff and Supersonic

- **T+14 Takeoff:** Control room calls for brake release and XB-1 initiates takeoff
- **T+17 Climb:** XB-1 ascends and sets up for the turn, preparing for the supersonic test run
- **T+25 Supersonic Test: at 34,000ft, the aircraft will accelerate to Mach 1.1, breaking the sound barrier**
- **T+29 Decelerate and Descend:** After the supersonic test, XB-1 will slow down and set up for landing
- **T+38 Approach and Landing:** The Landing Signal Officer guides XB-1 down for a safe landing.

[1]

About The Boom XB-1

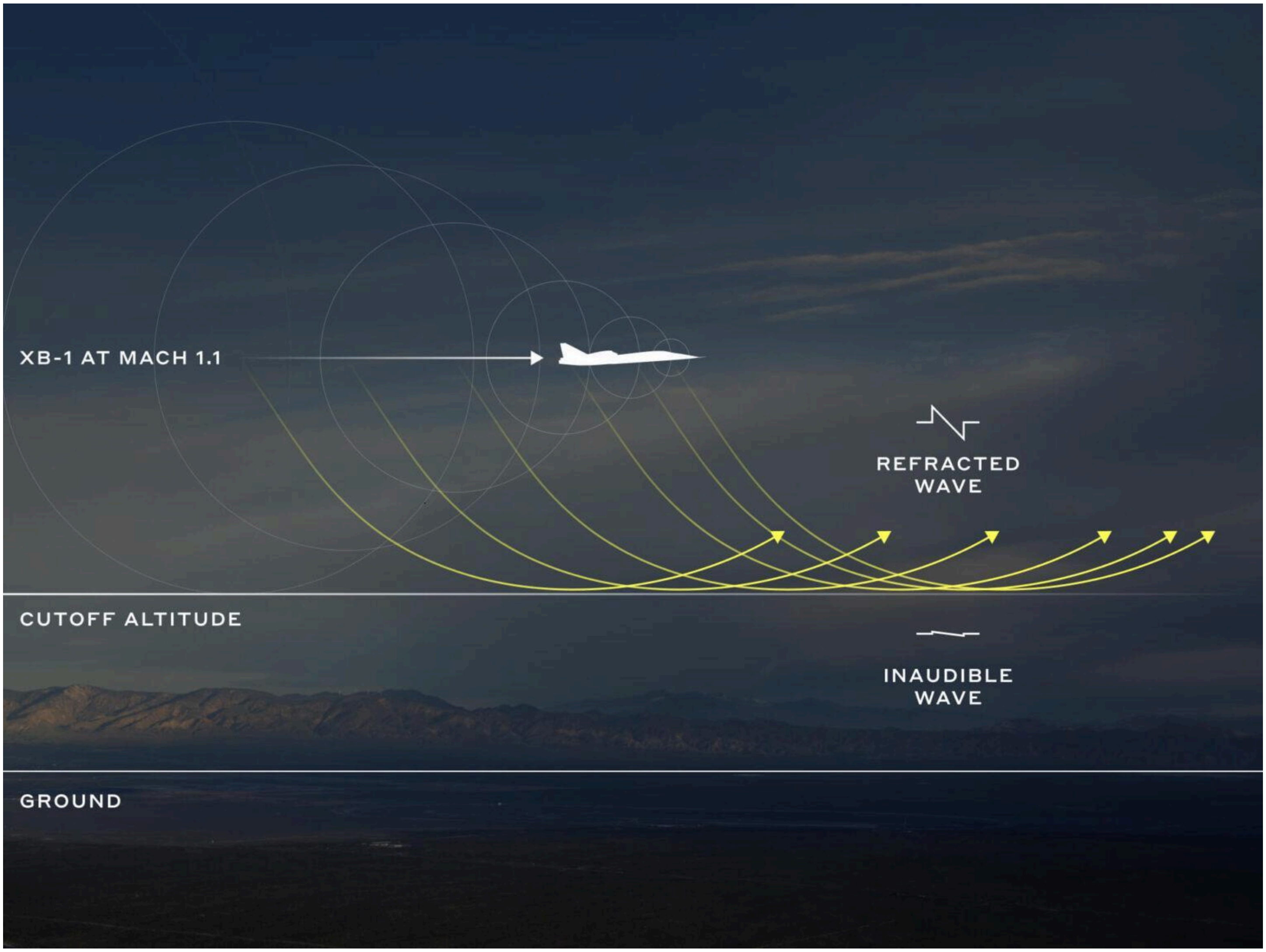
The Boom Supersonic XB-1 is a very special test aircraft. It is arguably just as important to supersonic flight as the Bell X-1 flown by General Chuck Yeager nearly 77 years earlier. It is the first civilian aircraft to fly supersonic since the Concorde's last commercial flight in October of 2003, and the first US built civilian aircraft to fly in supersonic cruise. However, the XB-1's most important mark on history is that it will be remembered as the first aircraft (both military or civilian) to ever fly supersonic without producing an audible sonic boom.

How The Boom XB-1 Flew Supersonic Without the Boom (Boomless Cruise/Mach cutoff)

On January 28 2025 XB-1 Test pilot Tristan "Geppetto" Brandenberg pushed the XB-1 into the pages of history by completing three supersonic cruise transitions in one flight achieving a top speed of Mach 1.1 or around 750 mph. He would go on to fly the XB-1 supersonic again a month later. Boom proudly announced no sonic booms were detected on either flight.

To understand how the XB-1 was able to do this, a simple discussion of supersonic flight and Mach cutoff must first be reviewed. As an aircraft flies along it pressurizes the air in front of it pushing compressed air to the sides just like the waves off the nose of a boat traveling through water. The faster the aircraft moves the more air continues to compress in front of it until it forms a conical shock wave around the entire airplane. A pressure analysis of this shock wave would show higher pressure readings observed at the nose that steadily decrease to a negative pressure reading at the tail. The process of the air instantaneously going from extremely high pressure down to negative pressure then back to normal atmospheric pressure as the plane passes through it, creates the audible sonic boom.

Mach Cutoff (M_{CO}) (aka Boomless Cruise) is a carefully balanced technique where an aircraft is flown "slow" enough but still above the speed of sound (usually around Mach 1.1-1.3), but also high enough for the sound waves of the sonic boom to never reach the ground. This is possible due to the upward refraction (or deflection) of the sonic boom sound waves off different atmospheric gradients such as temperature, wind, and density layers. This is similar to the way light bends when passing through a glass of water. The altitude at which complete refraction happens is known as the Cutoff Altitude (Z_{CO}) [7]. Though it is easy to assume the XB-1 would have to fly extremely high to accomplish this, the reality is the XB-1 completed its Boomless Cruise tests at roughly 35,000ft, with no audible sonic booms. Lastly, it is important to note that the XB-1 could still create an audible sonic boom if it would have flown faster than the Boomless Cruise requirements.



[2]

Why This Accomplishment Is So Important to Aviation

The Concorde's Achilles Heel was that it was not allowed to fly supersonic over land because of the sonic boom it created. This meant its true potential could only be realized on select trans-oceanic routes. By achieving Boomless cruise, the XB-1 has shown that trans-continental routes such as New York to Los Angeles are now possible at supersonic speeds provided the regulations prohibiting such flights are lifted (which Boom expects will happen).

The Future Plans of Boom Supersonic and the XB-1

"We make the world dramatically more accessible"
~Boom Supersonics' Mission Statement

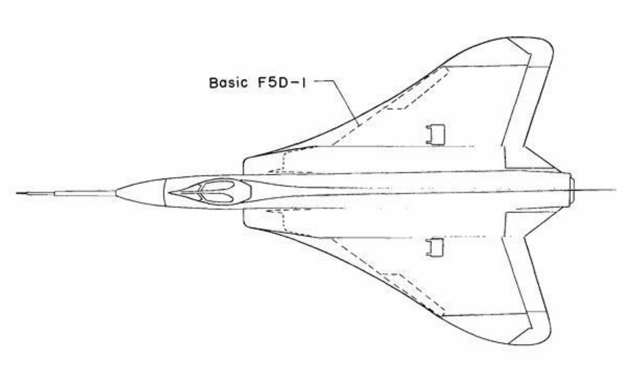
The real Boom XB-1 has already been retired. (Luckily it will continue to fly the virtual skies for many years to come.) The real aircraft will eventually find its place as a beautiful exhibit piece in the lobby of Boom's new Headquarter building located in Centennial, Colorado. However, the data it gathered has been instrumental in Boom's next aircraft development, the Boom Overture.

The Boom Overture pictured above [8] is planned to be the United States first commercial supersonic aircraft and the world's first commercial aircraft permitted to fly supersonic over land.

The XB-1 Fuselage Design/Powerplant Integration

The XB-1 is a single pilot tri-jet constructed primarily of Carbon Fiber, Titanium, A286 Stainless Steel, and Inconel (a super alloy consisting of Nickel and Chromium used for high temperature applications). The XB-1 is powered by three General Electric (GE) J85-15 engines (with afterburners) that produce 12,300lbs of combined thrust [5]. Fixed geometry engine intakes are used to help slow the incoming supersonic air to usable airspeeds to help prevent engine damage. The Center engine's intake is like the intakes used by the other two engines. However, it is inverted and placed on the top center fuselage forward of the vertical stabilizer. A "S" duct connects the inlet to the engine (not too dissimilar to the center engine inlet/duct setup used on both the Boeing 727 and Lockheed L1011) The fuselage uses a very minimum cross-section to reduce drag.

The XB-1 Wing



Like Concorde, the XB-1 uses an Ogival wing design [4]. Not to be confused with the delta wing, Ogive wings use a more curved triangular shape. The figure to the left [3] shows the curved leading edge of the test Ogive wing compared to the original straight edge (dotted lines) of a F5D-1 NASA test aircraft's delta wing. The Ogive wing's low drag characteristics at high speeds is why it is often selected for supersonic applications. Though, ogive wings excel flying fast, subsonic speeds (especially the slower approach speeds) tend to be where its performance drastically falls off. With a very small wingspan of just 21 feet, the XB-1s wing is designed to fly fast with the least amount of drag. However, its shape, small span and absence of flaps mean it requires a high angle of attack at slower speeds. This all contributes to the XB1s' 12 degrees nose up landing attitude.

The XB-1 Cockpit

The XB-1's test pilots worked side by side with Boom engineers to help optimize the XB-1s cockpit layout. All the important systems can be easily viewed and easily reached by the pilot. It may come as a surprise that an aircraft as advanced as the XB-1 primarily used off the shelf avionics often found in many general aviation applications or even some helicopters. The centerpiece of the XB-1s avionics suite is the Multi-Functional Display (or MFD) featuring software written in-house by Boom. Along with the MFD, there is also dual screen Avidyne IFD550/540 FMS/GPS/NAV/COM units, an Annunciator panel, and Avidyne AMX240 Audio Selector Panel. Like many modern fighter jets, the XB-1s three throttle levers are all on the left side of the cockpit next to where the pilots left thigh would be while sitting. This allows all three levers to be easily adjusted by the pilot's left hand with minimum arm movement needed. There is also a lower port window on each side of the cockpit. These aid in pilot visibility during taxi, takeoff and landing.

A Unique Landing Aid for a Unique Aircraft Landing (FLVS)

The XB-1 has no wing flaps and its wing has a short span and a high angle of attack at slow speeds. Because of this, the XB-1 has a unique way of landing. From final approach to touchdown the plane is pointed nose up nearly 12 degrees. The pilot is unable to see the runway out the forward window. To mitigate this the Forward-Looking Vision System (FLVS) is activated on approach. The FLVS consists of two cameras (a primary and redundant) placed on the nose gear and angled down 12 degrees. When the XB-1 enters this nose up attitude the cameras are angled perfectly for viewing the landing environment. The feed is sent to the MFD giving the pilot a live view of what cannot otherwise be seen forward of the aircraft **(*To reduce the impact on performance in the simulator, a synthetic vision system (SVS) is used to emulate the camera view*)**. The real FLVS feed is not too dissimilar from what a pilot would see looking through a Heads-up display or HUD. During approach/landing a flight director can also be followed all the way to the runway. The FLVS system consists of the two cameras—the main camera on the MFD display and redundant camera on the right Avidyne display **(not simulated)**, a Data Acquisition System and Inertia Navigation System or INS.

Aircraft Specifications/SPEEDS/Limitations

LENGTH	65.8Ft/20.05m
WINGSPAN	21Ft/6.40m
HEIGHT (GROUND TO TOP OF VERTICAL STAB)	15.5Ft/4.72m
EMPTY WEIGHT	12,000Lb/5443.1Kg
MAX ZERO FUEL WEIGHT (ZFW)	12,200Lb/5533.8Kg
MAX FUEL WEIGHT	5200Lb/2358.7Kg used to achieve MTOW (More can be carried)
FUEL CAPACITY/TANK	Forward Tank: 33Gal (222.75Lb/101.04Kg) Bottom Tank: 85Gal (573.75Lb/260.2Kg) Aft Tank: 73Gal (492.75Lb/223.5Kg) Mid Tank: 287Gal (1937.25Lb/878.72Kg) Main Tank: 313Gal (2112.75Lb/958.3Kg)
MAX TAKE-OFF WEIGHT (MTOW)	17,400Lb/7892.5Kg
MAX LANDING WEIGHT (MLW)	MTOW possible with Drag Chute (not simulated)
ENGINE SPECS	Three General Electric J85-15s producing more than 12,300Lbf thrust total (with afterburners)
SERVICE CEILING	FL400 (40,000Ft)
Vmo MAX OPERATING SPEED	Mach 1.18 achieved
Vne ENVELOPE/ MAX DO NOT EXCEED	Mach 1.4 (Capable of much faster but not tested)
Vr ROTATE (MTOW)	150Kts
APPROXIMATE TAKEOFF DISTANCE (MTOW)	~4000ft/1219.2m or 0 to 35ft 5750Ft/1752.6m
Vx BEST CLIMB SPEED	225Kts
Vapp Approach Speed	Between 170-180Kts Landing Angle of Attack (AOA) ~12Deg
STALL SPEED (GEAR RETRACT/GEAR EXTEND)	No Stall Speed just stall Do Not Exceed (AOA) 18Deg

Tutorial Flight

TBD.

