X-Plane
MD-82

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Background: The McDonnell Douglas MD-82

Photo credit: Wikipedia

The Douglas Aircraft corporation developed the DC-9 in the mid-1960s to serve as a twin-engined, short-range companion to the larger DC-8. An all-new design, the DC-9 featured two rear-mounted turbofan engines beneath a T-tail. The aircraft had a relatively narrow-body fuselage, with five-abreast seating, and a capacity of between 80 and 135 passengers, depending on aircraft model, and configuration.

The DC-9 airliner became one of the most successful of all time, with over 2,400 units produced. This ranks it third overall in sales, behind the Boeing 737, and Airbus A320 family.

In the 1970s, Douglas (by then McDonnell Douglas) began the development of the MD-80 series, which was a lengthened version of the DC-9-50. The new aircraft had both a higher maximum take-off weight (MTOW), and a higher fuel capacity. Fitted with the latest derivative of the Pratt & Whitney JT8D engine (with higher bypass ratios), there were multiple designs, known as the Series 50, 55, and 60. Ultimately, the effort focused on the Series 55, and the design was marketed as the "DC-9 Super 80" (or MD-80). Swissair launched the aircraft in October 1977 with an initial order for 15 units.

The MD-82 variant was announced on April 16, 1979. This was equipped with more powerful engines and intended for operation from high density altitude airports. The aircraft also offered a greater payload and range. Originally certified with Pratt and Whitney JT8D-217 turbofans, later aircraft were powered by the 217A variant. The first flight of the MD-82 was on January 8th, 1981, and the aircraft entered service in August of the same year. The final delivery of the aircraft was in November 1997. Further derivatives followed, labelled MD-83, MD-87, MD-88, MD-90, and MD-95.

McDonnell Douglas was acquired by Boeing in August of 1997, and the MD-95 was re-branded the Boeing 717. In total, 156 717s were produced, and the last aircraft rolled off the line in April 2006.

MD-80 Series Specifications

Engines:		
Model	--	2 x Pratt & Whitney JT8D-217 turbofan
Power	--	2 x 20,000 lb. thrust
Fuel:		
Capacity	--	5,840 Gallons / 22,100 liters / 48,500 lbs.
Fuel	--	Jet A-1
Fuel Burn (average)	--	6,000 lbs. per hour
Weights and Capacities:		
Max. Takeoff Weight	--	140,000 lbs. / 63,500 kg.
Max. Landing Weight	--	128,000 lbs. / 58,000 kg.
Empty Operating Weight	--	78,500 lbs. / 35,600 kg.
Maximum Payload	--	43,400 lbs. / 19,700 kg.
Performance:		
Max. Level Speed	--	500 KTAS
Long Range Cruise Speed	--	439 KTAS
Final Approach Speed		133 – 140 KTAS (full flap/gear down)
Takeoff Distance	--	7,450 ft. / 2,270 m.
Landing Distance	--	4,850 ft. / 1,478 m
Range	--	2,050 nm
Service Ceiling	--	37,000 ft. / 11,280 m.

The X-Plane MD-82

Unlike other flight simulators, X-Plane employs a technique called "blade element theory. This utilizes the actual shape of the aircraft (as modeled in the simulator) and breaks down the forces on each part separately. The force of the "air" acting on each component of the model is individually calculated, and combined, to produce extremely realistic flight.

When you "fly" an airplane in X-Plane, there are no artificial rules in place to govern how the aircraft behaves. Your control inputs move the control surfaces of the aircraft, and these interact with the virtual flow of air around it. As such, you may consider that you are really flying the aircraft.

Due to the use of 'Blade Element Theory' in X-Plane, an aircraft must be modeled with great accuracy, in order that is behave like its real-life counterpart. This means the fuselage, wings and tail surfaces must be the right size and shape, the center of lift and center of gravity must be in the right places, and the engine(s) must develop the right amount of power. In fact, there are a great many properties that must be modeled correctly to achieve a high-fidelity flight model.

The MD-82 featured in X-Plane has been modeled by our design team with a degree of accuracy that ensures its flight characteristics are like the real aircraft. However, despite this, some differences will be apparent, because even the smallest factor plays into the ultimate behavior of the aircraft, both in real life, and in X-Plane. The systems modeling of this aircraft involves some compromise too, because of the degree of complexity present in the real aircraft. However, in most cases, the actual MD-82 procedures could be followed when operating the X-Plane version. Checklists are presented later in this document (with modifications to suit this specific simulation platform and model). It is recommended that X-Plane pilots follow those procedures to extract the maximum capability and enjoyment from this aircraft.

Views and Controls

The X-Plane MD-82 features a detailed 3-D cockpit with a great many of the primary controls and systems modeled, including: Flight controls (yoke, rudder pedals, thrust levers, flap and speed-brake levers), electrical systems, pneumatic systems, navigation aids, radios, autopilot, interior and exterior lighting, and fuel systems.

Hint:

To best view some of the switches featured in this aircraft, it is helpful to hide the pilot and co-pilot yokes. This can be accomplished selecting “Joystick and Equipment” from the “Settings” menu, and assigning a button, or key, to the following:

Operation | Toggle Yoke Visibility

(The default keyboard assignment is ‘y’).

Use the assigned button/key to toggle the yoke view as required. This will have no effect on the yoke operation.

Creating “Quick Look” views

Before discussing the controls, we suggest that the pilot establish a series of “Quick Look” views that will be helpful later when interacting with this particular aircraft. If you are not familiar with this technique, more information is available in the X-Plane Desktop Manual.

The following “Quick Look” views are recommended for the MD-82, in a situation where the pilot is not using a Virtual Reality (VR) headset, or a head tracking device. To some degree, these correspond (on the keyboard Number Pad) with their physical locations in the cockpit, and are therefore logical and easy to recall later.

Control Display Unit (CDU)

Pilot’s Primary Instrument Panel

Thrust Lever Quadrant and Center Console

Co-Pilot’s Primary Instrument Panel

Pilot’s EFIS (Electronic Flight Instrument System) Control Panel / Instrument Lighting Panel

Engine Instrument Panel / Autopilot Panel

Co-Pilot’s EFIS (Electronic Flight Instrument System) Control Panel / Instrument Lighting Panel

Pilot’s Left
Glance View

Overhead Panel

Co-Pilot’s Right
Glance View

Operating the controls

This section covers the basics techniques for the operation of the controls that you will encounter in the cockpit of an X-Plane aircraft. Control manipulators are consistent across all X-Plane aircraft. However, the specific **ILLUSTRATIONS** in THIS chapter may differ from YOUR aircraft.

Toggle and Rocker switches are operated with a single click of the mouse. Place the mouse pointer slightly above, or below, the center point of the switch, depending on the direction you intend to move it. A small white arrow is displayed to confirm the intended direction. Click the mouse button to complete the operation.

Levers are operated by assigning a peripheral device to the necessary axes in X-Plane (throttle, prop, mixture etc.). More information is available in the X-Plane Desktop Manual.

Levers may also be operated by clicking and dragging the mouse pointer.

Some rotary dials are operated by positioning the mouse pointer on top of the control, and then a click and drag to the right, or to the left. The same can be accomplished using the mouse wheel - if one is present on your device.

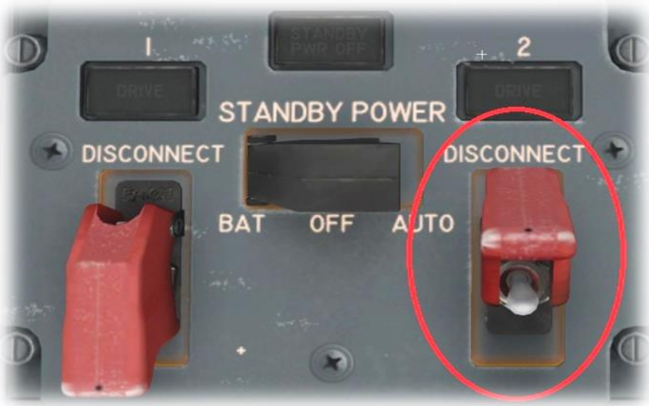
Other rotary controls require finer precision. When the mouse pointer is positioned slightly to the left of such a control, a counter-clockwise arrow appears. This indicates that you are ready to rotate the control counter-clockwise. Correspondingly, a clockwise arrow indicates that you are ready to rotate the control clockwise. After positioning the mouse pointer, changing the frequency in the desired direction is accomplished in two ways:

i) By rolling the mouse wheel forwards, or backwards

ii) By clicking (dragging is not supported here)

Radio and Navigation frequency rotary dials are grouped together as “twin concentric knobs”. Here, the larger rotary is used to tune the integer portion of the frequency, and the smaller rotary is used to tune the decimal portion. Each works independently, using the same technique, as described above.

Push buttons are operated by pointing and clicking with the mouse.



Guarded switches are used in situations where accidental activation of the switch must be prevented. To operate a guarded switch, the guard must first be opened. Do this by positioning the mouse pointer over the switch until the two vertical white arrows are displayed. Click once. If the switch is currently closed, it will open, and vice-versa. After the guard has been opened, the switch may be operated like a toggle and rocker switch (see earlier in this section).

The Yoke / Stick / Joystick is operated by assigning a peripheral device to the “roll” and “pitch” axes in X-Plane. This is discussed in greater detail later in the guide.

The Rudder Pedals are operated by assigning a peripheral device to the “yaw” axis in X-Plane. If your rudders also support toe braking, create additional assignments to the “left toe brake” and “right toe brake” axes in X-Plane. This is discussed in greater detail later in the guide.

Note that you may also assign keys on your keyboard, or buttons on your external peripheral to move the rudder to the left or right, or to center the rudder.

Assigning peripheral devices

This section of the manual deals with an “ideal” scenario, in terms of the assignment of external computer peripherals to operate the X-Plane MD-82 with the highest degree of realism. If you are missing some of these external peripherals, you may elect to choose a different configuration that better suits your hardware.

The MD-82 is equipped with Yokes, for roll and pitch control.

To simulate this, assign the lateral axis of your yoke (or joystick) to the “Roll” command in X-Plane, and the vertical axis to the “Pitch” command.

More information is available in the X-Plane Desktop Manual.

The MD-82 is equipped with dual thrust levers – which control the thrust generated by the left and right engines respectively.