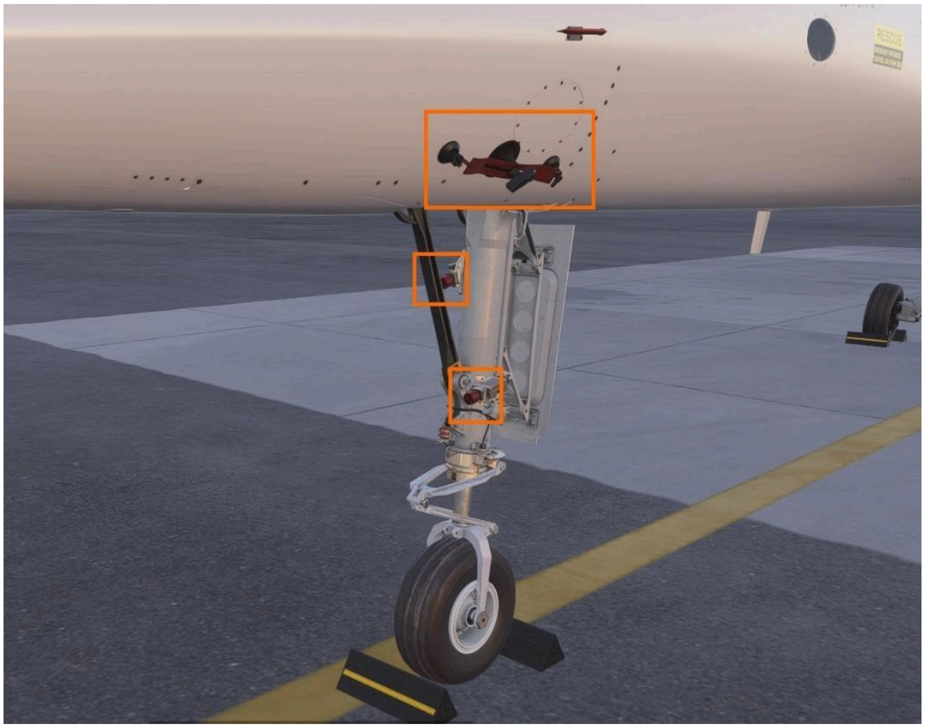
Walkaround Mode (Removing Covers)

The XB-1 comes with covers, panels and chocks that can be removed on the walkaround.

The Engine Inlet and Exhaust plugs (Not shown) can be removed/installed separate from the rest of the covers on the plane. Simply click on any of the red covers. (May need to right click the mouse first)

Chocks can also be removed/installed by clicking on a chock.

The static port reference for the cabin pressure outflow valve covers can be removed/installed. There is another on the other side. Clicking on one will remove/install on both.



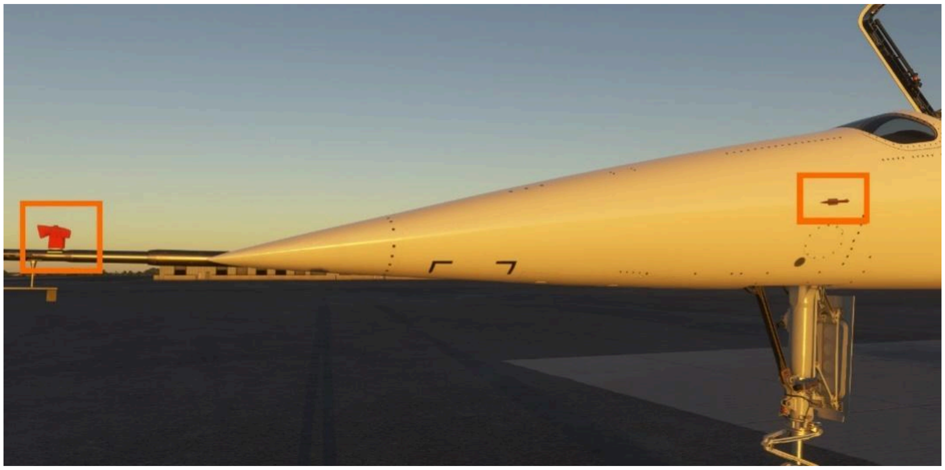
There are further air data static ports above the nose gear (on both sides of the nose). Removing/installing one side will affect the other the same.

The Camera lens covers for the FLV system can also be clicked on to remove/install.

Clicking on the nosewheel chock will remove/install all chocks.

The pitot tube covers can be removed separately from these covers. This will be highlighted below

The Test boom covers can be removed. The top vane is for Outside Air Temp (OAT) readings, the nose is the pitot port, the left is AOA and the bottom vane is for the beta/sideslip. However, the OAT cover can be removed/installed separately.



In this figure these sensors remain covered while all other sensors and camera lens covers are removed. They are installed/removed together.

Exhaust plugs are removed/installed with the Engine Inlet plugs. These are removed/installed separate from the other covers. Clicking on either will remove them all.

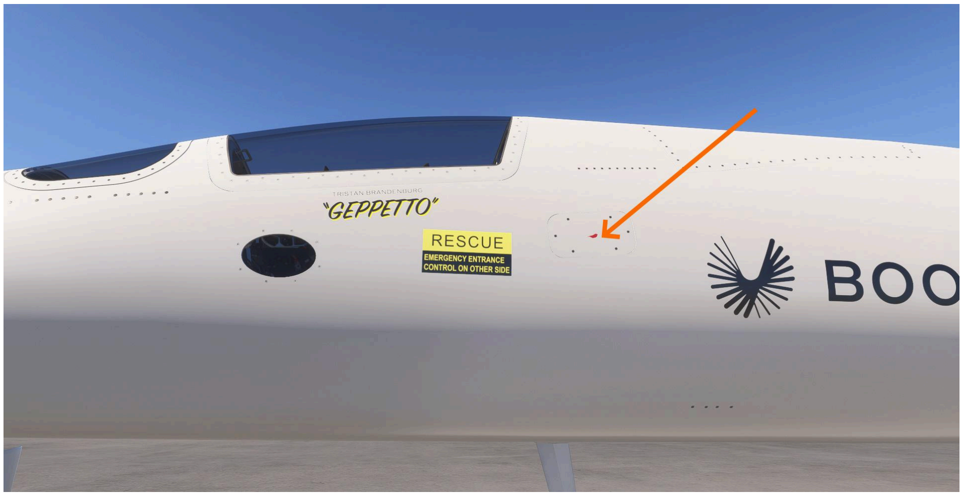
There are two cooling/pressure relief ports on the top of the aircraft that are removed/installed automatically with the main covers. (All the other covers other than the pitot and engine covers which are removed separately) These are used for engine bay pressure relief and cooling.

Canopy Control

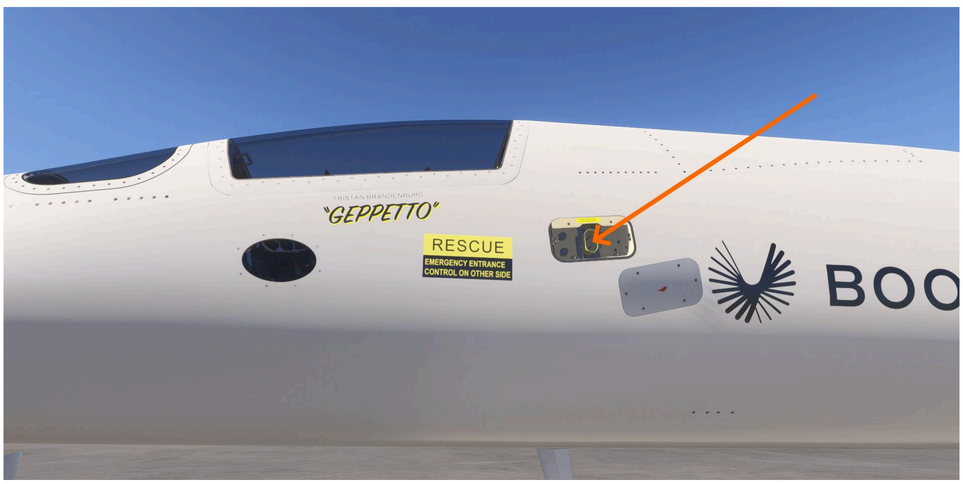
The yellow arrow points to the external Canopy control panel. (It is still closed in this figure)

Click on the access panel door to open it. Then click on the red lever.

GPU



The Ground Power Unit (GPU). Can be accessed by clicking on this panel. This will remove the panel and expose the power cable receptacle.



Click on the receptacle to "attach" the GPU. NOTE the GRD and various warning and caution lights will be activated in the cockpit.

The GPU will be powered on when plugged into the aircraft. To release the GPU click on the plug at the receptacle. Then click on the hanging panel to close the receptacle.

Welcome Aboard!

System Details and Overview

1. Fuel Control Panel
2. Hydraulic Control Panel
3. Electrical/Environmental Control Systems (ECS) Panel
4. Flutter Exciter System (FES) Interface panel (Not Simulated)
5. Landing Gear Control/Engine Fire Control Panel
6. Flight Control Panel
7. Engine Start Panel
8. Throttles
9. MFD (Multi-Function Display) (Forward-Looking Vision System mode selected)
10. IFD550 (Left IFD)
11. IFD540 (Right IFD)
12. AMX240 Audio Selector Panel
13. Annunciator Panel
14. Master Warning/Caution Button
15. GRT Display (Not Simulated, only used for Redundant Artificial Horizon Display)
16. Canopy Lock/Release handle
17. Flight Control Stick
18. Rudder Pedals

Fuel Control Panel

1. **Fuel Transfer Knob-**
Gives the pilot the ability to transfer fuel from the (FWD) Forward fuel tank (33 Gal/~223lbs), (BTM) Bottom fuel tank (85 gal/~574lbs), Aft fuel tank (73 gal/~493lbs), Mid fuel tank (287 gal/1937lbs) and Main fuel tank (313 gal/~2113lbs) With all other tanks full, the Forward fuel tank amount was often adjusted to meet the 5200lbs fuel total for MTOW*. **OFF** position: the fuel is only pumped from the Main fuel tank. **AUTO** position: the fuel is pumped from the transfer tanks into the main tank before being used. The transfer tank pumping order is Forward, Bottom, Aft and Mid.
2. **PRI LEAK Pushbutton-** When depressed the primary fuel isolation valve is closed and the secondary AC pump is activated. Normal fuel flow and fuel transfer are then maintained by the secondary system. FUEL SOV CL PRI advisory is indicated confirming the primary fuel isolation valve is closed (**Not currently simulated**)
3. **SEC LEAK Pushbutton-**
When depressed, the secondary fuel isolation valve is closed. Normal fuel flow and fuel transfer are maintained by the primary system.
4. **OVERFILL/LOW Indicators-**
OVERFILL (Not Simulated) used for fuel transfer system failure. LOW Indicates roughly 1800lbs of fuel remaining in Main Tank
5. **FWD LOW/BTM LOW Indicators-**
Indicates when the Forward and/or Bottom fuel tanks are empty.
6. **Aft LOW/MID LOW Indicators-**
Indicates when the Aft and/or Mid fuel tanks are empty

*To replicate this real world operation, the user must manually load the following fuel amounts in each tank using the EFB: 2097lbs in the Main Tank, 1915lbs in the Mid Tank, 524lbs in the Aft Tank, 585lbs in the BTM tank and 77lbs in the FWD tank

Hydraulic Control Panel

There is one hydraulic actuator for each aileron and one on the rudder. A hydraulic actuator is also used to turn a torque tube connected to the horizontal stabilizer. There are two Engine Driven Pumps (EDPs) and one backup pump (aka Drive Control Pump (DCP). There are two hydraulic systems on the XB-1 Flight (**FLT**) and Utility (**UTIL**). The FLT system is pressurized by the left EDP and only used for flight controls. The UTIL system is pressurized by the right EDP and is used for flight controls, landing gear, brakes, and nose wheel steering.

1. **(DCP) HYD PUMP CONTROL KNOB-**
OFF Pump will not power on for any condition. **AUTO** Pump comes on whenever UTL EDP PRESS is below 2200PSI. **ON** Pump is always powered on. Must be switched to this in case of an EDP failure. The DCP can also be activated in situations where there is more demand needed then what the EDP can provide such as landing gear extension/retraction.
2. **ANTISKID Activation Switch-**
The INS sends ground speed data to the antiskid controller to help prevent the tires from locking/skidding when brakes are applied. **AUTO** Brake antiskid system powered on. **OFF** Antiskid system powered off. Use gradual brake applications. Brake Lock is possible which may damage main landing gear tires. Antiskid is turned **OFF** in case of a UTIL pressure fault so that Hydraulic fluid is not wasted for a non-critical flight system.
3. **FLT LOW PRESS-**
Indicates that pressure is below 2200psi (nominal is 3000psi).
4. **EDP FAIL-**
Illuminates if the UTL system engine driven pump is not providing adequate pressure.
5. **UTIL LOW PRESS-**
Illuminates if pressure is below 2200psi
6. **ANTISKID FAULT LIGHT-**
Fault detected in brake antiskid system, ANTISKID Activation Switch must be switched OFF

Electrical/Environmental Control System (ECS) Panel

The XB-1 Electrical system consists of one 28VDC Integrated Drive Generator (IDG) on the left engine, four 24VDC batteries (which can power everything turned on for around 20mins), and three electrical buses; the Main bus, a Landing bus, and an Essential Bus. All three buses can receive power from the IDG only, the batteries only or both. The pilot can use the **AVIONICS Power Switch** to select which bus is to be used. External power can be plugged in on the ground. The Environmental Control System (ECS) and Pressurization system's primary purpose was to keep the air quality within the cockpit comfortable (albeit in a limited capacity) for the pilot especially at higher altitudes. It gave the pilot the ability to control the interior temperature and maintained a slightly pressurized cockpit at higher altitudes. The latter to help slow the effects of hypoxia in case of Oxygen system failure (required in flight). The bleed air used for conditioned air and pressurization is only taken from the center engine.

1. **Avionics Power Switch-**
Provides power to all associated avionics based on which electrical bus is selected by the pilot. **ON** the Main Bus powers everything including backup systems (Use this for sim). **LDG BUS** or the Landing bus only provided power to minimum equipment including one radio (Comm 2) and the right Avidyne for load shedding purposes (not needed in sim). NOTE: The following are rendered inoperative in the **LDG BUS** position so ensure switch is in **ON** if you see them: MFD pitch ladder, flight path marker, air data and ILS, Engine indications, engine/afterburner igniters, and fuel pumps/fuel transfer. **OFF** is the essential or battery power bus that powers no other avionics except the annunciator panel and INS. Other systems that can still operate off this bus (and must be turned off by circuit breaker only-not simulated) include, cockpit lighting, landing gear indications, Backup DC Hydraulic pump, Fire detection loops, and Bleed air leak detector.
2. **Generator Interconnect Switch-**
ON/OFF Used to connect or disconnect the generator to the three buses. **RESET** resets the generator to recommended normal/safe voltages.
3. **Generator Power Switch-**
This switch turns the generator on or off.
4. **Main Battery Switch-**
Connects or disconnects the batteries to the three buses.
5. **Battery Discharge Indication Light-**
DISCH Indicates the batteries are discharging. This light is expected with batteries on and generators offline (i.e. engines not running).
6. **Cockpit Air Temperature Selector-**
Helps the pilot control the cockpit air (bleed) temperatures. Does not work with RAM air. (There is no cockpit air temperature displayed to the pilot)
7. **Air Flow Interconnect Switch-** (in sim controls cockpit fans)
ON/OFF This switch controls the flow air valve which controls bleed air fed into the cockpit which the pilot could use the Cockpit Air Temperature Selector to control the temperature for. **RAM** controls ram air valve which allows outside air forced into the flightdeck (will not activate above 10000ft or with the Cabin Pressure Switch in the PRESSURIZED position.

8. **Cabin Pressure Switch-**
Used to activate/deactivate pressure regulating valve used to control the cabin pressurization system
9**. Bleed Air Leak Indication Light- BLEED LEAK** light indicates ECS bleed air leak detected. If illuminated in flight center throttle to idle, descend to 10000ft, lift cover Press Bleed Air Leak Indication Light. This will close both flow air valve and pressure regulating valve, and will open the RAM air control valve. (Failures such as this are not simulated)

Flutter Exciter System (FES) Interface Panel

Not Simulated, used for real world testing.

(The orange vanes on the wing tips are the Flutter Excitation System (FES). The cylinders rotate at increasing frequency to extract energy from the airflow to vibrate the airframe. The airframe response is then measured to ensure that the structural modes are appropriately damped.)

Oxygen Control Panel

Not Simulated, Oxygen control for pilots O_2 mask.

Landing Gear Control/Engine Fire Control

1. **Landing Gear Extension/Retraction Lever-**
Controls extension and retraction of both main landing gear and nose gear.
2. **Landing Gear/Landing Gear Door Position Lights-**
Indicates landing gear and landing gear door positions. Lights remain off when landing gear are up and Landing gear doors are shut. Yellow Door lights illuminate when gear doors are open. Green landing gear lights illuminate when landing gear are down and in a locked position.
3. **Engine Fire Detection Lights-**
One light for the Left, Center, and Right engine. When one of the lights illuminate the pilot must immediately press the associated light, pull the associated throttle to the Idle position then to Cutoff. Immediately press **EXT 1** pushbutton. Wait ~30 secs, if Fire Light remains illuminated press **EXT 2** pushbutton. (Must flip up plastic guard to press pushbutton)
4. **Engine Fire Extinguisher Discharge Lights-**
Pressed to activate one of two fire extinguisher bottles used to suppress engine fires. **EXT 1** is pressed first. If the fire light remains illuminated, **EXT 2** can be pressed after about a 30 second wait. The yellow DISCH light illuminates when the bottle is fully discharged or empty.
5. **Engine Bay Temperature/Oil Pressure Lights- BAY HOT L/C/R**
Illuminates when high engine bay temperature conditions are detected above normal engine operating temps. **OIL PRES L/C/R** illuminates when low engine oil pressure is detected.
6. **Loop A/Loob B Fire Detection Lamp Test Switch-**
Each engine uses 2 fire loop circuits (A and B) to help detect fires. A voltage is sent through each wire and once broken (open circuit due to fire) will initiate the Fire warnings. This switch is used to test all the fire warning lights associated with each loop.

7. **Bleed Air Leak Detection System (BALDS) Lamp Test Switch-**
Like the Loop A/B fire detection loops, the only difference being these fire loop circuits were wrapped around high bleed engine tubes to detect leaks. Same lamp test displays as Loop A/B Lamp Test Switch

Flight Control Panel

The XB-1 does not have a fly-by-wire flight control system. It also does not have an autopilot. Its flight control system is the same basic pulley, gear and torque tube (powered with hydraulic actuators) design found in many non-fly-by-wire aircraft. Though advanced computer finite analysis, simulations and wind tunnel testing can give engineers a pretty good guess how a plane will fly, they cannot account for every condition that aircraft will experience throughout the different phases of flight. Furthermore, the use of hydraulic actuators completely removes the feel of the dynamic forces acting on a flight control surface. This can translate to a disconnect between what the pilot expects to feel and what is actually felt. This disconnect could lead to pilot induced control inputs that could seriously damage the aircraft (or worse) especially when flying above the speed of sound.

The FLT CNTL (Flight Control) Panel has a series of switches and knobs that allows the pilot to adjust certain control characteristics such as dampening on each flight axis (Yaw, Roll and Pitch). This helps keep flight control inputs and responses within a safe margin throughout all phases of flight. (For flight simmers, this is like adjusting the hardware control sensitivity curves and reactivity settings.)

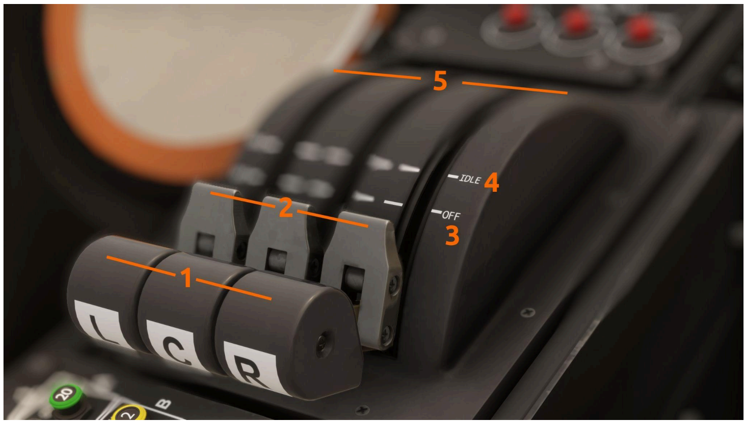
1. **ARI (Aileron Rudder Interconnect) Switch-** The ARI system connects the control stick roll inputs to the rudder such that during turns the rudder deflects just enough to maintain a coordinated turn with no slip.
2. **(YAW, ROLL, PITCH) Damper Switches-** This system helps prevent unwanted control oscillations by providing a proportional opposite control surface deflection based on the magnitude of the original yaw, roll or pitch rate.
3. **Q-FEEL FORCE-** As mentioned above, the use of hydraulic actuators effectively removes the "feel" of dynamic flight forces acting on the control surfaces (e.g. controls will not "feel" heavier the faster the air flow over the surface. Q feel (similar to force feedback available on many flight simulator joysticks) inputs a resistance (based on a programmed schedule) that makes the control feel lighter or heavier to replicate the forces canceled out by hydraulic actuators on the pitch axis.

4. **ROLL RATIO DEFLECTION Switch-** Roll ratio changer changes the ratio of stick input to aileron surface movement, but doesn't make the control feel heavier or lighter. There are Roll, Pitch (Q-feel) and Trim Indicators on the MFD OVR and ENS screens (See MFD section)

Engine Start Panel

Contains the three engine start buttons.

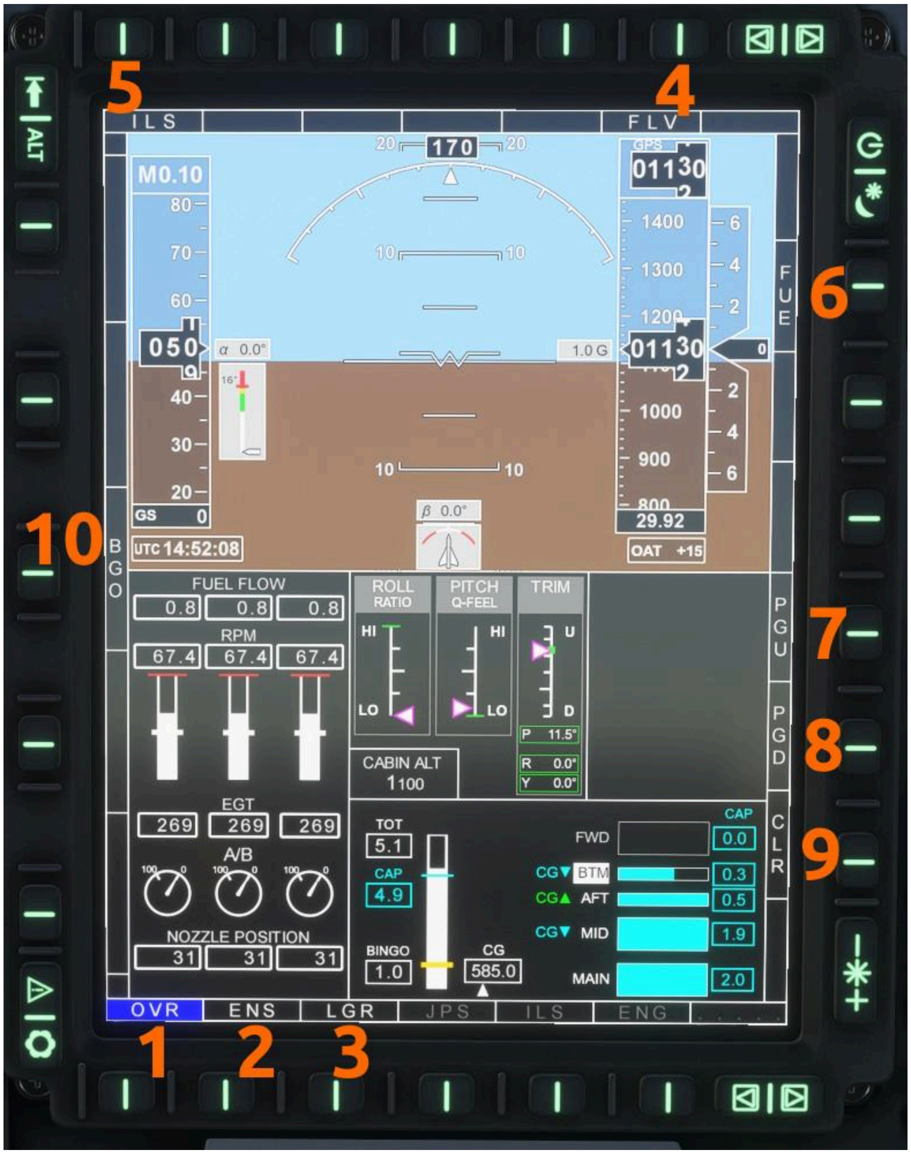
Throttle



1. **Throttle Levers-**
L for Left engine, C for Center engine, R for Right engine.
2. **Throttle Lever Interlocks-**
Must be lifted to move throttles into "Idle" at startup or into "Cutoff" for engine shutdown (Not simulated, will move automatically in sim.)
3. **Cutoff Gate-**
Lock out gate that will not allow throttles to be reduced past without first lifting Interlocks (not simulated). Once the throttles positioned below this gate will shut the engine/will not allow engine start
4. **Idle Gate-**
Idle position once engines are running.
5. **Afterburner Gate-** afterburner activation point

Avionics

MFD



1. **OVR-** Overview synoptic page key (synoptic page shown)
2. **ENS-** Engine Start synoptic page key
3. **LGR-** Landing Gear synoptic page key
4. **FLV-** Forward -Looking Vision system key
5. **ILS-** Landing System key (Requires Destination Runway in flight plan) Toggles landing needles and approach info box for selected runway
6. **FUE-** Fuel input synoptic pane key
7. **PGU-** Page Up select key to toggle up through Crew Alerting System (CAS) messages.
8. **PGD-** Page Down select key to toggle down through CAS messages.
9. **CLR-** Clear key for toggling caution and advisory CAS messages
10. **BGO-** Bingo fuel field edit key

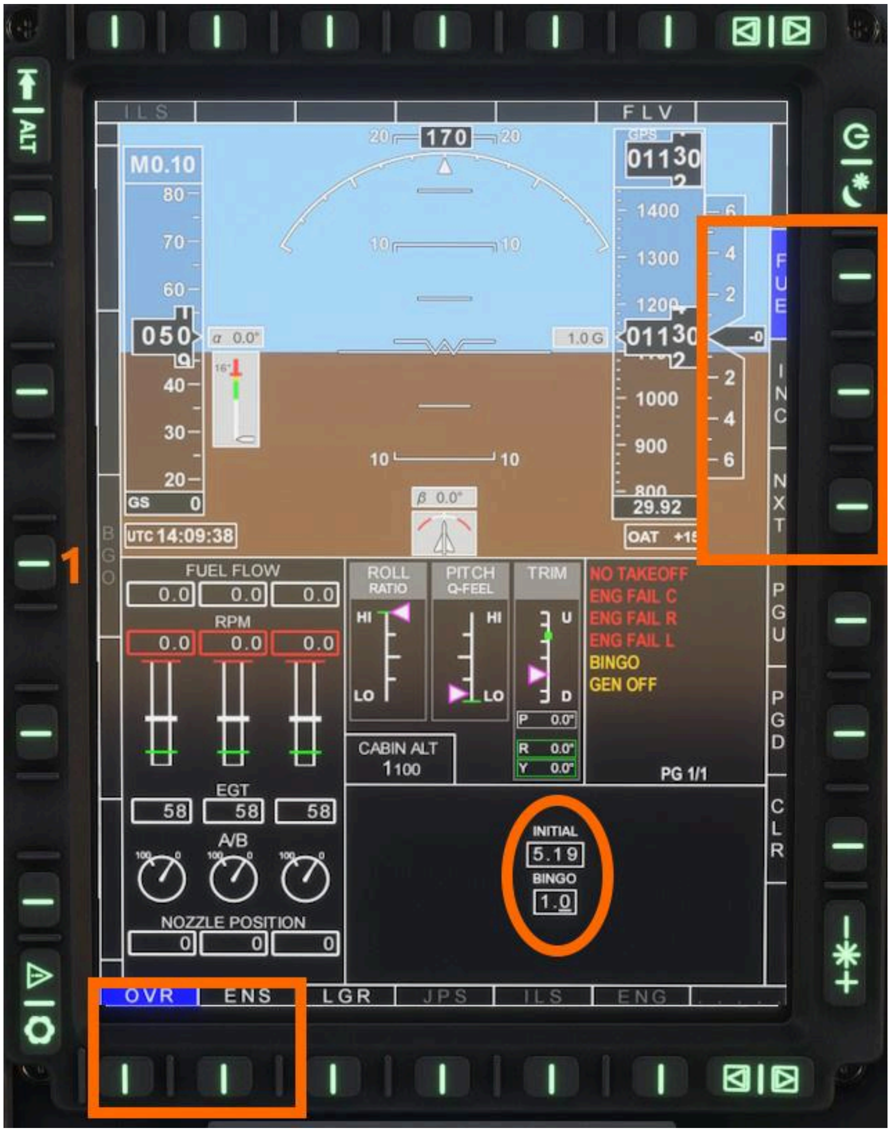
Artificial Horizon/Primary Flight Display (PFD)