To simulate the thrust levers for a MD-82, assign two levers on your quadrant to the “Throttle 1” and “Throttle 2” property in X-Plane.

The MD-82 is equipped with a “Fuel Flow lever” for each engine. These are manually actuated by the flight crew to introduce fuel to the engines during the start procedure.

To simulate this, assign two levers on your quadrant to the “Mixture 1” and “Mixture 2” properties in X-Plane.
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The MD-82 is equipped with a Flap lever, which controls the deployment of the flaps for takeoff and landing.

To simulate this, assign a peripheral lever to the “Flaps” property in X-Plane.
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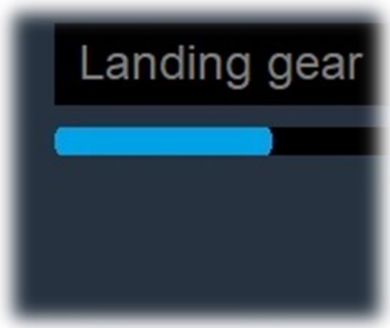

The MD-82 is equipped with a Landing Gear lever.

To simulate this, assign a peripheral lever to the “Landing gear” property in X-Plane.
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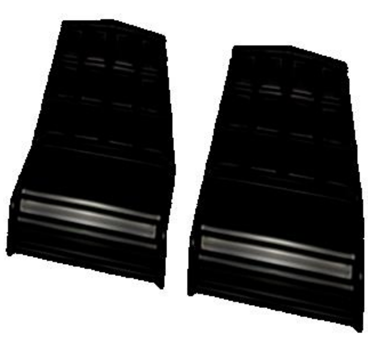
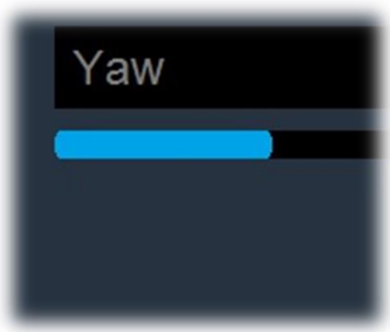
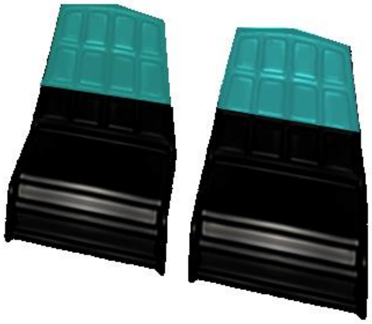




The MD-82 has conventional rudder controls, actuated by the rudder pedals.

The pedals activate the rudder, which is part of the tail assembly, and this “yaws” the aircraft to the left or right. The rudders keep the aircraft straight during takeoff and landing, and help make coordinated turns.

To simulate this, assign the yaw axis of your pedals peripheral device (or a joystick axis) to the “yaw” property in X-Plane.



The MD-82 has rudder toe-braking, actuated by the tip of the rudder pedals.

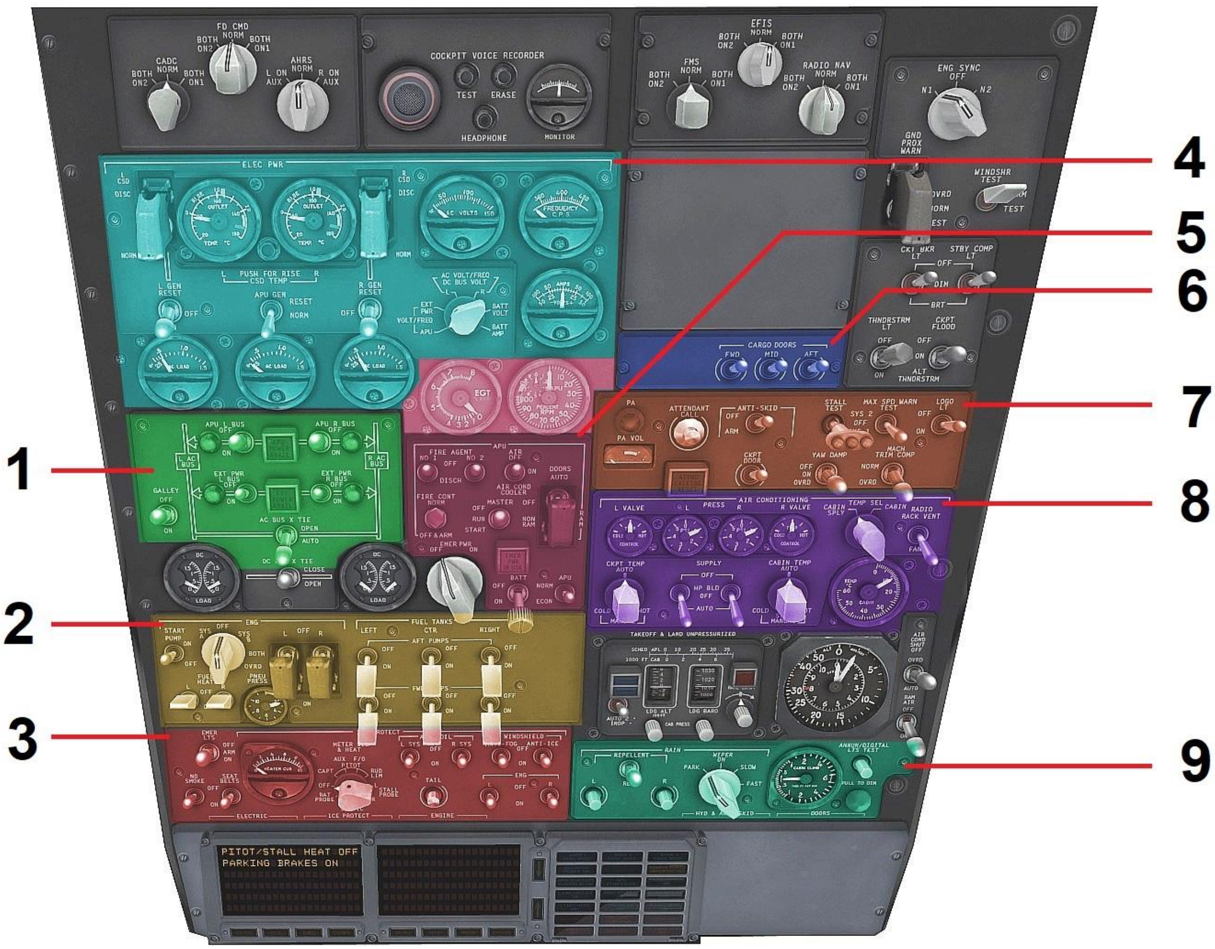
To simulate this, assign the brake “toe-tipping” motion of each individual pedal (or a joystick axis) to the “left toe brake” and “right toe brake” property in X-Plane.

A Tour of the Cockpit

In this section of the manual, the cockpit will be broken down into distinct functional areas, and the controls that are featured in those areas will be identified and described. This will assist in locating the necessary instruments and controls later, when working through the aircraft check lists, and flying the aircraft.

Overhead Panel

The overhead panel comprises a collection of smaller panels that manage the aircraft's electrical, pneumatic, lighting, pressurization, engine start, and other systems. Many of these were previously the domain of a flight engineer in the era of three-person flight crews.



1. APU / External Power Bus Panel

This panel is used to control the electrical power to the aircraft, when the main engines are not running.

Power may be sourced from an external generator, or the APU.

2. Engine and Fuel Pumps / Engine Start Panel

This panel controls the hydraulic pumps used for engine-start, and fuel flow (from the left, right and center tanks).

There are two engine-starter systems in this aircraft – System A and System B. They are identical, and present for redundancy. The pilot may choose to use either of these using the rotary control.

The gauge displays the pressure in the pneumatic system

3. Ice Protection Panel

This panel monitors and controls the anti-icing systems.

The pitot tube anti-icing systems is permanently on, and the rotary provides the pilot with the option to check the electrical current flowing to each probe.

The wing, engine, and windshield anti-icing systems are manually operated using the associated switches.

This panel also features the ‘No Smoking’ and ‘Seat Belts’ illumination switches.

4. Electrical Panel

This panel is used to control and monitor the electrical power to the aircraft, when the main engines are running.

The left and right generators are driven by the main engines and produce electrical power.

The ‘AC Load’ gauges display electrical current (or load) that is being drawn from the bus in question. When both left and right buses are active, they share this load, and therefore the draw from each individual bus is diminished.

The rotary control (in association with the nearby voltage gauges) provides the pilot with a means to check the available voltage from each potential source of electricity – APU / External Power / Aircraft’s own batteries.

5. Battery Master / APU Control Panel

This panel contains the battery master switch that provides electrical power to the aircraft from the on-board batteries. Battery power provides a short-term electrical source, until a more sustainable source is activated.

This panel is also used to start the APU and control the (bleed) air output.

The APU is a small turbine at the rear of the aircraft that provides a source of power when the main engines are not running. It also provides compressed (bleed) air that is used to power the aircraft’s air conditioning packs and start the main engines.

The gauges show the EGT (Exhaust Gas Temperature leaving the APU), and turbine RPM (percentage of maximum).

6. Cargo Doors Control Panel

This panel is used to open or close the three (animated) cargo doors.

7. Miscellaneous Panel

This panel contains several miscellaneous functions.

Flight attendant call and reset.

Anti-skid braking system.

Cockpit door lock and unlock.

Yaw damper activation. The yaw damper provides automatic operation of the rudder, and may be used with, or without the autopilot engaged. Its mission is to counteract yaw oscillations called 'Dutch Roll', and to assist with coordinated turns (when the aircraft is rolling to the left or right). For large aircraft such as the MD-82, the yaw damper is typically engaged during the entire flight, except for take-off and landing.

Stall (audio warning) test.

Tail logo illumination.

8. Air Conditioning Panel

This panel contains several miscellaneous functions.

The rotary controls set the temperature for the cockpit and cabin respectively.

The cluster of four gauges indicate the air temperature to the cockpit, and cabin, and the bleed-air pressure from the engines to the air-conditioning system.

The large gauge indicates the current temperature of the cabin.

The Air Conditioning Supply has two modes (controlled by the associated switches). HP BLD OFF (High-Pressure Bleed) is selected on the ground provided pressurization of the aircraft is NOT required. AUTO is selected once one or both engines are started. The HP valve opens, allowing the aircraft to be pressurized.

9. Rain Panel

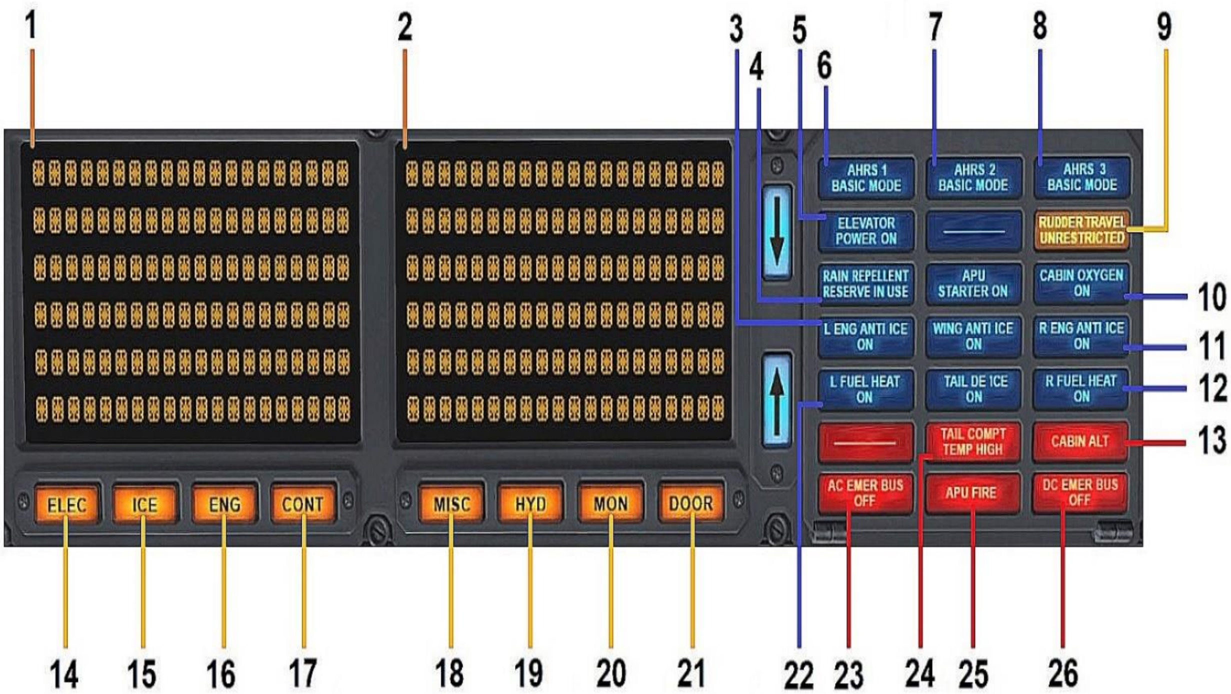
This panel operates the windshield wipers.

The rotary control is used to set the wiper speed.

This panel also features an annunciator test button. This illuminates every light in the annunciator panel, to test these prior to the flight.

Annunciator Panel

This panel displays the status of the aircraft's equipment and systems. Red indicators are warnings, amber indicators are cautions, and blue indicators are for information.



Note: A test switch is located on the overhead panel. Depressing this switch illuminates every light in the panel, to confirm each one is working.

1	Left Flight Mode Panel	One of two display panels that keep the flight crew continuously informed of ongoing system status.
2	Right Flight Mode Panel	One of two display panels that keep the flight crew continuously informed of ongoing system status.
3	LEFT ENGINE ANTI-ICE ON	**Severity: Information** Illuminated when the anti-icing system has been turned on for the left engine. Not currently supported.
4	Rain Repellant Reserve in Use	**Severity: Information** Illuminated when the reserve fluid container has been selected. Not currently supported.
5	Elevator Power On	**Severity: Information** Illuminated when hydraulic elevator augmenter system has been activated. Not currently supported.
6	AHRS 1 Basic Mode	**Severity: Information** When a system fault is detected in relation to the AHRS (Altitude Heading Reference System) #1, this system will enter a reduced performance mode, and this annunciator will be illuminated. Altitude and heading data from that system may no longer be reliable. Not currently supported.
7	AHRS 2 Basic Mode	**Severity: Information** When a system fault is detected in relation to the AHRS (Altitude Heading Reference System) #2, this system will enter a reduced performance mode, and this annunciator will be illuminated. Altitude and heading data from that system may no longer be reliable. Not currently supported.
8	AHRS 3 Basic Mode	**Severity: Information** When a system fault is detected in relation to the AHRS (Altitude Heading Reference System) #3, this system will enter a reduced performance mode, and this annunciator will be illuminated. Altitude and heading data from that system may no longer be reliable. Not currently supported.
9	Rudder Travel Unrestricted	**Severity: Information** Indicates full rudder travel is available. At high speeds, the rudder travel is automatically limited to prevent excessive yaw from pilot inputs. Not currently supported.

10	Cabin Oxygen On	**Severity: Information** Illuminated when the passenger supplemental oxygen system has been armed (in case of emergency). Not currently supported.
11	Right Engine Anti-Ice On	**Severity: Information** Illuminated when the anti-icing system has been turned on for the right engine. Not currently supported.
12	R FUEL HEAT ON	**Severity: Information** Illuminated when the engine bleed air has been directed to the air/fuel heat exchanger. Must be OFF for takeoff, landing or go-around. Not currently supported.
13	CABIN ALT	**Severity: Warning** Illuminated when cabin altitude exceeds 10,000 feet.
14	ELEC	**Severity: Caution** Not currently supported.
15	ICE	**Severity: Caution** Not currently supported.
16	ENG	**Severity: Caution** Not currently supported.
17	CONT	**Severity: Caution** Not currently supported.
18	MISC	**Severity: Caution** Not currently supported.
19	HYD	**Severity: Caution** Not currently supported.
20	MON	**Severity: Caution** Not currently supported.
21	DOOR	**Severity: Caution** Not currently supported.

22	L FUEL HEAT ON	Severity: Information Illuminated when the engine bleed air has been directed to the air/fuel heat exchanger. Must be OFF for takeoff, landing or go-around. Not currently supported.
23	AC EMER BUS OFF	Severity: Warning Indicates the emergency A/C bus has no power.
24	TAIL COMPT TEMP HIGH	Severity: Warning Indicates the temperature of the tail compartment is exceeding the normal range.
25	APU FIRE	Severity: Warning Indicates a fire in the Auxiliary Power Unit (APU).
26	DC EMER BUS OFF	Severity: Warning Indicates the emergency D/C bus has no power.

Primary Instrument Panels

Airspeed Indicator

This instrument displays the speed of the aircraft (in knots) relative to the air (not the ground).

The white, green and amber ‘speed bugs’ can be manually dragged to their respective V-speeds (after calculating these).

The red and white ‘barber pole’ indicates the maximum safe operating speed.

A digital Mach number is also provided in the top center of the dial.

Note: The scaling on this instrument is not uniform, and this is apparent by differences in the white bars around the perimeter. The white-bars have no aerodynamic relevance (e.g. flap or gear speed).

Electronic Attitude Director Indicator (EADI)

This is the upper LCD panel in the avionics cluster. The EADI displays the attitude of the aircraft relative to the horizon, and the altitude (above sea level) - via the scale on the right.

The attitude display informs the pilot whether the aircraft is flying straight, or turning, and whether the aircraft is climbing, or descending. This information is crucial in "instrument conditions" - when the outside horizon is not visible.

The EADI also displays localizer and glideslope deviation, when coupled to an ILS approach.

Electronic Horizontal Situation Indicator (EHSI)

This is the lower LCD panel in the avionics cluster. The EHSI displays the aircraft's position & (magnetic) heading.

The display is presented in a plan view, as if looking down at the aircraft from directly above.

If a flight plan has been input (using the FMS), this panel also displays the aircraft's position relative to the desired track.

Altimeter

This instrument displays the altitude above sea level (not the ground). This model combines a digital and analog presentation.

Altimeters use barometric pressure to determine altitude. As such, they must be calibrated at the start of the flight, and periodically re-calibrated during the flight, to account for the current local conditions (using the published barometric pressure).

Use the rotary at the lower left to set the barometric pressure in either millibars, or inches of mercury.

Use the rotary at the lower right to set the decision height 'bug' - for instrument approaches that require this.

Variometer (Vertical Speed Indicator)

This instrument informs the pilot of the rate of climb, or the rate of descent, in terms of thousands of feet per minute.

Chronometer

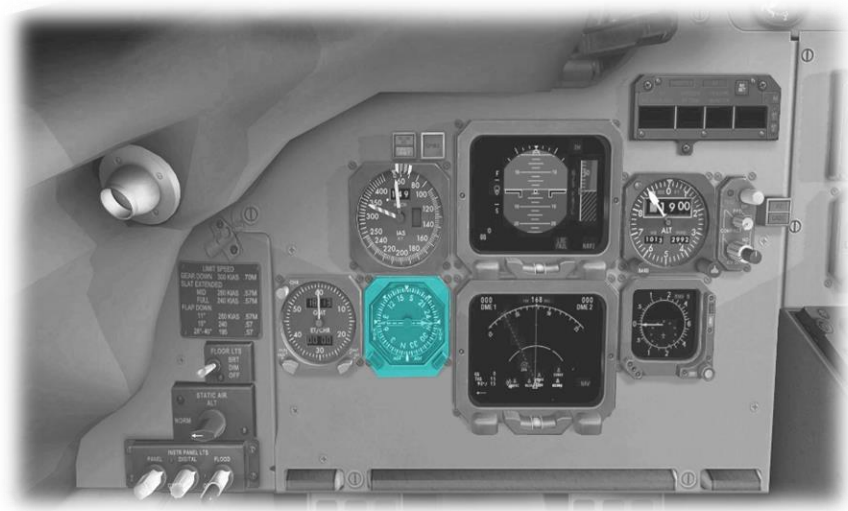
This instrument displays the current time, and (flight) elapsed time.

Current time is displayed in GMT, or local (controlled by the switch at the lower-right).

Start or Hold the elapsed timer using the switch in the lower-left.

Reset the elapsed timer using the switch in the upper-left.

ADF (Automatic Direction Finder)



This instrument displays a direct course to the chosen navigation aid (VOR or NDB).