1. Mach Number
2. KCAS (Knots Calibrated Airspeed) Airspeed Tape (never shows less than 50 kts)
3. Groundspeed
4. UTC Time
5. Alpha (Angle of Attack) Indicator (green band is for landing)
6. Beta (Yaw) Indicator
7. Pitch Ladder
8. Outside Air Temperature
9. Baro Setting (Set on Left Avidyne)
10. Baro Altitude Tape
11. Vertical Speed Tape
12. G meter/Load Factor
13. Roll Indicator
14. Magnetic heading
15. Flight path marker

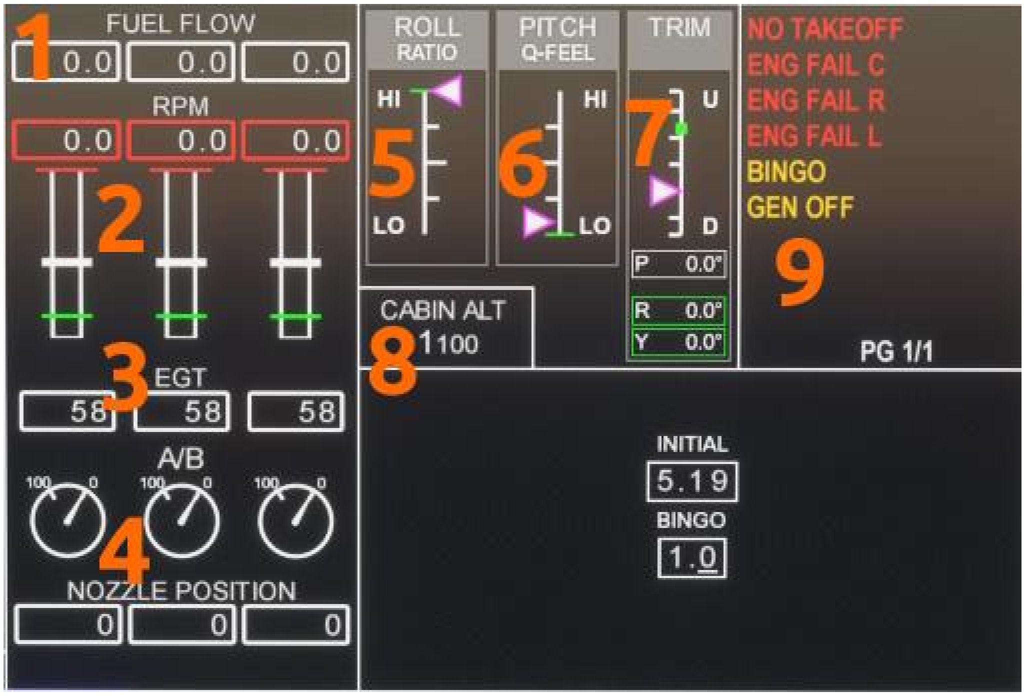
*These indications will also show on the FLV screen
**Since Instrument Landing System (ILS) approaches were still a WIP at the time of writing, the Selected Approach box and magenta ILS needles are not visible above. Refer to *The Challenge of Landing the XB-1* Section

OVR (Overview) Synoptic Page

The OVR page is used for all phases of flight. When starting cold and dark, the OVR and ENS synoptic pages will prompt the pilot to enter the Initial and Bingo Fuel (the minimum amount of fuel needed to return to base or alternate) quantities in thousands of pounds. **These should be filled in on either page**. The values can be input by using the INC button to increase the value of the current digit and the NXT button to cycle through the digits. Once both are set, the pilot will select the FUE button to close the pane and submit the values. When starting on the runway, with the engines already running, the initial fuel value for the totalizer, as well as the Bingo level, will already be set. (The bingo value defaults to half of the initial fuel value.)



1. **BGO (Bingo) Select Key-**
Enables Bingo fuel edit mode, allowing the pilot to quickly adjust the BINGO fuel amount as needed in flight. INC and DEC select keys will become active in the two spaces below the BGO key when it is enabled, and will adjust the BGO value in 100 lb increments. The BGO select key is disabled when the fuel editing pane is open (see the FUE key above).



1. **Fuel Flow for each engine-** (in thousands of pounds/hr.)
2. **Percent (%) RPM for each engine-** The RPM number outlined in red if below idle (Box around number value will be red instead of white)
A green line will be seen across the bottom of the RPM tapes during engine start. This line, which sits at 14%, is displayed when RPM is below stable idle and the aircraft is on the ground. This simulates the indicator used to verify the air start cart is providing appropriate pneumatic pressure needed to spin the engine to the correct RPM for fuel introduction. RPM must be above 14% for the engine to light.
3. **EGT (Exhaust Gas Temperature)-**
T5 Overtemp conditions will cause the EGT value to be outlined in either amber or red, depending on how high the temperature is.
4. **Afterburner and Afterburner nozzle position-** (MUST ACTIVATE AFTERBURNER TOGGLE IN MSFS2024 CONTROLS MENU)
Once Afterburners are toggled on, the throttles can be moved further up into various power settings within the Afterburner scale. The circle will be filled-in white when afterburners are active (see *FUE Synoptic* description below).
5. **Roll Ratio Changer-**
Uses an actuator to change the ratio of stick roll input to aileron movement. The strength of the effect is a function of airspeed and the position of the ARI (aileron-rudder interconnect) switch on the Flight Control Panel. (See Flight Control Panel) The green line denotes the ideal approach and landing position.
6. **Q-Feel-**
Uses an actuator to change the amount of stick force per degree of deflection in the pitch. The strength of the effect is a function of the current Mach and altitude. (See Flight Control Panel). The green line denotes the ideal approach and landing position.

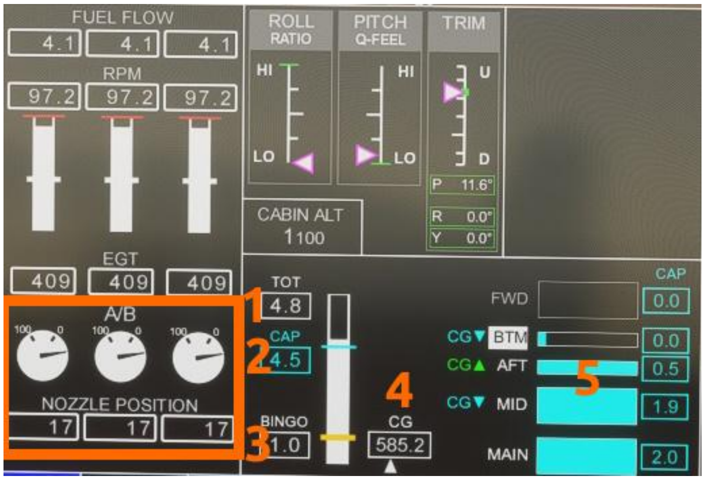
7. **Trim-**
P=Pitch, R=Roll, Y=Yaw P, R, Y values are outlined in green when within the acceptable range for takeoff and on the ground.

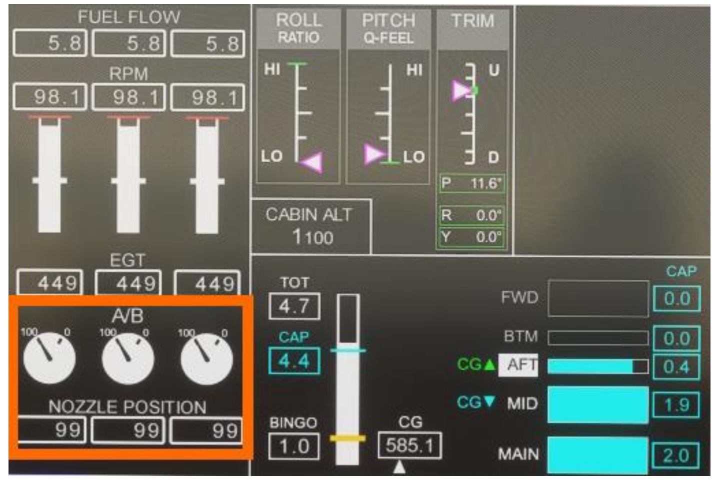
P Takeoff Range +10.7 to +12.7
R Takeoff Range -1.0 to +1.0
Y Takeoff Range -1.0 to +1.0

8. **Cabin Altitude** (Not fully simulated)
9. **Message Display Field-**

Displays CAS warnings, cautions, and advisories. If more than 9 messages are active, the PGU (Page Up) and PGD (Page Down) keys allow scrolling. Pressing the CLR key temporarily hides cautions and advisories, while pressing it again brings them back.

OVR FUE (Fuel) Synoptic Page





**Notice in the two figures above that the Afterburner scales are now filled white (three circles in orange boxes). This indicates the afterburners are activated. The figure on the left shows minimum Afterburner power and nozzle openings while the figure on the right shows full Afterburner power with fully open nozzles.

The FQIS (Fuel Quantity Indication System) is a flight computer application charged with calculating fuel totals based on flow rates and tank capacity sensors, and calculates the aircraft's center of gravity (CG) based on the distribution of fuel across the various tanks.

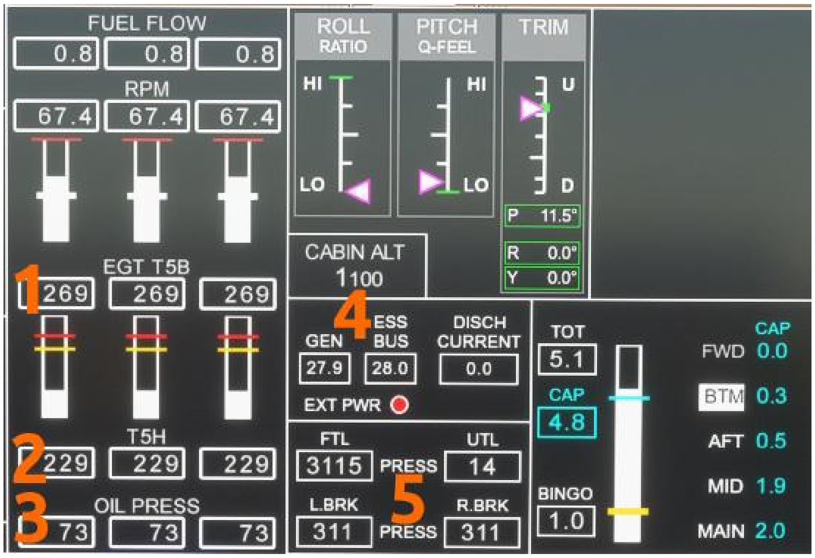
1. **TOT (Fuel Totalizer)-**
This shows the quantity of fuel on board, derived from the initial fuel value minus subsequent fuel flow, also depicted by the white bar to the right.
2. **CAP (Fuel Capacity)-**
This is the sum of all the individual fuel tanks measured by sensors within the tanks. The Cyan line to the right shows this value as well.
3. **BINGO-**
The Bingo fuel value is intended to give pilots a warning as to when their fuel is running low. When starting cold and dark, it is initially entered by the pilot on the fuel entry pane. However, when starting on the runway with engines running, it will have already been set to half the initial fuel value. It can quickly be edited mid-flight by pressing the BGO key on the left, which reveals INC and DEC buttons that add or subtract 100 lbs from the value in the display. It is also visually represented by the yellow line to the right, and a caution will appear when the remaining fuel drops below this level. To remove the caution condition, simply lower the Bingo level.
4. **CG (Center of Gravity)-**
The center of gravity (measured here in inches aft of a reference point) will vary depending on fuel distribution (See the next description) as it is transferred across tanks and burned. The indicator will change color from white to amber when not within range (582 to 591) and CG FWD or CG AFT CAS messages will be triggered. Note that filling all fuel tanks to 100% capacity will put the aircraft's center of gravity slightly too far forward for flight.

5. **Fuel Tanks-**

This display uses a top-down transfer logic. The forward, bottom, aft, and mid tanks all transfer their fuel into the main tank before it is fed to the engines. Fuel will first be transferred first from the FWD (Forward) tank—until empty, then BTM (Bottom), AFT, and finally MID. The main tank is the only tank which directly feeds the engines. The CG up/down arrows next to each tank indicates the direction of CG movement as fuel is transferred from that tank. The CAP values show the fuel amounts sensed in each tank. As each transfer tank is emptied its indication will be greyed out, its CAP will show 0.0, and its associated CG arrow will be hidden. Fuel cannot be transferred from one transfer tank to another. To achieve MTOW for takeoff approximately 5200lbs of fuel is loaded.

ENS Engine Start Synoptic Page

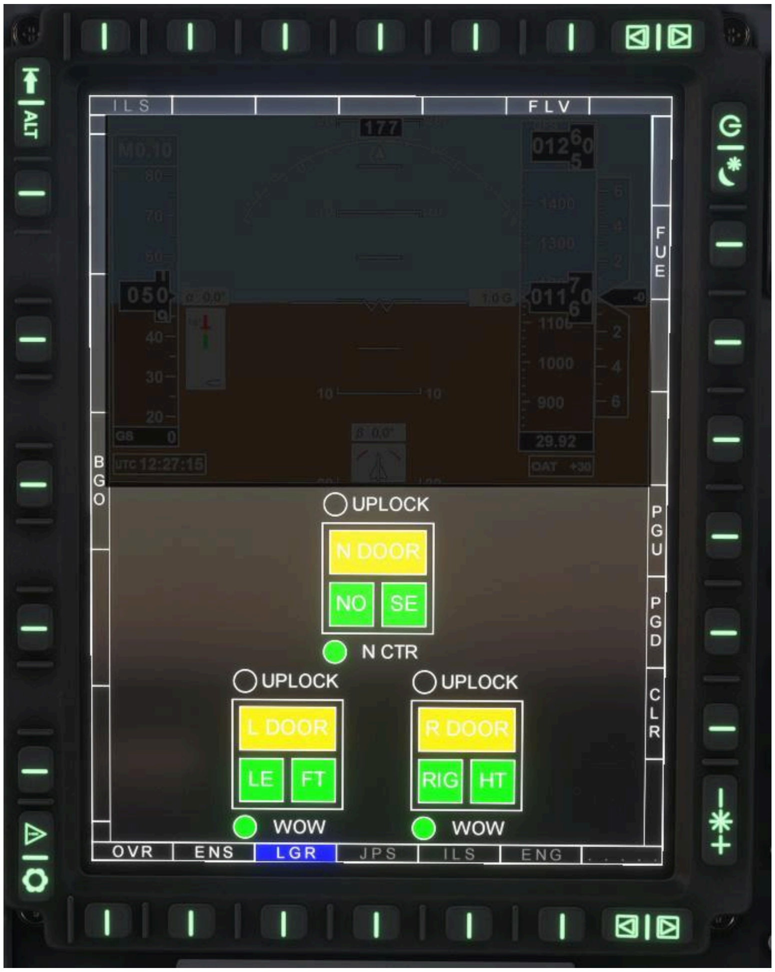
While mostly similar to the OVR page, there are some key differences seen on the ENS page. Like the OVR synoptic page, the pilot can enter the Initial and Bingo fuel levels at startup with the ENS. This is only needed on one or the other. If entered on OVR it will display here. The FUEL FLOW, RPM, ROLL RATIO, Q-FEEL, TRIM and MESSAGE FIELDS remain unchanged. The FUEL TANK display is minimized by removing the CG arrows, fuel tank tape indicators, and CAP Amounts. The ENS includes both T5B and T5H EGT indicators, Oil Pressure, Electrical System field and Hydraulic system field.