The chosen navigation aid is that tuned by the active ‘Nav’ radio.

EADI / EHSI Lighting Panel

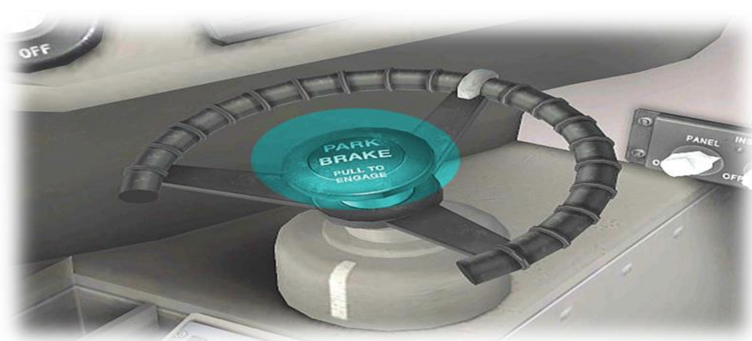
The rotary controls on this panel control the brightness of the EADI and EHSI displays.

Additionally, this panel features a ‘Decision Height’ rotary control, that sets the display of the D/H on both the EADI, and the secondary altimeter.

Instrument Back-Lighting Panel

The rotary controls on this panel adjust (from left to right) the instrument back-lighting, digital display brightness, and overhead floods respectively.

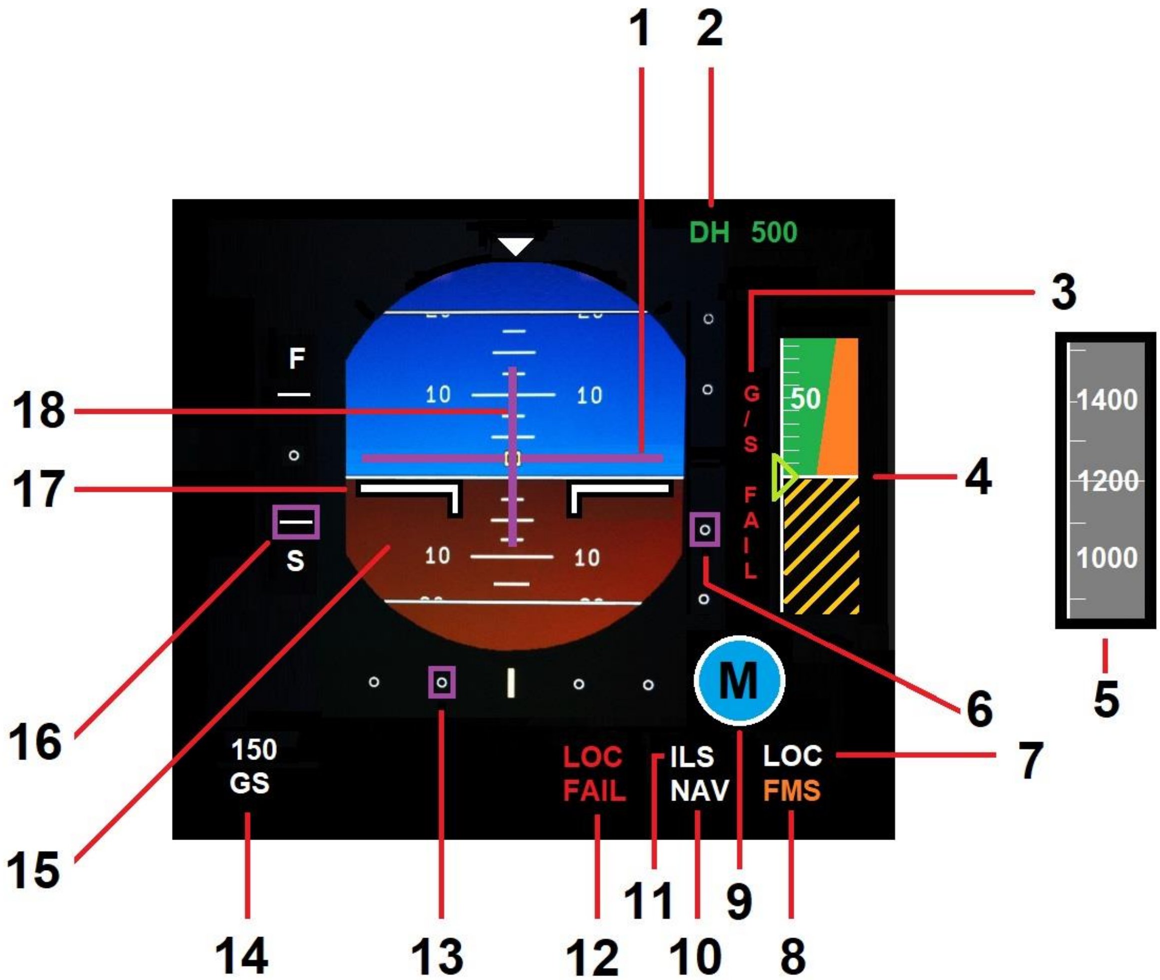
Tiller and Parking Brake



Large aircraft are frequently equipped with a tiller for nosewheel steering. The tiller here will respond to rudder commands for steering on the ground.

Click the center of the tiller unit to toggle the parking brake ON and OFF.

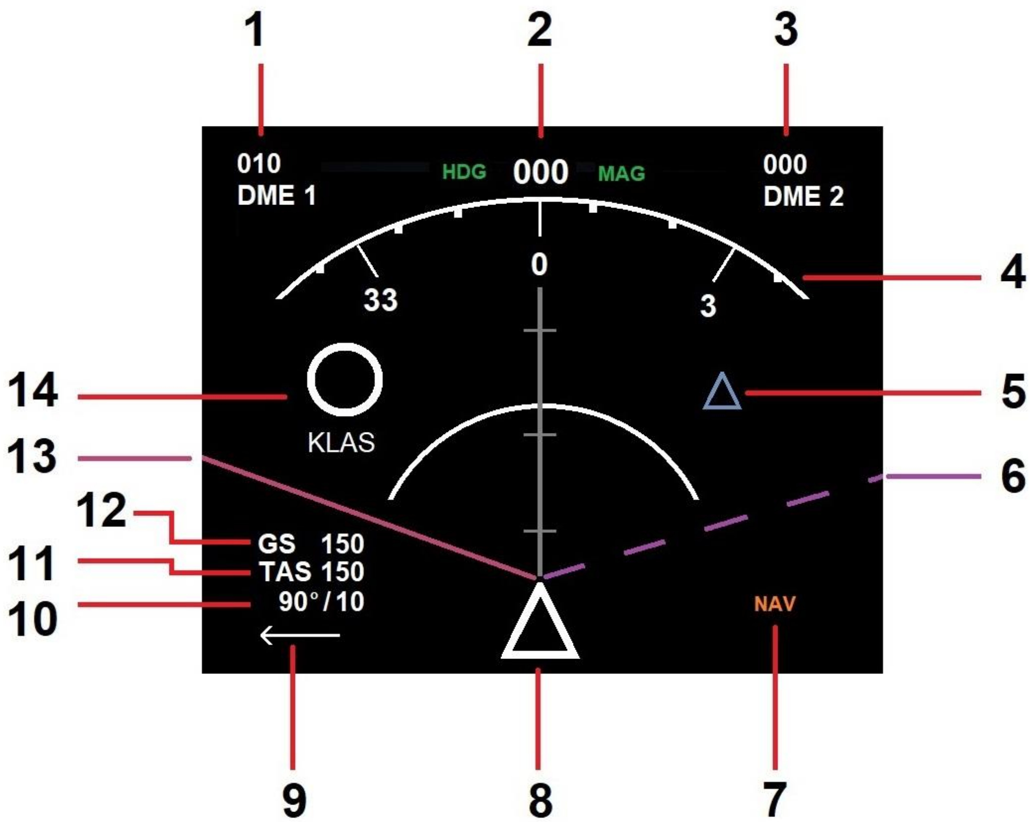
Electronic Attitude Director Indicator (EADI) Components



1	**Flight Director Vertical Deviation Bar**	When the aircraft is following a flight-plan, or according to a navigation aid, this bar informs the pilot to steer left, or right, to intercept the desired track.
2	**Decision Height**	The decision height (pre-selected using DH Rotary Control) for instrument approaches that utilize this.
3	**G/S FAIL Annunciator**	Illuminated when the current navigation frequency does not support an ILS glide-slope. This warns the pilot to ignore information provided by the ILS Vertical Deviation Scale.
4	**Altitude Above Ground (AGL) Scale**	Altitude Above Ground (from the radio-altimeter) between 0 and 500 feet
5	**Altitude Above Ground (AGL) Scale**	Altitude Above Ground (from the radio-altimeter) between 500 and 2,500 feet
6	**ILS Vertical Deviation Scale**	Displays the extent of any vertical deviation above, or below, an ILS glide-slope.

7	**LOC Annunciator**	Displayed when an ILS Localizer or VOR Radial is captured
8	**Active Navigation Device Annunciator**	Informs the pilot of the active navigation device (FMS, NAV1, NAV2, ADF etc.) currently coupled with the EADI.
9	**Marker Annunciator**	Illuminated when the runway outer, middle or inner marker are encountered (in conjunction with an ILS approach).
10	**NAV Annunciator**	Illuminated when the aircraft heading is under the control of the autopilot.
11	**ILS Annunciator**	Illuminated when both the ILS Localizer and Glide-Slope have been captured.
12	**LOC FAIL Annunciator**	Illuminated when the current navigation frequency does not support an ILS localizer. This warns the pilot to ignore information provided by the ILS Lateral Deviation Scale.
13	**ILS Lateral Deviation Scale**	Displays the extent of any lateral deviation to the left, or right, of an ILS localizer.
14	**GS**	Ground Speed
15	**Attitude Indicator**	Displays an artificial horizon to provide the pilot with attitude reference information.
16	**Speed Deviation Scale**	Displays the aircraft speed relative to the programmed speed for the current leg in the (FMS) Flight Plan.
17	**Static Reference Lines**	A static reference showing the position of the aircraft with respect to the artificial horizon – in terms of ascent, descent, a left turn, or a right turn.
18	**Flight Director Horizontal Deviation Bar**	When the aircraft is following a flight-plan, or according to a navigation aid, this bar informs the pilot to climb, or descend, to intercept the desired altitude.

Electronic Horizontal Situation Indicator (EHSI) Components



1	**DME 1**	Distance to the navigation aid associated with the NAV 1 device (if DME is present)
2	**Magnetic Heading**	The aircraft’s current magnetic heading
3	**DME 2**	Distance to the navigation aid associated with the NAV 2 device (if DME is present)
4		Compass Scale
5	**Navaid / Waypoint**	The location of a navigation aid or waypoint relative to the current position of the aircraft
6		Current (pre-selected) Autopilot Heading (for use with HDG mode)
7	**NAV / ADF Annunciator**	Displays ‘NAV’ by default. Displays ‘FMS” when the autopilot is in FMS mode, and the Flight Director is engaged (see Autopilot Operation).

8		The current location of the aircraft on the map
9		Wind Direction relative to the aircraft's heading
10		Absolute Wind speed and Direction
11	**TAS**	True Air Speed
12	**GS**	Ground Speed
13		Flight Plan Course
14	**Airport**	The location of an airport relative to the current position of the aircraft

Electronic Horizontal Situation Indicator (EHSI) Control Panel

An EHSI Control Panel is provided for the pilot. This panel is used to customize the information presented on the associated EHSI display:

MODE Rotary	**APP**	Places the EHSI display in 'Approach' mode. A lateral deviation scale (from the desired course) is included below the map.
MODE Rotary	**VOR**	Places the EHSI display in 'VOR' mode. A lateral deviation scale (from the desired radial) is included below the map.
MODE Rotary	**MAP**	Places the EHSI display in 'MAP' mode. The location of the aircraft is presented at the bottom of the screen, and the map incorporates airports, navigation aids and waypoints (within the selected range) that are ahead of, and 45 degrees either side of, this position.
MODE Rotary	**PLN**	Places the EHSI display in 'PLAN' mode. The location of the aircraft is presented at the center of the screen, and the map incorporates airports, navigation aids and waypoints (within the selected range) in all directions.
ADF/VOR Rotary	**ADF**	Places the EHSI in 'ADF' mode. A magenta bar is displayed indicating the relative direction of the selected NDB (Non-Directional Beacon). Note if the NDB is not in your approximate path, the EHSI must be in 'Rose' mode for the blue arrow to be visible.

ADF/VOR Rotary	**VOR**	Places the EHSI in 'VOR' mode. A blue arrow is displayed indicating the relative direction of the selected VOR radial.
ROSE Rotary	**OFF**	This control is disabled if the Mode Rotary is set to 'PLN'. When 'OFF' is selected, the compass scale will comprise only 45 degrees to either side of the current heading.
ROSE Rotary	**ROSE**	This control is disabled if the Mode Rotary is set to 'PLN'. When 'ROSE' is selected, the compass scale will comprise the entire 360 degrees.
RANGE Rotary		Controls the range displayed on the EHSI map. When set to a given distance (in miles), the map incorporates only airports, navigation aids and waypoints that are within that distance.
Feature Buttons	**WTHR**	When the MODE Rotary is set to 'MAP' or 'PLN': Displays weather radar information on the EHSI.
Feature Buttons	**AIRP**	When the MODE Rotary is set to 'MAP' or 'PLN': Includes airports (within the selected range) on the EHSI display.
Feature Buttons	**NAV**	When the MODE Rotary is set to 'MAP' or 'PLN': Includes navigation aids (within the selected range) on the EHSI display.
Feature Buttons	**WPT**	When the MODE Rotary is set to 'MAP' or 'PLN': Includes waypoints (within the selected range) on the EHSI display.

Center Panel

Backup Attitude Indicator

The backup Attitude Indicator is electrically powered and connected to bus zero. This provides redundancy, in case of failure of the primary instruments.

This is not modeled as a separate system in the X-Plane MD-82 and is therefore a duplicate of the primary attitude indicator.

Backup Altimeter/Airspeed Indicator

The backup Altimeter/Airspeed indicator in the real aircraft is powered by the pitot-static system, to provide redundancy, in case of failure of the primary instruments.

This is not modeled as a separate system in the X-Plane MD-82 and is therefore a duplicate of the primary altimeter and airspeed indicators.

Left and Right Engine Pressure Ratio (EPR)

[From Wikipedia] The engine pressure ratio (EPR) is the total pressure ratio across a jet engine, measured as the ratio of the total pressure at the exit of the propelling nozzle divided by the total pressure at the entry to the compressor.

This is an indication of the total thrust developed by the left, and right engines.

Left and Right Engine N1 Compressor Rotational-Speed

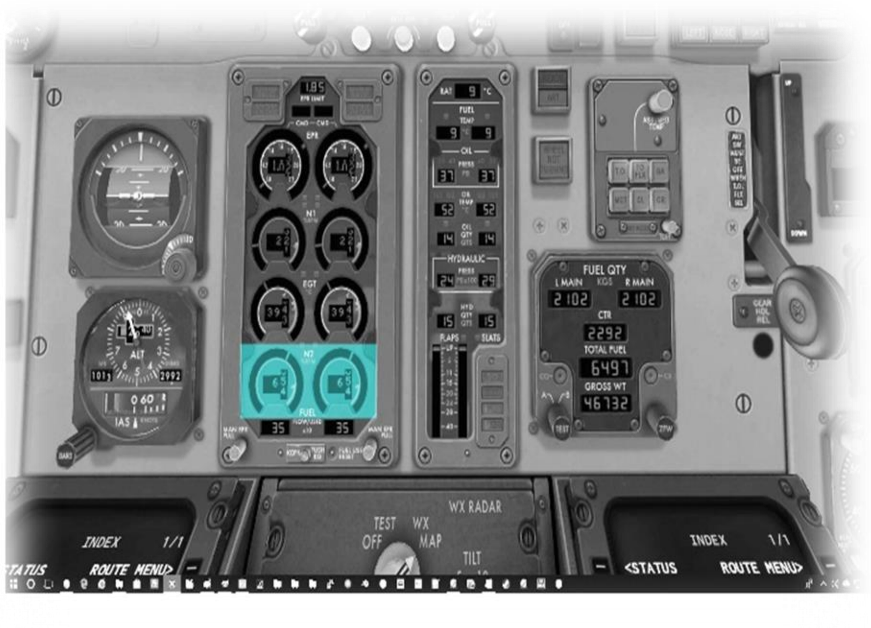
The turbofan engines used by the MD-82 feature a low-pressure compressor at the front, and a high-pressure compressor at the rear.

N1 is a measure of the rotational-speed of the low-pressure compressor at the front of the engine. This is expressed as a percentage of the maximum.

Left and Right Engine Exhaust Gas Temperature (EGT)

Exhaust gas temperature for the left and right engines respectively, in degrees Celsius.

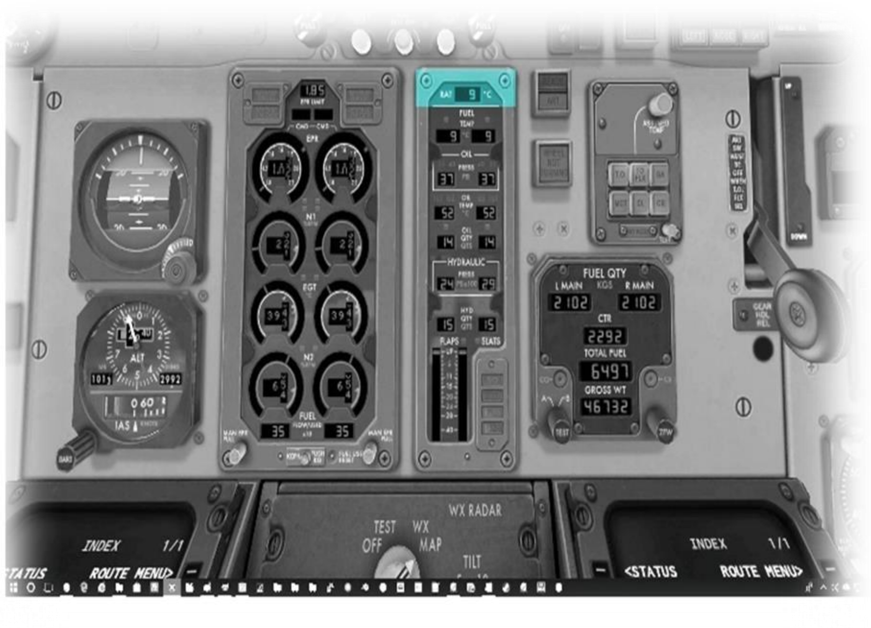
Left and Right Engine N2 Compressor Rotational-Speed



The turbofan engines used by the MD-82 feature a low-pressure compressor at the front, and a high-pressure compressor at the rear.

N2 is a measure of the rotational-speed of the high-pressure compressor at the rear of the engine. This is expressed as a percentage of the maximum.

Ram Air Temperature



This is the temperature of outside the air as indicated by the ram-air probe. Moving air colliding with the probe has a higher temperature and this is therefore the effective temperature of the air, as experienced by the airframe.

Fuel Temperature

This is the temperature of the fuel, measured as it enters the engines.

JET-A fuel will begin freezing at -40 degrees Celsius.

Oil Pressure

This is the left and right engine oil pressure respectively.

Minimum oil pressure for takeoff is 40 psi.

Minimum oil pressure for cruise is 35 psi.

Oil Temperature

Left and right engine oil temperature respectively.

Maximum continuous oil temperature is 135 degrees Celsius.

Maximum oil temperature for 15 minutes is 165 degrees Celsius.

Oil Quantity

Left and right engine oil quantity respectively.

In the real aircraft, the oil quantity range is zero to 16 quarts.

This is not modeled in the X-Plane MD-82 and has a permanent value of 14 quarts.

Hydraulic Pressure

Left and right engine hydraulic pump pressure respectively.

Maximum safe hydraulic pressure is 3,000-psi.

If a hydraulic pressure failure is set for both systems, the displayed pressure will drop to zero, and the annunciator warning 'HYD PRESSURE LOW' will be triggered.

Hydraulic (fluid) Quantity

Left and right engine hydraulic fluid reservoir quantity respectively.

In the real aircraft, the hydraulic (fluid) quantity range is zero to 18 quarts.

This is not modeled in the X-Plane MD-82 and has a permanent value of 16 quarts.