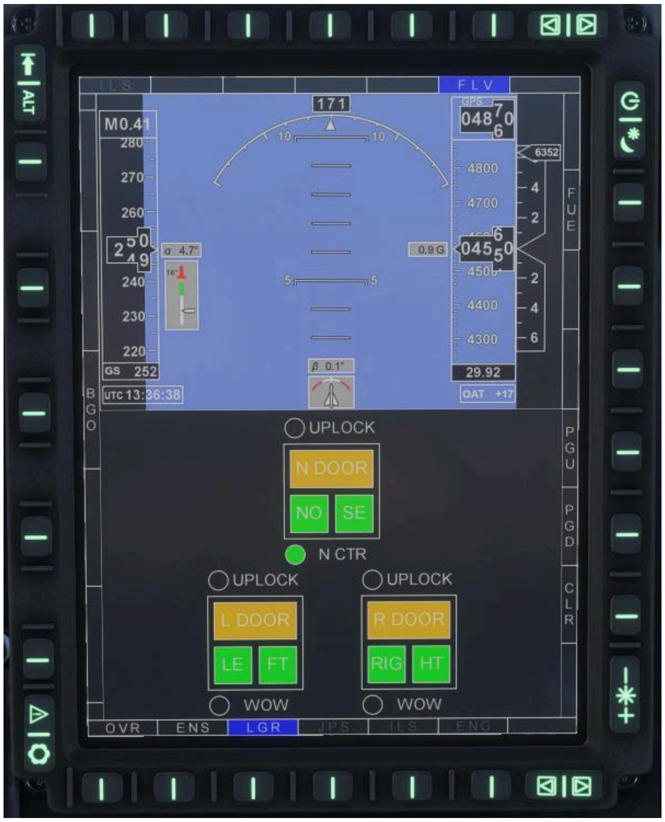
1. **EGT T5B-**
T5B/H are EGT sensors. The T5B EGT reading is the same value shown on the OVR page. The ENS EGT readings include tape indicators with caution (yellow line) and warning (red line) limits for closer monitoring especially during engine start. Max is 925C
2. **EGT T5H-**
In sim these indications are not independently simulated, instead they follow EGT T5B at 85%. T5H has no limits.
3. **Engine Oil Pressure-**
Box around values will turn red if a low-pressure condition is detected or yellow for an overpressure. (Not yet simulated)
4. **Electrical System Indications-**
GEN shows the Generator voltage. BUS shows the selected electrical bus voltage. DISCH CURRENT shows the current total amperage draw. The EXT PWR indicator (Not Yet Simulated) will show green when External Power is connected.
5. **Hydraulic System Indications-**
FLT (Flight) and UTIL (Utility) system pressures are displayed on the top. Left and Right Brake pressures are shown on the bottom.

LGR (Landing Gear) Synoptic Page

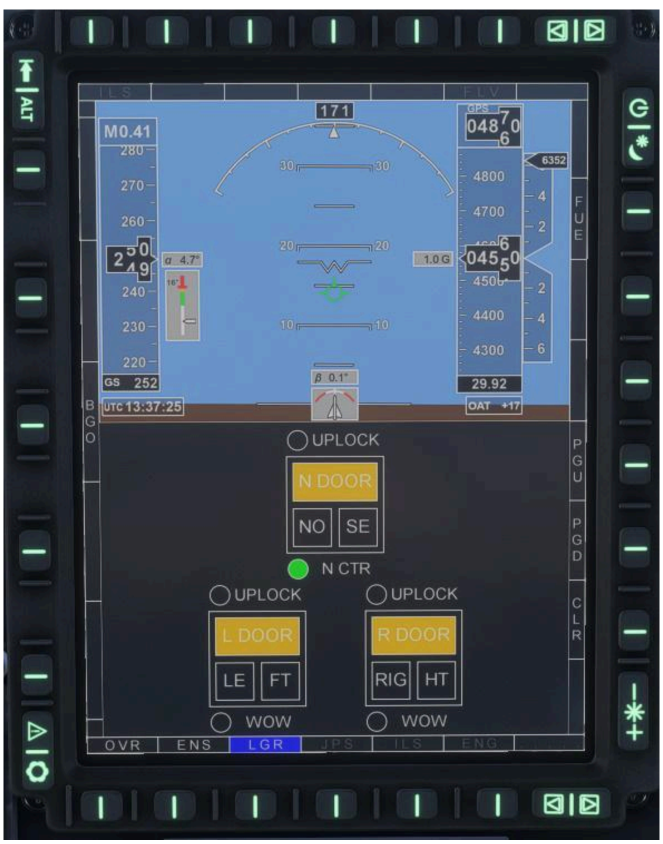
This page works in collaboration with the gear handle and primary gear indications. LGR is used to give a visual representation of the Landing Gear (and gear door) position and relevant sensor information.



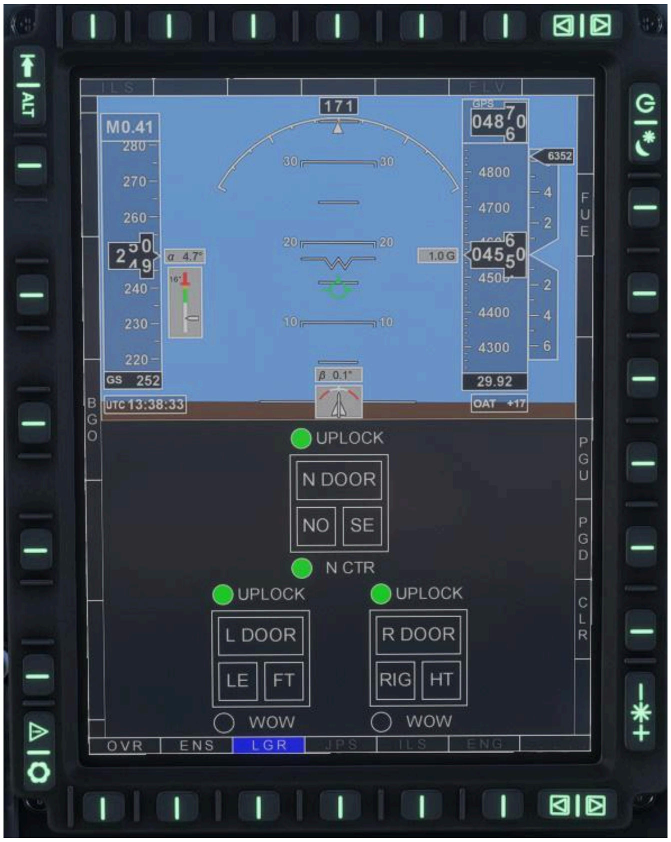
1. There are two Downlock sensors per gear (**NO** and **SE** on the nose gear, **LE** and **FT** on the left main landing gear, and **RIG** and **HT** on the right main landing gear). When the gear is "down and locked," the sensor box is filled green. Unlocked sensors will be filled black.
2. There is one **Uplock** sensor per gear. The **Uplock** sensor circle indicator is filled green when the landing gear is "up and locked" and black when unlocked (as shown in the figure above indicating down and locked landing gear.)
3. There is one door sensor (**N, L, R Door**) per gear. The indication is filled yellow anytime the door is open. Once the door closes the indication is filled black.
4. The nose gear has a center position steering sensor (**N CTR**) which tells the pilot when the nose gear is centered. The circle indication is filled green whenever the nose gear is centered on its steering axis. It is black any other time.
5. There is one Weight on Wheels (**WOW)** sensor on each main landing gear. The WOW is only activated when the main gear is compressed. Under this condition the WOW circle indication is filled green. It will be filled black anytime the gear is uncompressed (no weight detected).



In this example, Uplocks are unlocked (black), doors are open (yellow), nose is centered (green) and Downlocks are still locked (green). However, the WOWs are black which indicates the airplane is flying with landing gear "down and locked."



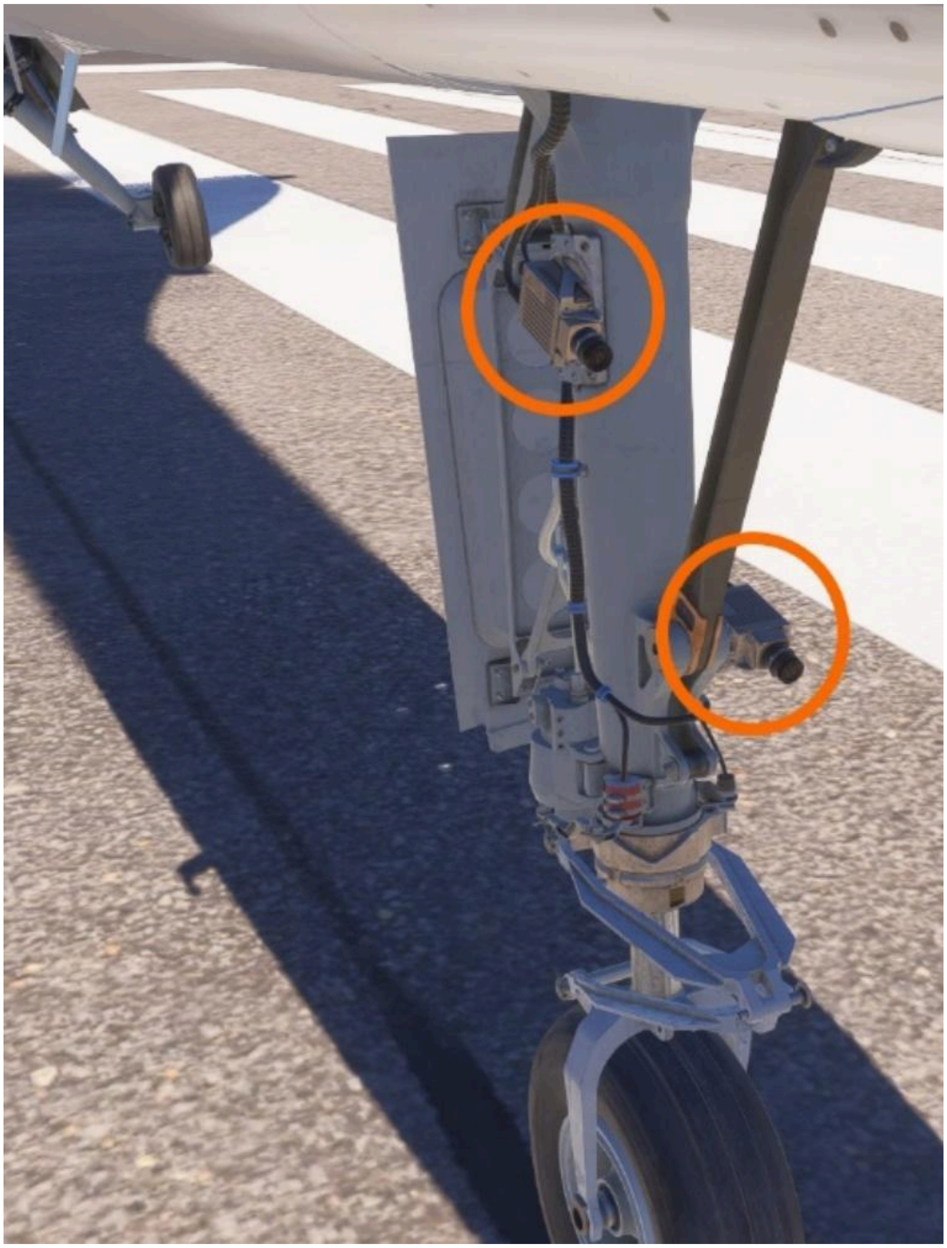
In this example, Uplocks are unlocked (black), doors are open (yellow), nose is centered (green) but the Downlocks are now black. Combined with WOWs that are also black this example shows the landing gear actively retracting (would show the same for extending).



Finally, in this example everything but the Uplocks (which are now green showing that they are locked) and the centered nose steering are all black. This indicates the landing gear are up and locked and the landing gear doors are closed.

FLVS (Forward Looking Vision System)

Due to the XB-1s pitch attitude of around 12 degrees nose up on approach and landing, the pilot is unable to see the runway. The FLV system uses two cameras (a primary and redundant) placed on the nose gear to send a live feed to the MFD (see figure below). For the sim the MFD uses synthetic vision vs an actual in sim camera view. The cameras are angled down 12 degrees on the nose gear strut which means when the FLV system is selected on the ground, the pilot will only see a ground view. However, this can be used to help the pilot maintain centerline steering during taxi, takeoff, and landing.



The FLVS cannot be selected when the landing gear is retracted. To access the FLV feed simply press the FLV select key on the MFD.

Note the nearly 10 degrees nose up pitch on the Left Avidyne Artificial Horizon display. Also note the lack of an outside view of the landing environment other than the FLV. Eventually ILS magenta needles will also be displayed on this view. The green circle (flight path indicator) and “E Bracket” to the right of it showing above the runway is another AOA indicator. Do not confuse it for an ILS/Glide Slope (GS) indicator. It will only appear in the FLV screen. (ILS approaches are quickly covered in the IFD Flight Planning section)

Avidyne IDF550/540

The two Avidyne IFDs supplement the MFD by providing additional flight management data to the pilot and an interface for navigation planning/monitoring and radio communications. Additionally, they can also be used as redundancies for both the PFD and to display the backup camera FLV feed. The left IFD (IFD550) provides the backup PFD capability with the pilot selected option with or without synthetic vision. The GRT screen is used to provide a tertiary PFD display without any synthetic vision/camera view. For better performance in sim the left IFD can also be used as the backup FLV display. In the real aircraft this was done by the right IFD. In sim this would require a third synthetic vision integration which could drastically affect overall performance. The left IFD also is used to configure Radio 1 and set Barometric settings.