Flap position indicator

Indicates the current FLAP deployment in degrees.

Slat position indicator

Slats are leading edge flaps that allow the wing to operate at a higher angle of attack. The MD-82 slats move in unison with the flaps and are operated with the same (flap) lever.

T/O
: Set for take-off.

DISAG
: Left and right slat positions do not agree

AUTO
: Automatic deployment of slats has occurred to prevent a stall

LAND
: Slats are fully extended for landing (flaps are at 28 or 40 degrees).

Fuel QTY panel

This panel displays:

Fuel remaining in left-tank (in Kg.)

Fuel remaining in right-tank (in Kg.)

Fuel remaining in center-tank (in Kg.)

The current gross weight (in Kg.) of the aircraft (when on the ground).

Landing Gear Lever

Used to raise and lower the landing gear.

Move the lever up to raise the gear.

Move the lever down to lower the gear.

The status of the left, right, and nose landing gear is displayed by the three individual landing gear annunciators above the lever.

The annunciators will display green when the gear is down, and red when the gear is in the process of being raised. When the gear is fully raised, the annunciators are not illuminated.

VHF Nav Radios

This aircraft is equipped with two VHF navigation radios (VHF NAV 1) and VHF 2.

Use the rotary controls below each of the frequency displays to change the frequency.

Use the CRS rotary to set the desired VOR radial (where applicable).

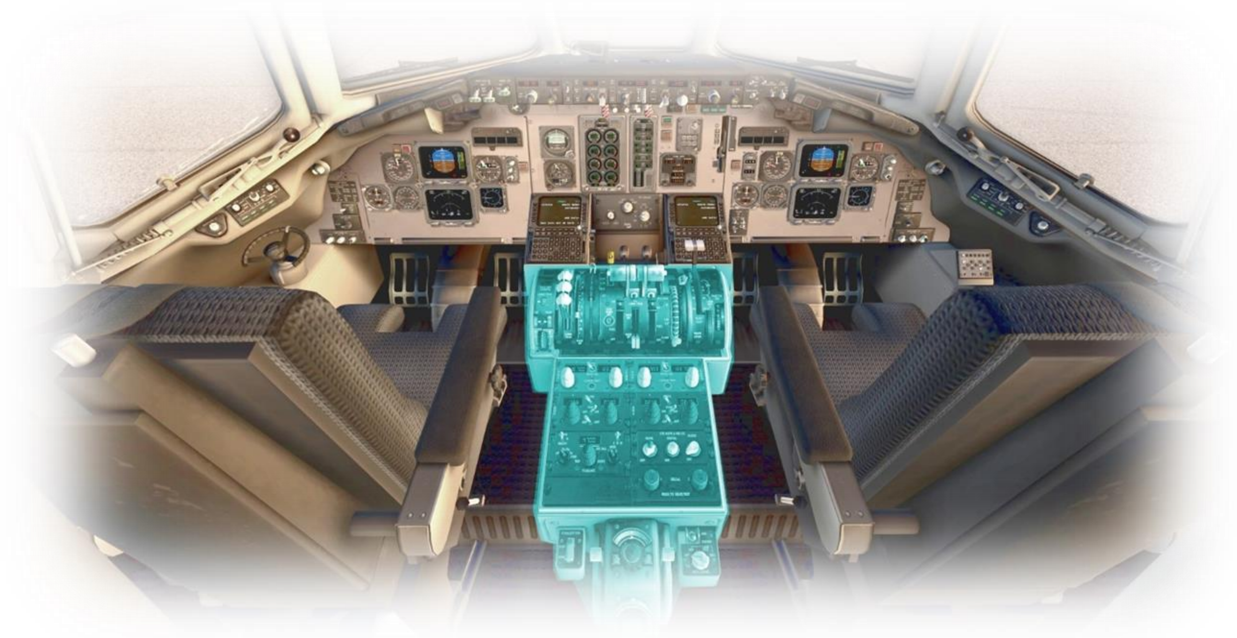
The course deflection indicator is built into the EHSI.

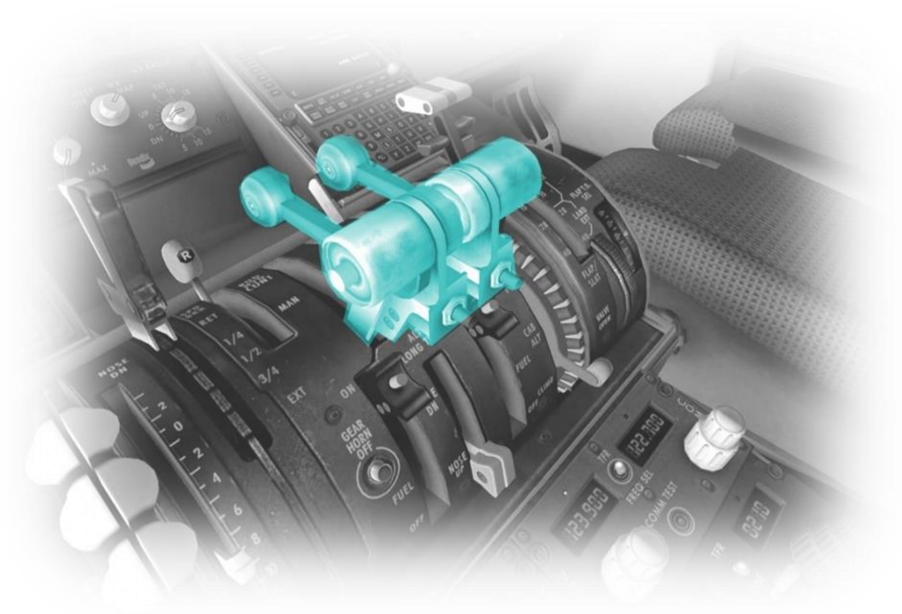
Use the 1-2 selector below the AP switch to toggle the NAV1 or NAV2 output to the EHSI:

FMS Control Display Units (CDUs)

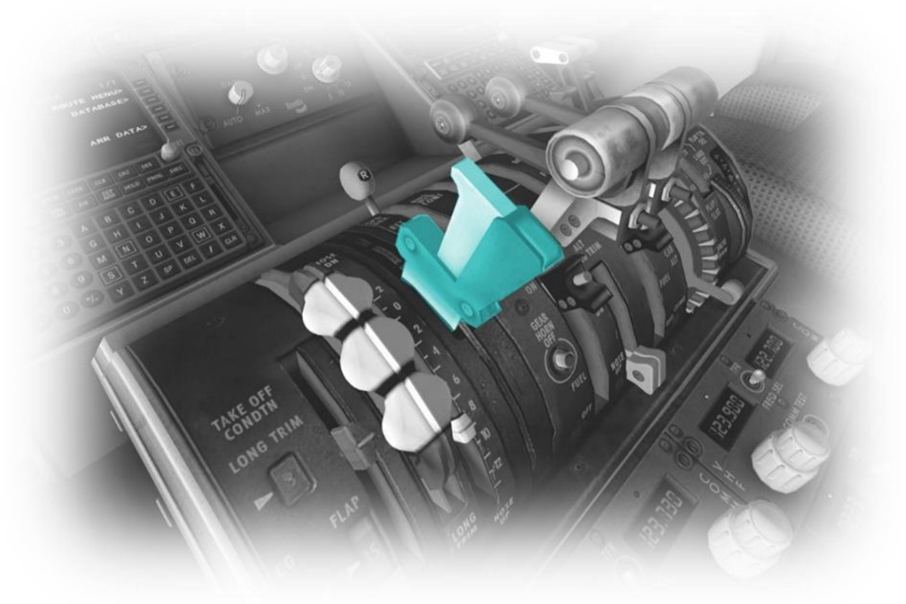
See the (separate) **X-Plane Flight Management System (FMS) Manual** for comprehensive instructions in relation to the function and operation of the Flight Management System installed in this aircraft.

Center Pedestal



Thrust Levers 	The MD-82 is equipped with dual thrust levers – which control the thrust generated by the left and right engines respectively. Also included in this unit are (smaller) reverse-thrust levers, located behind the (larger) thrust levers. Advance the thrust levers to increase thrust and retard them to reduce thrust. Pull the reverse thrust levers towards you to engage reverse thrust, and back to their resting position to disengage. Note: Jet engines do not respond instantaneously to changes in thrust settings, and take time to spool up or down, once the lever position has been set.

Speed Brake Lever



The MD-82 is equipped with speed brake levers, which deploy the speed brakes located on top of the wings.

Speed brakes are very effective at reducing lift generated by the wings and adding drag, and are usually deployed partially during descent, or fully at touchdown.

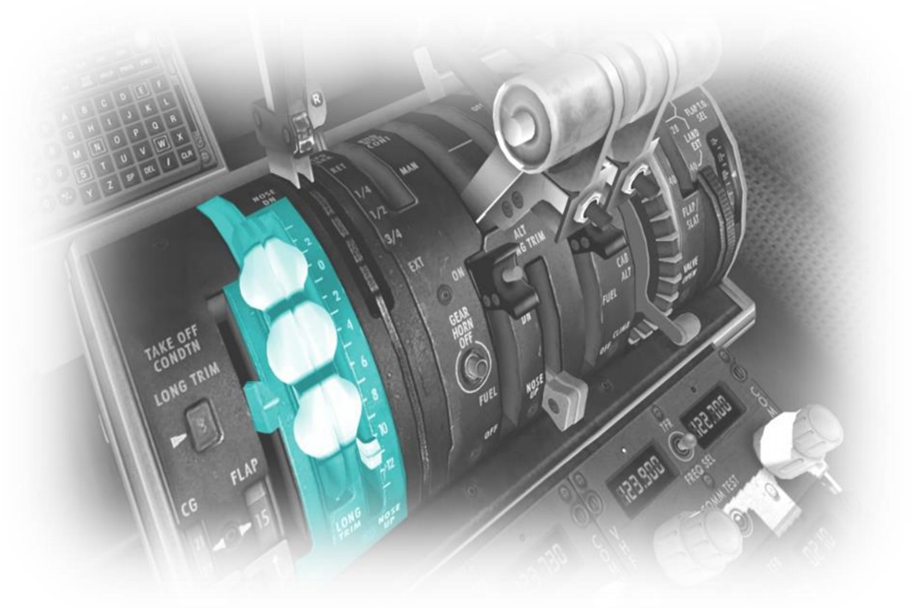
This lever provides for a linear extension of the speed brakes, with markers present for ¼, ½, ¾ and (fully) EXT(ended).