The right IFD (IFD540) is virtually identical to the left IFD550. The major difference between the two is the SVS (Synthetic Vision System) button on the left IFD and slightly different (Boom specific) operation requirements for the right IFD vs the left. The right IFD gives the pilot the ability to configure Radio 2 and acts as a Navigation Display (ND) displaying relevant route maps and ADS B traffic. The basic IFD description below can apply to both IFDs.

Basic IFD Functions/Descriptions

Once the power has been applied to the Avionics and the Avidyne boot screen clears, the initialization screen will show on both IFD's. Press the highlighted bezel button or the "Proceed" button on the screen to open the default display. (If CTRL-E is used for quick start the Avidynes may boot twice due to a temporary overload on the batteries.)

The PFD (Primary Flight Display) is the default menu display on the left IFD. It will default with the SVS (Synthetic Vision System) activated along with the highlighted "SVS" page function button. To toggle SVS on/off press the highlighted left bezel button or "SynVis" on screen button. The default menu on the right IFD is the MAP menu display.

This shows the PFD with the SVS system selected off. The left IFD is also where the pilot sets the BARO (Barometric) Pressure settings. The highlighted bezel button will bring up the "BARO" indicator. The highlighted knobs on the right (both inner and outer) can be used to adjust the reading. Both the "SynVis" and "Baro" selections will disappear off the screen if not being used

The FMS (Flight Management System) page function button pulls up the flight planner. (See the Flight planning section of this manual)

The NRST on screen tab and bezel button both bring up the nearest selection pages. Pressing the bezel button cycles through the nearest Intersections, user waypoints, airports, VORs, and NDB options nearest the aircraft. The highlighted knobs allow the pilot to scroll the lists up and down. The pilot can also scroll each list by touching the screen and dragging the list up and down. Once a selection is made it can be pressed on screen or highlighted using the knobs then selected by pressing the "ENTR" bezel button.

The MAP display is the default screen after the "Proceed" button is pressed on the right IFD. The map screen can also be accessed by pressing the highlighted MAP page function button. See Charts section for the CHART tab. Terrain features and navigation aids can be decluttered off the map by pressing the two highlighted bezel buttons next to "Land" and "Nav." This screen shows no declutter with all selected map features active. Note Terrain Avoidance (in circle) is available on the MAP Display. The TAWS tab is not present in the current IFD.

This screen shows a full declutter with all selected map features minimized.

The highlighted tuning knobs (both inner and outer) can be used to zoom the map in or out

The AUX (Auxiliary) page function serves as a "Settings" page for the IFD. The first tab is the AUDIO tab used for adjusting volumes of the radios and various IFD alerts.

The SETUP tab is the options list. Map, Radio, Charts, Alert, FMS, plus so many more options can all be found on this page. If there is a question where to set something or how to change a setting, it may be found somewhere in this list of options. As more features become available in the Avidynes, more options will become available on this list.

This screen is best manipulated using the touch screen function. Most categories have numerous adjustments that can be made within them. To see everything in a particular category tree PRESS the "+" next to the category selection needing to be viewed. The "+" will turn to a "- "once the category tree is expanded. Note how there is another "+" next to VNAV that shows it can further be expanded. (There is no VNAV on the XB-1

The SYS (System) tab is a simulated GPS reference and signal page.

The ALERT tab will display any active alerts on the IFD.

The highlighted Direct To Bezel button allows the input of a waypoint or airport that the IFD will then provide a direct navigational path to. Note there is no LNAV VNAV or Autopilot in the XB-1 so the pilot would have to manually fly any routes/route changes programmed in the IFD.

The highlighted FREQ button will automatically generate important radio/comm frequencies near the aircraft location. The pilot can then easily select the frequency needed which will automatically send it to the standby Comm/Radio 1 position (i.e. where the 124.855 position here).

CDI (Course Deviation Indicator) Nav source. Allows the nav source to be switched between GPS or *VLOC (Visual Localizer) VLOC is the setting used for VOR (Visual Omni Range) nav sources.

The active and standby radios are displayed on the FMS, MAP and AUX function pages. The Left IFD has Radio 1/Nav 1 while the right IFD has Radio 2/Nav 2. To change a radio or Navigation frequency (i.e. ILS or VOR) the frequency must first be placed in the standby window. The white numbers are the standby frequencies and the green numbers are the active frequencies. The highlighted knob is used to adjust the frequency (the outer knob adjusts the .xxx portion while the inner knob adjusts the xxx. portion) **NOTE** The comm/nav radios will not show on the SVS display of the left IFD550

The highlighted Frequency Swap button will allow the standby frequency to become the active frequency and vice versa.

Press the orange highlighted area of the tuning knob to switch between Radio 1 and Nav 1 tuning. Nav 1 works on the same tuning principle as Radio 1 covered above. The frequency must first be put in the standby window (white number), then the Frequency Swap must be pressed to move it to the active.   NOTE When adding an ILS to a flight plan the ILS frequency for the selected runway will AUTOMATICALLY be tuned in the standby Nav 1 window. Once the first leg of the ILS is active it will automatically activate the ILS frequency. The pilot can also use the Frequency Swap button to move it to the active window.

IFD Charts Tab

Charts can be displayed on the CHARTS tab. (Limited chart availability at writing). When the CHARTS tab is initially selected there may be a chart already displayed of the airport where the aircraft loads (or of the departure airport of a loaded flight plan). However, in most cases a blank screen will be displayed such as below.

Press (on screen) the "Select Chart" section. If no chart is already loaded another blank screen will appear. If a chart is loaded, pressing "Select Chart" will return the user to a list of all the available charts for the selected airport.

If there is no list of charts shown on this screen, no airport has been selected. The 4 digit International Civil Aviation Organization (ICAO) airport code will need to be entered in the box highlighted above by selecting it. This will populate the QWERTY keyboard.

The user can either “press” the letters for the airport code on the screen, or use the Right Tuning Knobs to select the letters. Knob “2” scrolls through the alphanumeric list for each position. Knob “1” moves the cursor left (turned counterclockwise) or right (turned clockwise) between each position. Press the “ENTR” on screen or the “ENTR” bezel button when complete if knobs are used. Whichever technique used, the airport code must be entered at this point.

Once an airport is entered, the "Chart Selection" list will populate with all the available charts for that airport. Either knob of the Right Tuning Knob can be used to scroll up or down through the list. The user can also make the selection by pressing on screen and scrolling up or down by hand.

Once a chart is selected, “Select Chart” can be used to return to the “Chart Selection” list. Lastly, the inner right tuning knob can be used to zoom each chart in or out.

(zoomed in view)

The chart can also be moved around on the screen by “pressing” (on screen) and dragging the map by hand.

Flight Plan Entry Example

First and foremost, this section is not a full flight tutorial. It will not cover setting up the XB1, engine start etc. Its sole purpose is to provide an example of how to load a flight plan into the IFD550/540. However, there is an example of following the flight plan in flight and an example of an ILS approach using the FLVS at the end. NOTE This is an accurate recreation of an experimental aircraft built to fly in very specific testing environments (see page 7). There is NO AUTOPILOT or AUTOTHROTTLE. It has a very rudimentary LNAV (Lateral Navigation) display and as of this writing no VNAV (Vertical Navigation) outputs, other than ILS glideslope (which as of writing is still a WIP). Therefore, the flight plan example used in this flight is not an accurate depiction of the kind the XB1 would traditionally operate. (i.e. flying in Class B airspace on an IFR flight plan.) It is also important to note that though the IFD550/540s used in the XB1 are pretty feature rich, one may find that they have slightly different capabilities in other aircraft they can be found in. If a flight plan is built (or first loaded) into the simulator flight planner before loading the aircraft, the flight plan should already be loaded in the IFDs. It should still be checked and confirmed to be active before commencing the flight. As of this writing there is currently no Simbrief integration available. THIS IS FOR SIMULATED USE ONLY.

For this example, the right IFD540 will be used. It and the MFD can be powered on by the LDG Bus with no other avionics. In this configuration its lower power consumption should be sufficient for entering and activating the flight plan without depleting the batteries. After pressing the “Proceed” button on the Initialization page the figure above shows the default map view the IFD will open too. The route loaded will be KPHX to KLAX via *ZEPER2 RRSTA ELLDA RKSTR4*. The departure runway will be 07L at KPHX and the arrival runway will be 26L at KLAS. More specifically this will be an ILS(Z) 26L approach via the PRINO transition. The aircraft will be started from a remote parking spot near 07L at KPHX.

The “No Comm with VHF” Alert can be removed from the default page by pressing the “CLR” bezel button. To create a new flightplan the “FPL” tab must be selected on the FMS page (Press FMS Page function key). Nothing will display initially. Press the “ENTR” bezel button to bring up the menu shown above.

Double tap “Origin” to bring up the QWERTY keyboard screen. The Right Tuning Knob can also be used to first highlight the “Origin” then “ENTR” can be pressed to pull up the keyboard.

Use the keyboard to type the four-digit airport identifier. Then press "ENTR" on screen or the "ENTR" bezel button. (The Right Tuning Knob can also be pressed to select).

The Departure field will populate behind the menu. If there is no departure being used and the departure runway does not matter then "Waypoint" can be selected to program the first direct-to waypoint. However, in most cases the departure runway should be programmed as a minimum. To load the departure runway and/or departure first press "CLR" to remove the menu.

Note the Departure field has the airport listed but it is missing runway (Rwy) and "Departure" data.

Double tap or use the Right Tuning Knob to scroll to and select the empty portion of the "Departure" as highlighted above.

This will open a list of all the available standard departure procedures for the selected airport. Use the Right Tuning Knob to scroll to the appropriate procedure. Press the "ENTR" bezel button or double tap the selection on screen.

This will populate every waypoint of the procedure below the departure airport field. **NOTE** "GOALY" also has an altitude constraint shown.

The Right Tuning Knob can be used to scroll up and down through the list. Note the highlighted “FT” in the “SPRKY” Waypoint field. Though the IFD will automatically load the required altitude constraints for a departure or arrival procedure, it also gives the pilot the ability to input manual altitude constraints at every waypoint (see the figure below). Though there is no VNAV capability the IFD will still calculate and display a T/D (Top of Descent) point on the active flight-plan.

Note the Cyan line between the “MAYSA” and “RRSTA” waypoints. This line can be selected as there are a few options that can be selected in case changes in the flight plan may need to be made such as adding a waypoint or even……Holds.

Holds will not be covered here but to initiate one just click on the "Hold at (waypoint)" and fill in the relevant information. To choose which waypoint in the flight plan to hold at, place the Cyan line below the Waypoint. "Exit Hold" commands will also be generated.

Though the "FPL" page is selected to create the flight plan, the pilot can monitor and quickly check if the routing is correct using this "Map" Tab.

Unlike the MAP function page, this map shares the screen with a minimized version of the flight plan. The Right Tuning Knob can still be used to scroll up and down the flight plan. Note the altitude constraints of the departure already showing on the map. Once the flight plan is active this can be used to follow the flight plan both on the map and in the listed plan. The active waypoint will be magenta in color on the flight plan list.

Once the pilot has verified the departure is correct on the map, the enroute portion of the flight plan can be started. Using the right knob scroll all the way to the bottom of the current list. There should be a Cyan line there as highlighted above. Note the vertical "ZEPER2" callout near the "JOLAR" waypoint. It is showing all the waypoints that fall under its departure. As the Arrival and Approach are built with similar callouts it is easier for certain waypoints in the route to be quickly located based on which phase of the flight it falls under. Once the Cyan line is scrolled all the way to the bottom (after the last waypoint of the departure), double tap the cyan line. (As of this writing, pressing "ENTR" or the Right Tuning Knob will not work for this).

This is the point where the enroute waypoints can be added to the flight plan. Select "Waypoint"

**(*To avoid repeating the following steps again throughout this section, assume anytime "Select XYZ" is used one of the following actions are taken immediately after. Either double tap "XYZ" on the screen, use the Right Tuning Knob to scroll to "XYZ" followed by pressing the "ENTR" bezel button, or use the Right Tuning Knob to scroll to "XYZ" followed by pressing the tuning knob*) **

As of this writing Airways cannot yet be selected. However, this menu is where they will show if the previous waypoint is a part of one. Since Airways are not currently modeled, each enroute waypoint will have to be entered manually.

When "Waypoint" is selected the QWERTY keyboard will show. Since there are no enroute waypoints on this route the arrival airport can be entered here instead.

After entering the arrival airport at first glance nothing may have seemed to change. However,attention must be given to the highlighted scroll bar. It will show there is now more lower on the list.

The arrival airport field has now been generated at the bottom of the list. It will need more information loaded. Select the “Arr” (Arrival) field first.

This will open a list of all the standard arrival procedures for the selected airport.

Select the arrival procedure.

Once again pay attention to the scroll bar if nothing appears to happen.

Use the Right Tuning Knob to scroll down the list. The selected arrival procedures waypoints should now be populated. NOTE the highlighted crossing restrictions, and the vertical "RKSTR" showing the arrival section of the flight plan is now being shown.

Continue scrolling all the way to the bottom of the list to the arrival airport block. The "Arr" (arrival) procedure should be filled in now. The "App" (approach) field (highlighted above) should still be blank. Note a runway has been automatically calculated based on the arrival information already filled in. However, the next step is where it can be changed if necessary.

Select the “App” empty field. A list of all the runways available for that approach will be populated.

Scroll down to and select the runway that will be used for landing.

This will automatically populate a list of all the transitions for that approach.

The scroll bar will again confirm something has been added to the flight plan.

Scrolling to the arrival airport block there are quite a few things to observe in this example. First the vertical "ILS 26L Z" encompassing all the waypoints of this approach leading to the airport. In the airport block itself the "App" field has now been filled in with the selected transition ("PRINO.ILS 26L Z"). In the Standby Navigation Frequency window, the ILS frequency has been automatically loaded (highlighted "111.50") Lastly, the scroll bar shows there is more under the airport block…

The highlighted boxes show the missed approach . **(As of this writing instruction has not been provided on how to activate a Missed Approach in the XB-1 as there is no TOGA (Takeoff Go Around) button). **

Open the "MAP" function page to get a complete route overview to ensure your routing does not have any random/wrong waypoints. Note the altitude constraints of both the departure procedure and arrival/approach are also shown on the map. Range can be adjusted with the Right Tuning Knob.

Once the route is confirmed to be correct on the map, return to the "FMS" function page and ensure the "CDI" is in "GPS". If it is, the route is ready to be activated. Select the highlighted "Activate Flight Plan" button.

This will activate the first leg of the flight plan which is easily confirmed by the first waypoint (or instruction in this case) box now being Magenta colored instead of grey.

Further confirmation the flight plan is now active can be found on the PFD displays of the Left IFD550. The highlighted box is a simple Lateral Navigation (LNAV) indicator. The top arrow represents the aircraft and is always stationary. The bottom arrow represents the current active leg/airway being navigated on and it can move. VNAV equipped aircraft will have another indicator like this just positioned vertically (roughly above the "0 FPM" vertical speed indicator.) The flight plan is now loaded.

DRAG CHUTE
AOA INOP
RELEASE
ENGINES
LEFT
CENTER
RIGHT
TEST
DAS
CNTL
PITCH

For some the XB-1 will be difficult to fly. Trying to fly it on a flight plan may further add to its difficulty. The pilot must remember that at its core the XB-1 is a very basic stick and rudder kind of airplane, (it happens to be very light with A LOT of thrust.) There are no fly by wire systems in the XB-1. There is no autopilot to help alleviate the work load. The pilot maintains course, and holds the correct altitude, even when flying above the speed of sound. The XB-1 requires the pilot's full attention through every phase of flight, especially at landing.

If the sim pilot wants to fly the XB-1 as "Geppetto" did. The challenge starts at takeoff. Full throttle is set and the Afterburners are set to their "Full" output. As the XB-1 approaches 120kts the Afterburners are then pulled back to their minimum setting (this is done to reduce loads on the airframe). 150kts is rotation speed…. All this will happen faster than this description explaining how it is done was just read. For first time (Sim) XB-1 pilots **Tip #1 Do not use the Afterburners for takeoff** especially if you plan on flying a departure. The plane has plenty of power at the Military power setting (maximum non afterburner engine throttle). In the figure above the pilot has just taken off from KPHX. Note no afterburners were used on this departure. Yet at only 3000ft the aircraft has already broken the 250kt below 10000ft limit.

The Map display (with Flight plan) on the right IFD540 and LNAV Indicator on the left IFD550 show the pilot is currently on course.

The main landing gear are still down in these pictures and there are a couple CAS/Master Warnings active; this flight was done with a WIP build. No sound barriers were broken this day

However, that changes at the first turn of the procedure. While focusing on getting the speed under control this pilot flew through the turn. Note the deviation shown on the LNAV display in comparison to how far the aircraft is off course on the Map display.

When a deviation is allowed to continue the LNAV indicator will turn the bottom arrow yellow. Until the course is corrected. The pilot finally got both course and speed under control in the figure on the next page.

The pilot will be responsible for properly observing all altitude and speed constraints especially when flying standard departure and arrival procedures. The LNAV indicator is quite helpful for staying on course. **Tip #2 Anticipate turns, especially the higher angle (70+ degree) heading changes.** Despite its incredible max roll rate of 120°/sec, the XB-1 does not turn as sharply as some may expect (especially with Roll Ratio Deflection set to “LO”). Remember the XB-1 was built to go fast, not necessarily be as agile as possible (though it is still very agile considering).

The Challenge of Landing The XB-1

Up until this point this manual has referred to the vertical and lateral navigation used at landing as an "ILS" approach. The truth is the real XB-1 did not use a traditional ILS approach system. Because it literally operated out of one runway (for both takeoff and landing), the avionics had a custom "Pseudo ILS" programmed by Boom with a 2-degree glideslope angle to that runway. It did not have a navigation radio with a programmed ILS capability in the traditional sense. However, this capability has been given to the sim pilot. As of this writing the ILS tuning is still a WIP. Some indications below are not displayed correctly. However, there is enough here to get a general idea how it will all work. This section will be updated in future revisions of this manual to show how these indications should display.

The XB-1 has a high fuel burn. The aircraft in the figure above has just achieved the same speed the real XB-1 did in testing. However, it did so just as it hit BINGO fuel. This tells the pilot it's time to return to base.

In the figure above the aircraft is descending on the downwind portion of the programmed approach. The XB-1 pilot would maneuver the aircraft onto the ILS like in any other aircraft flown manually. There are some differences once the XB-1 gets on final approach. The XB-1's approximate approach speed is around 170-175kts. It is also important to call attention to the roll rate of the XB-1. By the landing phase of the first flight the new XB-1 pilot has probably noticed a perceived "inconsistency" in how the aircraft rolls. While rolling the aircraft either direction various points within the bank may feel to roll really fast, then suddenly slow, then roll fast again despite the pilot maintaining a steady control input. If the pilot has not noticed that by the landing phase, it will most likely be noticed during the slower approach speeds. The roll rate may feel "jumpy" as the pilot applies roll deflections when completing turns and lining up with the runway. This is a completely normal flying characteristic modeled after the real aircraft.

The highlighted ILS Select Key can be pressed on the MFD. If the ILS is active the highlighted "ILS" indicator on the PFD screen will turn blue and an approach box will populate showing the arrival airport code, selected approach runway, and the programmed glideslope descent angle. For the sim a magenta dual cue FD (Flight Director) will also populate to aid in the final approach down to the runway (Shown but not working in this figure). If the ILS has not activated the pilot should confirm the correct ILS frequency is swapped into the Active Navigation Frequency window (the green numbers) as shown on the right IFD540 in the figure above. The FLVS is shown engaged in the figure above, but the ILS indications will display the same on the default PFD display as well.

The FLVS cannot be activated until the landing gear is extended. As the aircraft slows due to its lack of flaps the pilot will have to keep pitching the nose up to maintain level/stable approach. This means the landing gear is extended earlier than in other aircraft. This way the pilot can activate the FLVS and regain forward sight of the runway during the approach. Though the ILS is showing a deviation, the pilot above is established on a stable approach to the runway (note where the path marker is aligned) in the figure above. Also notice the nearly 10 degrees nose up pitch angle on the left IFD550 versus the runway view displayed on the FLVS.

With no flaps the XB-1 lands fast. Even at touchdown the XB-1 is still moving at more than 160kts (the Drag Chute is not simulated). As the pilot slowly lowers the nose, the FLVS view will suddenly change….

Tip #3 The FLVS Runway View Becomes A True Ground View As The Nose Gear Lowers…. This along with the port windows on the side of the cockpit are both useful for maintaining centerline steering on runway and while taxing.

For simmers who enjoy flying fighter jets the XB-1 will not be too challenging of an aircraft to master. For those not familiar with them, it is highly suggested practice flying the XB-1. It is recommended that new pilots do pattern work (takeoff, turn 180 degrees, fly parallel to the runway then fly an approach and landing back to the same runway) before trying to go on a complete supersonic flight. As mentioned, the XB-1 has a high fuel burn so do not plan to take it on cross country flights without many stops pre-planned. especially if cruising above Mach 1.0. This aircraft was an experimental airplane built to get up to cruise altitude fast, do a couple supersonic runs and get back down (See *A Historic Flight* page 7). The pilot will have full control of the aircraft from chocks removed to chocks back in place (the full flight). There is no autopilot, autothrottle or any other aids that will allow the pilot to give up control of the aircraft to the aircraft. The XB-1 can be very demanding but once the pilot understands its quirks it can also be quite a rewarding experience to fly.

Avidyne AMX240 Audio Selector Panel

This panel serves as a control interface used to aid in managing audio communications. Like many of the other avionics in the XB-1, this panel is an off the shelf item programmed specifically for the XB-1. Not every feature it offers is used in the jet. Green buttons are active, and white in-active.

1. **Pilot Volume Knob-** This controls the Pilots intercom volume
2. **Transceiver Selection- (MIC 1/MIC 2)** Are the transceiver (can transmit and receive) audio selectors. (COM 1/COM2) Are the two-receiver audio selectors.
3. **Navaid Receiver Selectors- (NAV 1/NAV 2)** Allows the pilot to hear audio from nav radios (e.g. audio radio identifiers.)
4. **MKR (Marker Beacon) Audio Button-** This allows the pilot to hear or mute the marker beacons audio.
5. **SPKR (Speaker) Audio Button-** Allows the pilot to switch speaker output from headphones to the speaker in the cockpit.
6. **MUTE Button-** is used to silence all external warnings generated away from the unit such as the TAWS (Terrain Awareness Warning System). However, it will not silence Marker Beacon.

Annunciator Panel

The annunciator panel works in coordination with the Master Caution/Warning Light located above the MFD and the Crew Alerting System (CAS) messages to provide both aural and visual caution (yellow) and warning (red) fault indications to the pilot. **Not every indication is simulated on this panel** (other than during lamp tests) since the XB-1 does not have failure simulations. The included CAS messages with the XB-1 can be found in the CAS Indications table (see next page). Not all realworld CAS messages are simulated.

XB-1 Simulation Differences

Fuel System

If the user would like to load the fuel as the real aircraft was fueled first open the EFD/Tablet. Then select "More Apps" -> "Flight Planner" -> "Configure." To select a fuel tank simply click on the tank. In the BTM tank enter "585" lbs., in AFT tank enter "524" lbs., in MID tank enter "1915" lbs., in MAIN tank enter "2097" lbs. This should leave 77lbs that needs to be entered in the FWD tank which would be the last tank fueled once all the others were filled. To hit the MTOW approximately 5200lbs of fuel was loaded in total. If the user just enters "5200" lbs. in the fuel planner the fuel will be automatically evenly distributed in all the tanks due to how the sim is programmed to load fuel.

ECS

The Cockpit Air Temp Selector can move (there is no actual cabin temp displayed anywhere). The Air Flow Interconnect switch is used to control cockpit fans (this may be included as a sound) Cabin Altitude is not simulated, though a pseudo figure may be displayed on the Cabin Altitude indicator on the MFD.

Flight Control Panel (Custom Controls)

Only custom sim controls can be assigned to yaw and pitch trim. There is currently no stock MSFS2024 key assignment for Q-feel, dampers, or roll deflection settings though custom key assignments may be possible through FSUIPC or SPAD controls.

Other Systems

FES and Oxygen controls are not simulated. Not every real-world XB-1 CAS message and warning/Caution indicator is simulated (see next section for a list of the messages that are used), Failures are not simulated. "Psuedo" ILS flight director is still a WIP at time of writing.

Crew Alerting System (CAS) Indications

Alert	CAS Description	In-Flight Suggested Action
CANOPY UNLOCKED	Canopy latch switch is open	Canopy handle full forward. Descend to 10000-15000ft Airspeed below 300 KIAS. Land ASAP
ENG FAIL C	The center engine is below IDLE RPM.	Attempt airstart below, if airstart fails Land ASAP
ENG FAIL L	The left engine is below IDLE RPM.	If altitude permits a restart attempt: 1. Throttle affected engine- OFF (for 10 seconds if practical) 2. Avionics knob- ON 3. Altitude- below 25,000 ft MSL 4. Engine RPM- Ensure within airstart envelop (17% minimum, 17-22% optimum) 5. LEFT ENGINE START button- PUSH 6. Left Throttle - IDLE Note: ● Leave throttle at IDLE for 30 seconds before aborting start ● Expect at least 25 seconds to develop usable thrust from minimum airstart RPM. If restart attempt fails: 7. Left Throttle- OFF Land ASAP
ENG FAIL R	The right engine is below IDLE RPM.	Attempt airstart above, if airstart fails Land ASAP
ENG RPM LIM (L/C/R)	Affected engine RPM is greater than 106%.	1. *Throttle (affected engine)- IDLE 2. Throttle (affected engine)- advance. Maintain less than 101% RPM 3. Land as soon as practicable If unable to maintain rpm within limits: 4. Throttle (affected engine)- OFF
NO TAKEOFF	Pitch, roll, and/or yaw trim is out of position for takeoff; and/or Q-FEEL FORCE, ROLL RATIO DEFLECTION, and/or the Rudder LIMITER is not in the appropriate position for takeoff and the center throttle is advanced beyond 55 deg Throttle Lever Angle. Warning is inhibited above 120 KIAS.	1. Abort 2. Check takeoff trim settings 3. Q-FEEL FORCE Knob- AUTO or LO 4. ROLL RATIO DEFLECTION Knob- AUTO or HI 5. LIMITER Knob- AUTO or HI If condition persists: 6. Do not takeoff

OIL PRES LOW (L/C/R) OIL PRES (ANNUNCIATOR PANEL) ENG OIL PRESS	Affected engine oil pressure is below limits. If at least 5 psi can be maintained at IDLE power, the engine may be allowed to continue to operate at IDLE power even if the CAS stays on.	1. *Throttle (affected engine)- IDLE If 5 psi cannot be maintained at IDLE: 2. Throttle (affected engine)- OFF 3. Land ASAP
BINGO (Cautions are Yellow. Orange used for easier viewing in this chart)	Fuel totalizer has calculated that the fuel remaining is less than the BINGO fuel level.	
CG AFT	Aircraft center of gravity is aft of expected range.	If supersonic: 1. Minimize longitudinal stick inputs during deceleration through transonic. In all cases: 1. FUEL TRANSFER Knob- AFT 2. CG and fuel transfer- Monitor 3. Fly a 10 deg AOA approach, do not exceed 12 deg AOA.
CG FWD	The aircraft's center of gravity is forward of expected range.	1. TRANSFER Knob- FWD or MID 2. CG and fuel transfer- Monitor
FLT LOW PRESS LOW PRESS (ANNUNC. PANEL)	Flight hydraulic system pressure is below 2200 PSI.	1. Airspeed- reduce as required 2. Land ASAP. 3. Minimize control movements during landing gear extension until gear is down and locked
FUEL LOW	Main tank fuel level is low. The CAS is set when the main tank is below approximately 1600lb at a pitch attitude of 14 deg. The caution light on the fuel panel is set by a separate level switch in the main tank and will illuminate with approximately 1700lb remaining in a level attitude.	1. Throttles- reduce fuel flow, (if practical) 2. Individual fuel tank quantities- check If transfer fuel available: 3. FUEL TRANSFER Knob- Cycle OFF then AUTO If condition persists: 4. FUEL TRANSFER Knob- manually select the next tank with available fuel 5. CG and fuel flow- Monitor 6. Land as soon as possible
FUEL PRESS (L/C/R)	Affected engine fuel inlet pressure is low.	If all three engines affected: 1. Throttles- IDLE 2. Initiate immediate descent to 12,000-15,000 ft MSL 3. Throttles- Minimum practical 4. Land ASAP If only one engine affected: 5. Throttle (affected engine)- Minimum practical 6. Land as soon as possible. If condition persists with affected engine at IDLE: 7. Throttle (affected engine)- OFF