Flap Lever

The Flap Lever operates the wing flaps. Wing flaps change the contour of the wing. When extended, the flaps generate more lift, and more drag, which is beneficial during the takeoff and the landing phases of the flight.

This lever provides for a fixed extension of the flaps, at 0, 11, 15, 28 and 40 degrees.

Pitch Trim Wheel

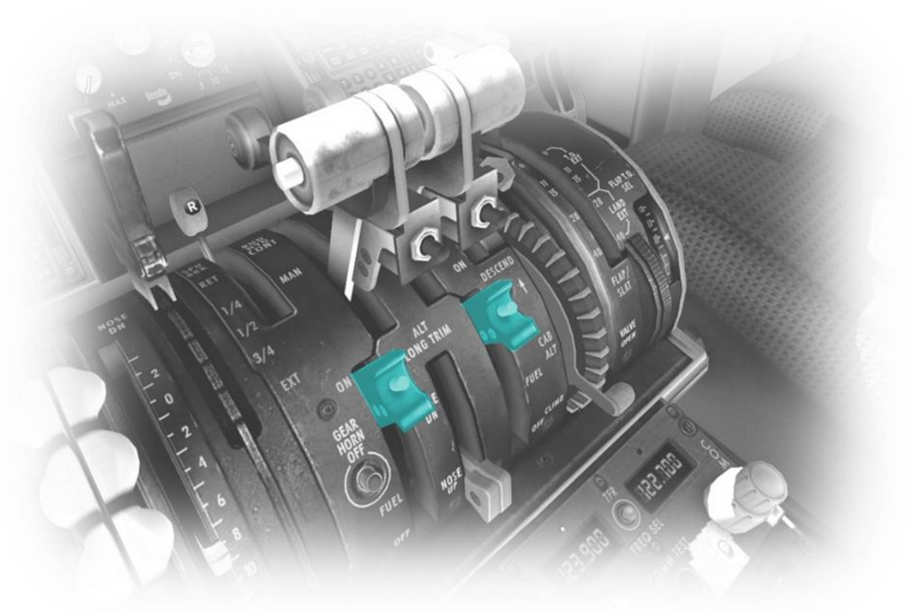


The elevator is a control surface built into the tail assembly and is used to pitch the aircraft up or down.

The Pitch Trim Wheel operates a trim tab that is built into the elevator. This control is used to relieve the pilot from continuous manual input to the elevator.

It is recommended the pilot assign an external peripheral axis to this control if one is available.

Fuel Control Levers



The Fuel Control Levers are manually actuated by the pilot to introduce fuel into the engines, or cut-off fuel from the engines.

During startup, the pilot moves the lever to the up position to introduce fuel when the jet turbine has achieved the desired rotation speed.

During shutdown, the pilot moves the lever to the down position to close the supply of fuel to the engine.

VHF (Comm) Radios

This aircraft is equipped with two communications radios (VHF 1 (on the left of the pedestal) and VHF 2 (on the right of the pedestal).

Use the toggle switch located between the frequency displays to select the active frequency (indicated by a green light)

Use the rotary controls below each of the frequency displays to change the frequency. The outer-rotary changes the numeric value, and the inner-rotary changes the decimal value.

See also [Audio Switching Panel.]

ADF Radios

This aircraft is equipped with two ADF (Automatic Direction Finder) radios (ADF1 on the left of the pedestal) and ADF2 (on the right of the pedestal).

These can be tuned to any Non-Directional Beacon (NDB) that is within range. It provides a direct course to or from the radio source, which is displayed by the needle on the ADF that is part of the [Primary Instrument Panels].

Audio Switching Panel

The switches on these panels (located to the left of the pilot, and right of the first officer, and on the overhead) are used to enable or disable audio from the selected radio and navigation devices. For example, if the VHF 1 switch is set to 'On' and the VHF 2 switch is set to 'Off', the pilot will transmit and receive audio using the VHF 1 radio.

Audio in this context is dependent on the selected device:

VHF Radios (Voice TX/RX)
Nav Radio (Morse)
ADF (Morse)
DME (Morse)
Marker Beacon (Morse)

Transponder Panel

The transponder works in conjunction with ATC radar, to identify the aircraft to controllers. When operating in controlled airspace, each aircraft is provided with a unique transponder code to accomplish this.

Use the outer-rotary control to adjust the transponder code up or down, in units of 100.

Use the inner-rotary control to adjust the transponder code up or down, in units of 1.

Set the transponder to STBY when operating on the ground, and XPDR when in flight.

Lighting Panel

Use the ‘PANEL’ rotary control to adjust the back-lighting of the analog instruments contains in the Primary Instrument Panels.

Use the ‘DIGITAL’ rotary control to adjust the intensity of the digital displays (radio frequencies, etc.).

Use the ‘FLOOD” rotary control to adjust the intensity of the overhead cockpit flood lighting.

Left and Right Pneumatic Cross-Feed Valve Levers

These levers are used to route pneumatic (air) pressure from the APU, GPU, or engine bleeds.

When these levers are in the open (up) position, and the aircraft is on the ground, air will be routed from the APU/GPU to the engine starters / air-conditioning packs.

After engine start, these levers are normally closed (down), which routes the engine bleed air to the air-conditioning packs.

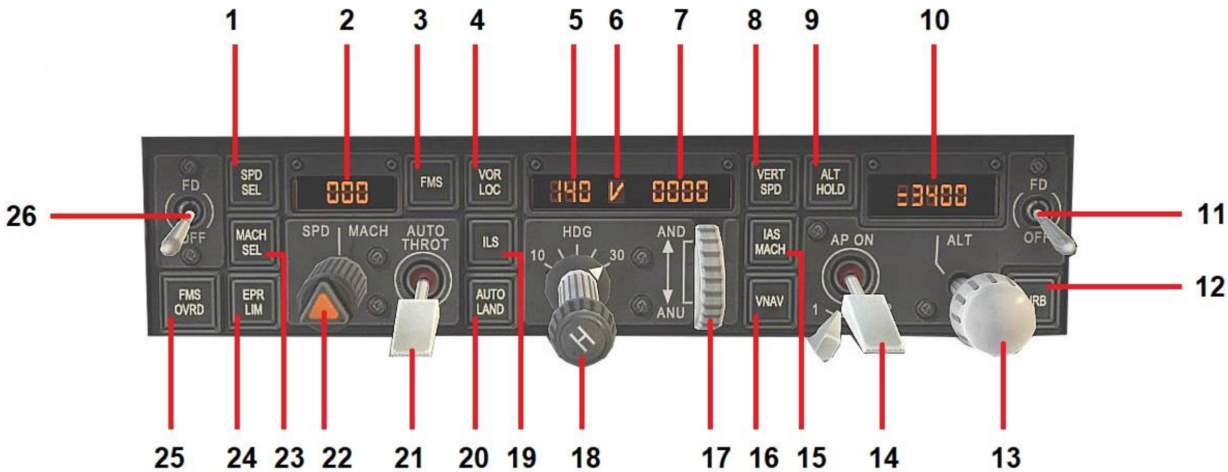
Automatic Braking System Control Panel

The Automatic Braking System applies brake pressure automatically during landing. This ensures the brakes are engaged at precisely the right time for optimum speed-reduction. This is particularly valuable when landing on a wet or snowy runway.

Set the toggle switch to 'Arm' to engage the auto brakes

Set the intensity of the braking using the adjacent rotary control.

Autopilot Operation



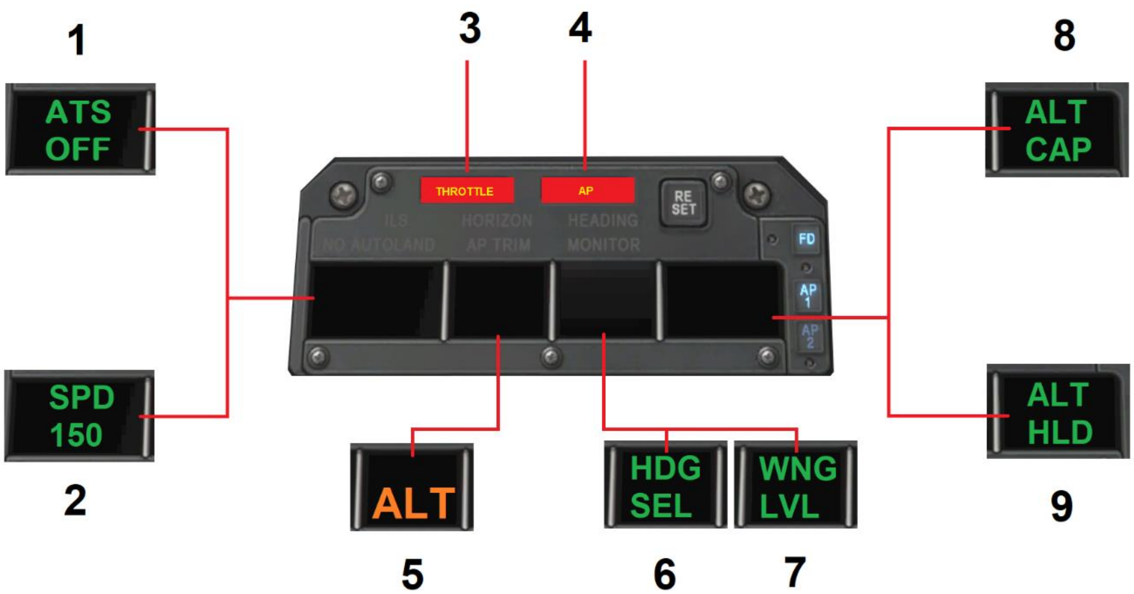
1	**SPD SEL**	**Speed Select Button** This button is used in conjunction with the Speed Select Rotary, and Auto Throttle. When engaged, the units for selected speed will be KIAS (Knots Indicated Airspeed).
2	**Selected Speed Display**	This display is used in conjunction with the Speed Select Button, and Auto-Throttle. When Auto-Throttle is engaged, the autopilot will govern the speed according to this value.
3	**FMS**	**Flight Management System (FMS) Button** This button is used in conjunction with a programmed flight plan. When engaged, the autopilot will steer the aircraft <u>laterally</u> according to that flight plan. For more information, see the (separate) 'Flight Management System' manual.
4	**VOR LOC**	**VOR / Localizer Button** This button is used in conjunction with the selected VHF / NAV 1 frequency panel (to the left of the autopilot panel). To intercept a VOR radial, the pilot selects the appropriate frequency (of the VOR navaid) and CRS (radial) then engages the VOR LOC button. To intercept an ILS localizer, the pilot selects the appropriate frequency (of the ILS) then engages the VOR LOC button. When intercepting an ILS localizer, the current aircraft situation must not exceed the autopilot's maximum input for bank-angle, otherwise intercept will fail.
5	**Selected Heading Display**	This display is used in conjunction with the Heading Select Rotary. When heading mode is engaged, the autopilot will steer the aircraft according to the value displayed here.