GEN OFF	Generator Contactor is open and the generator is not providing DC power. Electrical power is provided by batteries.	1. Throttles- MIL or Below 2. Left Throttle- Set 85% RPM or greater 3. GEN Switch- RESET then ON If light remains on: 4. Left Throttle- Set 65% RPM or less 5. GEN Switch- RESET then ON 6. Descend below 25,000 ft MSL (lower when practical) 7. AVIONICS Knob- LDG BUS 8. Backup PFD- Interrupt shutdown (if required) 9. Reference backup PFD and backup AOA gauge 10. Left Throttle- midrange or greater 11.GEN Switch- RESET, then ON If generator reset is successful: 12. Land as soon as possible When within 5 minutes of landing: 13. AVIONICS Knob- ON If generator reset is unsuccessful and main bus desired for landing: 14. AVIONICS Knob- ON (Greater than 2 minutes to landing) 15. Consider turning FUEL TRANSFER Knob OFF to conserve battery power 16. Land as soon as possible If generator reset is unsuccessful and main bus NOT desired for landing: CAUTION Dampers are not powered on the LDG BUS 17. Q-FEEL FORCE Knob- LO 18. ROLL RATIO DEFLECTION Knob- HI 19. LIMITER Knob- HI If rudder limiter is not disengaged: 20. RUDDER LIMITER Circuit breaker (B3)- Pull 21. Rudder Pedal- Kick to disengage limiter 22. Land ASAP
OIL HOT (L/C/R)	Affected engine oil temperature is above limits.	1. Throttle (affected engine)- IDLE If condition persists and control directs: 2. Throttle (affected engine)- OFF 3. Consider restart for landing

OIL PRES HIGH (L/C/R)	Affected engine oil pressure is above limits.	1. Throttle (affected engine)- IDLE If condition persists and control directs: 2. Throttle (affected engine)- OFF 3. Consider restart for landing
T5 OVERTEMP (L/C/R)	Affected engine T5B indication exceeds 678C for 10 seconds.	1. Throttle (affected engine)- reduce to maintain less than 678C. 2. Land ASAP If unable to control EGT within limits: 3. Throttle (affected engine)- OFF
UTIL LOW PRESS	Utility hydraulic system pressure is below 2200 PSI.	1. Left Throttle- 85% minimum (if practical) 2. BACKUP HYD PUMP- ON 3. Airspeed- slow to subsonic If caution light remains illuminated: 4. BACKUP HYD PUMP- OFF 5. ANTISKID Switch- OFF 6. Execute Landing Gear Emergency Extension Procedure (p. 27) 7. Land ASAP 8. DRAG CHUTE Handle- PULL and TURN (if required) 9. Brakes- Apply gradually, regulate brake pedal force to prevent wheel skid (ANTISKID not available) 10. Do not taxi even if caution clears
ANTISKID OFF	Antiskid is inoperable either due to a fault or the ANTISKID Switch is in OFF.	Ground: 1. Brakes- Release 2. ANTISKID Switch- OFF 3. Brakes- apply gradually In Flight: If ANTISKID desired: 1. ANTISKID Switch- Cycle OFF then AUTO
FCS INTERRUPT	The FCS INTERRUPT button has been pushed and all trim and Damper actuators are disabled.	If trim or dampers are desired 1. DAMPER switches- As desired 2. FCS INTERRUPT button- PUSH
FUEL TRNSFR OFF	The fuel transfer system is commanded off and is not transferring fuel.	

Checklists

Before Starting Engine
01. Remove pitot covers — Off
02. Remove chocks — Off
03. Remove instruments covers — Off
04. Bleed air button — undepressed
05. Cabin switch — Depressurize
06. Air flow switch — Off
07. Air temp knob — Auto
08. Battery switch — Off
09. Gen switch — On
10. Avionics knob — Off
11. Backup hyd pump knob — Off
12. Antiskid switch — Auto
13. Fuel transfer knob — Off
14. Fuel supply PRI and SEC buttons — undepressed
15. Engine fire lights — undepressed
16. Landing gear handle — Down
17. Yaw, roll, pitch, ARI knob — Off
18. Yaw, roll, q-feel knobs — Auto
19. Throttles — Off

Starting Engine
01. External Power — Connect
02. Battery switch — On
03. Avionics knob — Landing bus
04. CAS messages — Check
05. MFD ENS page — Select
06. Avionics knob — On
07. DAS switch — REC/TM
08. Bingo — Set
09. Cabin altitude — Check
10. CAS messages — Check
11. Light test switch — Lights
12. Annunciator Panel TEST Button — Push
13. Engine fire lights — Depress and undepressed (check EXT light)
14. External Power — Off (verify BATT DISCH)
15. Flight controls — Verify clear
16. Backup hyd pump knob — Auto
17. Util hyd pressure — 2850-3150
18. Util low pressure light — Off
19. Backup hyd pump knob — On
20. External Power — Connect
21. Fuel supply sec light — Depress and undepressed (check light)
22. Fuel supply pri light — Depress and undepressed (check light)
23. Canopy — Canopy down and locked

Start Left Engine
01. Left engine start button — Push and release
02. FLT HYD pressure — Around 3000PSI within 30 sec
03. Engine RPM — Above 12%
04. Left throttle — Idle

05. FLT LOW PRESS Light — Off
06. EGT/RPM/Fuel flow/Oil press — Monitor
07. GEN light/CAS — Verify clear
08. External Power — Off
09. GEN and ESS BUS voltage — 28.0V
10. Left throttle — 62%
11. Battery switch — Off
12. Verify generator carries electrical load — Verify
13. Flight controls — Check
14. Backup hyd pump knob — Auto
15. Util hyd pressure — 2850-3150
16. Util low pressure light — Off
17. Flight controls — Check
18. Backup hyd pump knob — Off
19. Battery switch — On
20. Left throttle — Idle

Start Center Engine
01. Center engine start button — Push and release
02. Engine RPM — Above 12%
03. Center throttle — Idle
04. EGT/RPM/Fuel flow/Oil press — Monitor

Start Right Engine
01. Right engine start button — Push and release
02. Engine RPM — Above 12%
03. Right throttle — Idle
04. EGT/RPM/Fuel flow/Oil press — Monitor
05. Backup hyd pump knob — Auto

Before Taxi
01. External Power — Off
02. Cabin switch — Pressurize
03. Air flow switch — On
04. Canopy — Canopy down and locked
05. Cabin altitude — Check
06. Cabin switch — Depressurize
07. Cabin altitude — Check
08. Cabin switch — Pressurize
09. Air flow switch — RAM
10. Air temp knob — Auto
11. Center throttle — Idle
12. Fuel transfer knob — Auto
13. Yaw, roll, pitch, ARI knob — On
14. Yaw LIMITER Knob — Auto
15. R RATIO DEFLECTION Knob — Auto
16. Q-FEEL FORCE Knob — Auto
17. Verify ROLL RATIO indicates HI on MFD — Verify
18. Verify PITCH Q-FEEL indicates LO on MFD — Verify
19. Trim — Set for takeoff (0 roll, 0 yaw, 12 TEU pitch and green boxes)
20. OVR Page — Select
21. Fuel transfer knob — FWD (Verify on MFD)
22. Fuel transfer knob — BTM (Verify on MFD)
23. Fuel transfer knob — AFT (Verify on MFD)

24. Fuel transfer knob — MID (Verify on MFD)
25. Fuel transfer knob — AUTO (Verify on MFD)
26. Canopy — Verify closed

Taxi
01. NWS — Check
02. Brakes — Check
03. Attitude, Heading, and Turn/Slip indications — Check
04. Transponder — Set/Altitude

Before Takeoff
01. CAS messages — Check
02. Canopy — Verify closed
03. Yaw, roll, pitch, ARI knob — Verify on
04. Yaw, roll, q-feel knobs — Verify auto
05. MFD ENS page — Select
06. Flight controls — Check
07. OVR Page — Select
08. Trim — Verify set
09. Antiskid switch — Verify auto
10. Backup hyd pump knob — Verify auto
11. Fuel transfer knob — Verify auto

Takeoff
01. Brakes — Hold
02. Engines — Individually MIL then IDLE
03. Center Throttle — MAX (as required)
04. Nosewheel — Recenter (if required)
05. Main tank fuel quantity — Check
06. Throttles — 85%
07. Brakes — Release
08. Throttles — Max
09. At 120 KIAS, Throttles — MIN afterburner
10. At 150 KIAS, smoothly rotate to capture 10° pitch attitude — Verify

After Takeoff
01. Landing gear handle — UP (below 225 KIAS)
02. Air flow switch — On
03. Transponder — ALT

Climb
01. Cockpit pressurization — Check
02. Altimeter — As Required

Descent
01. Air temp knob — As Required
02. Altimeter — Set

Before Landing
01. Approach and landing speeds — Estimate (~160 KIAS + 6kts/ 1000 lb.)
02. Landing gear handle — Down
03. Yaw, roll, pitch, ARI knob — Verify on
04. Yaw, roll, q-feel knobs — Verify auto
05. Antiskid switch — Auto

06. CAS messages — Check

After Landing

01. Air flow switch — Off
02. Cabin switch — Depressurize
03. Cabin altitude — Check
04. Yaw, roll, pitch, ARI knob — Off
05. Trim — Set 0 degrees

Engine Shutdown

01. Chocks — On
02. Fuel transfer knob — Off
03. Throttles — Off
04. Util hyd pressure — ensure backup hyd pump providing pressure
05. Backup hyd pump knob — Off
06. Canopy — Open
07. Avionics knob — Off
08. Battery switch — Off

List of Acronyms and Abbreviations

Acronym	Full Form	Context/Description
AOA	Angle of Attack	Indicator/Sensor, used for landing speed/attitude
ARI	Aileron Rudder Interconnect	Flight control system
BALDS	Bleed Air Leak Detection System	Fire/Leak detection system
BARO	Barometric	Barometric Pressure Settings
BGO	Bingo	Minimum amount of fuel needed to return to base or alternate
BTM	Bottom	Bottom fuel tank
CAP	Capacity	Fuel Capacity
CAS	Crew Alerting System	System for crew indications/messages
CG	Center of Gravity	Aircraft balance point
CLR	Clear	MFD key function
DCP	Drive Control Pump	Backup hydraulic pump
ECS	Electrical/Environmental Control System	System for electrical power and cockpit environment
EDP	Engine Driven Pumps	Primary hydraulic pumps
EGT	Exhaust Gas Temperature	Engine temperature monitoring
ENS	Engine Start	MFD Synoptic Page
FADEC	Full Authority Digital Engine Control	System not present on the XB-1
FES	Flutter Exciter System	Real-world testing system (Not simulated)
FL	Flight Level	Service Ceiling (e.g., FL400 = 40,000 Ft)
FLT	Flight	Flight hydraulic utility system
FLV	Forward-Looking Vision system	MFD Synoptic Page (also FLVS)
FLVS	Forward-Looking Vision System	System using cameras to view the runway on approach
FMS	Flight Management System	Navigation unit
FQIS	Fuel Quantity Indication System	Flight computer application for fuel calculation

Acronym	Full Form	Context/Description
FUE	Fuel	MFD Synoptic Page
FWD	Forward	Forward fuel tank
G	Gravity	G meter/Load Factor
GE	General Electric	Engine manufacturer
GPS	Global Positioning System	Navigation system
HUD	Heads-up Display	Display type (used as comparison to FLVS feed)
IDG	Integrated Drive Generator	Primary electrical power source
IFD	(Avidyne) Integrated Flight Display	Dual screen avionics units (e.g., IFD550/540)
ILS	Instrument Landing System	Approach aid
INS	Inertia Navigation System	Primary Navigation source/Ground speed system
KCAS	Knots Calibrated Airspeed	Airspeed unit displayed on PFD
LGR	Landing Gear	MFD Synoptic Page
MLW	Max Landing Weight	Maximum certified weight for landing
MCO	Mach Cutoff	Supersonic flight technique (also Boomless Cruise)
MFD	Multi-Functional Display	Centerpiece of the avionics suite
MTOW	Max Take-Off Weight	Maximum certified weight for takeoff
ND	Navigation Display	Route map display
OVR	Overview	MFD Synoptic Page
PFD	Primary Flight Display	Main flight instrument display
PGD	Page Down	MFD key function
PGU	Page Up	MFD key function
PSI	Pounds per Square Inch	Unit of pressure (e.g., for hydraulics)
RAM	Ram Air	Outside air forced into the flightdeck
RPM	Revolutions Per Minute	Engine speed
SVS	Synthetic Vision System	Avidyne feature used for simulated FLVS display
TOT	Totalizer	Fuel Totalizer

Acronym	Full Form	Context/Description
UTC	Universal Time Coordinated	Time standard
UTIL	Utility	Utility hydraulic system
Vapp	Approach Speed	Speed for final approach
VDC	Volts Direct Current	Electrical unit
Vmo	Maximum Operating Speed	Maximum certified speed
Vne	Velocity Never Exceed	Maximum speed for structural integrity
Vr	Rotate	Speed at which to pitch up on takeoff
Vx	Best Climb Speed	Speed for best angle of climb
WOW	Weight on Wheels	Sensor that detects if the aircraft is on the ground
ZCO	Cutoff Altitude	Altitude at which complete refraction of the sonic boom occurs
ZFW	Zero Fuel Weight	Maximum certified weight of the aircraft without fuel

References

1. [Test Flight Path] Supersonic, B. (2025, January 27). Flyby - XB-1 supersonic test flight mission. https://boomsupersonic.com/flyby/xb-1-supersonic-test-flight-mission
2. [Image] *Boomless Cruise*. Boom. (2025, July 1). https://boomsupersonic.com/boomless-cruise
3. [NASA Image] Rolls, L. S., Koenig, D. G., & Drinkwater, F. J. (n.d.). Flight investigation of the aerodynamic properties of an ... https://ntrs.nasa.gov/api/citations/19660003728/downloads/19660003728.pdf
4. [Ogival Wing] Supersonic, B. (2023, April 22). *Flyby - from "canoe" to assembled aircraft: XB-1 approaches the Taxiway*. https://boomsupersonic.com/flyby/from-canoe-to-assembled-aircraft-xb-1-approaches-the-taxiway
5. [12,300lb J85] Supersonic, B. (2023b, April 27). *Flyby - key design features of BOOM's supersonic demonstrator, XB-1*. https://boomsupersonic.com/flyby/key-design-features-of-booms-supersonic-demonstrator-xb-1
6. [XB-1 Afterburner] Supersonic, B. (2023c, December 28). *Flyby - XB-1: Path to first flight - December update*. https://boomsupersonic.com/flyby/xb-1-path-to-first-flight-december-update
7. [Mach cutoff] Cliatt, Larry J.; Hill, Michael A.; Haering, Edward A. (2016). "Mach Cutoff Analysis and Results from NASA's Farfield Investigation of no-boom thresholds" (PDF). NASA. Retrieved 19 February 2025
8. [Overture] Supersonic, B. (2024, May 24). Flyby - travel trends will be reshaped by Supersonic Flight. https://boomsupersonic.com/flyby/summer-travel-trends-future-travel-onboard-overture
9. [Image Boom Crew] *XB-1*. Boom. (2025, February 14). https://boomsupersonic.com/xb-1