6 / 7	**Vertical Speed Display**	This display is used in conjunction with the Vertical Speed Rotary, and Vertical Speed Mode Button. When Vertical Speed Mode is engaged, the autopilot will govern the rate of ascent, or descent, according to this value. Note: Auto-throttle is normally engaged with this mode, to ensure the airspeed is correctly managed as the autopilot adjusts pitch to maintain the desired vertical speed.
8	**VERT SPD**	**Vertical Speed Mode Button** This button is used in conjunction with the Vertical Speed Mode button, and Vertical Speed Select Rotary. Click this button to engage Vertical Speed Mode. The autopilot will govern the rate of ascent, or descent, according to this value.
9	**ALT HOLD**	**Altitude Hold Button** This button is used in conjunction with the Selected Altitude Display. When engaged, the Selected Altitude Display will be set to the current altitude, and the autopilot will immediately level-off and hold this.
10	**Selected Altitude Display**	This display is used in conjunction with the Altitude Selection Rotary, Altitude Hold Button and Vertical Speed Button. When Altitude Capture is engaged, the autopilot will ascend, or descend to the altitude displayed here. When Altitude Hold is engaged, the autopilot will immediately level-off, and hold, the altitude displayed here.
11	**FD (First Officer)**	**Flight Director Toggle Switch** Use this switch to toggle the 'Flight Director' display on, or off. The flight director computes and displays the proper pitch and bank angles required for the aircraft to follow the desired flight plan. When the autopilot is engaged, the Flight Director Pitch and Bank Command bars) are always displayed on the EADI. However, when the autopilot is disengaged, these may be toggled on, or off (using this switch). The pilot can manually fly the aircraft according to the flight plan - by aligning the attitude indicator with the Pitch and Bank Command bars.
12	**TURB**	**Turbulence Mode Button** When engaged, the autopilot will allow for greater fluctuations in altitude before applying the necessary correction. This assists in passenger comfort, and fuel saving, when experiencing turbulence.
13	**ALT**	**Altitude Selection Rotary** This is a two-way control: Use the rotary to select the desired altitude to be captured by the autopilot (when in altitude capture mode). Pull the switch (mouse-click the center of the rotary) towards you to engage altitude capture mode. Push it away from you to disengage.

14	AP ON	**Autopilot Toggle Switch** This switch is used to toggle the autopilot on, or off. When the autopilot is on, the pilot must also select the desired mode of operation.
15	IAS MACH	**IAS / Mach Button** This button synchronizes the Selected Speed Display to the current speed (in either KIAS or Mach number), depending on the current mode.
16	VNAV	**VNAV (Vertical Navigation) Button**
17	AND (Adjust Nose Down) ANU (Adjust Nose Up)	**Vertical Speed Select Rotary** This rotary control is used in conjunction with the Vertical Speed Button and Vertical Speed Display. Use this rotary control to select the desired rate of ascent or descent, when the autopilot is in Vertical Speed mode.
18	HDG	**Heading Select / Bank Angle Rotary** This is a three-way control: The inner rotary is used to select the maximum bank angle that the autopilot will utilize. Options are between 10 degrees and 30 degrees. The outer rotary is used to select the desired heading (when the autopilot is in heading mode). Pull the switch (mouse-click the ‘H’) towards you to engage heading mode. Push it away from you to disengage.
19	ILS	**ILS Button** This button is used in conjunction with the selected VHF / NAV 1 frequency panel (to the left of the autopilot panel). To intercept an ILS localizer and glide-slope, the pilot selects the appropriate frequency (of the ILS) then engages the VOR LOC button. When intercepting an ILS localizer and glide-slope, the current aircraft situation must not exceed the autopilot’s maximum input for pitch and bank-angle, otherwise intercept will fail.
20	AUTO LAND	**Auto Land Button**
21	Auto Throttle Toggle Switch	This switch is used in conjunction with the Speed Select Rotary, and Selected Speed Display. Use this switch to toggle the Auto Throttle on, or off. When Auto Throttle is engaged, the autopilot has command of the throttles, and will govern the airspeed according to the value indicated by the Selected Speed Display.

22	**SPD | MACH**	**Speed Select Rotary** This rotary control is used in conjunction with the Auto Throttle Toggle Switch. When the Auto Throttle is engaged, the autopilot will govern the airspeed according to the selected value here (displayed immediately above the rotary). The selected value may be in KIAS (Knots Indicated Airspeed) or Mach number (depending on the chosen mode).
23	**MACH SEL**	**Mach (number) Select Button** This button is used in conjunction with the Speed Select Rotary, and Auto Throttle. When engaged, the units for selected speed will be Mach Number.
24	**EPR LIM Button**	Not Modeled
25	**FMS OVRD Button**	Not Modeled
26	**FD (Pilot)**	**Flight Director Toggle Switch** Use this switch to toggle the 'Flight Director' display on, or off. The flight director computes and displays the proper pitch and bank angles required for the aircraft to follow the desired flight plan. When the autopilot is engaged, the Flight Director Pitch and Bank Command bars) are always displayed on the EADI. However, when the autopilot is disengaged, these may be toggled on, or off (using this switch). The pilot can manually fly the aircraft according to the flight plan - by aligning the attitude indicator with the Pitch and Bank Command bars.

Autopilot Annunciator



1	**ATS OFF**	Auto-Throttle system is OFF.
2	**SPD (value)**	Auto-Throttle is engaged and will maintain THIS pre-selected speed.
3	**THROTTLE**	Auto-pilot is ON, but Auto-Throttle is OFF. A potentially dangerous situation.
4	**AP**	Illuminated for a few seconds immediately after auto-pilot is disengaged.
5	**ALT**	Illuminated when a pre-selected altitude is in effect, the auto-pilot is in altitude capture mode, and the aircraft is climbing or descending to that altitude. When the altitude is captured, this annunciator is cancelled.
6	**HDG SEL**	Heading-mode is engaged. Auto-pilot is steering aircraft according to the pre-selected heading.
7	**WNG LVL**	Auto-pilot is engaged and maintaining a wings-level attitude. Auto-pilot is not steering according to a pre-selected heading.
8	**ALT CAP**	Illuminated when the autopilot is climbing, or descending, to a pre-selected altitude.
9	**ALT HLD**	Illuminated when the autopilot is maintaining a pre-selected altitude.

Flight Planning

Flight planning is the process of determining a route from origin to destination that considers fuel requirements, terrain avoidance, Air Traffic Control, aircraft performance, airspace restrictions and notices to airmen (NOTAMS).

General information about flight plans is available on Wikipedia at http://en.wikipedia.org/wiki/Flight_planning

Flight plans can be generated by onboard computers if the aircraft is suitably equipped. If not, simulation pilots may elect to use an online flight planner. A web search for the phrase “Flight Planner” will yield a great many options, many of which are free services.

A good online flight planner will utilize the origin and destination airports, together with the aircraft type and equipment, the weather conditions, the chosen cruise altitude, known restrictions along the route, current NOTAMS, and other factors to generate a suitable flight plan. The waypoints incorporated into the flight plan can be subsequently input into the aircraft’s Flight Management Computer (FMS), or Global Positioning System (GPS). Some online flight planners provide the option to save the plan as an X-Plane compatible file, with an ‘fms’ extension. A saved flight plan can be loaded into the GPS or Flight Management Computer unit featured in the MD-82.

It is recommended the pilot generate a flight plan for the chosen route before using the FMS or GPS units.

Instructions for operating the Laminar Research FMS and GPS units can be found in separate (dedicated) manuals.

Fuel Calculation

Note: All calculations here are based on the X-Plane MD-82, and NOT the real-life MD-82. Differences may exist.

Taxi Fuel

The estimated fuel required to taxi from the startup location to the active runway at the origin, plus the estimated fuel required to taxi from the active runway to the shutdown location at the destination. This is dependent on the ground route that will be followed, and the traffic at the airports in question. The pilot must use his or her judgement to determine the total taxi time. Once this has been estimated, use the following lookup table to determine the amount of fuel required.

Taxi Fuel Table

Taxi Time (minutes)	Fuel Flow (lbs. / hour)	Total Fuel Weight (lbs.)	Total Fuel Weight (Kgs)
10	3600	600	272
20	3600	1200	544
30	3600	1800	816
40	3600	2400	1089
50	3600	3000	1361
60	3600	3600	1633

Trip Fuel

The estimated fuel required to complete the cruise portion of the trip. This will be a factor of the expected elapsed time for the flight, which will be provided by your chosen online flight planner. Once this has been calculated, use the following lookup table to determine the amount of fuel required.

Trip Fuel Table

Flight Time (minutes)	Fuel Flow (lbs. / hour)	Total Fuel Weight (lbs.)	Total Fuel Weight (Kgs)
20	5500	1833	
40	5500	3667	
60	5500	5500	
80	5500	7333	
100	5500	9167	
120	5500	11000	
140	5500	12833	
160	5500	14667	
180	5500	16500	
200	5500	18333	
220	5500	20166	
240	5500	22000	
260	5500	23833	

Load Sheet

Proper weight and balance control is crucial to the safe operation of any aircraft. Two elements are vital in this process:

Total Weight

This must be no greater than the maximum allowed by the regulatory body that oversees the operation of the aircraft. In the United States, this is the Federal Aviation Administration (FAA).

Center of Gravity (CG)

The point at which all weight is concentrated. This must be within the allowable range published for the aircraft in question.

Load Sheet Tables

The table below illustrates a series of hypothetical load-sheet scenarios. For practicality purposes, this table does not include taxi-time, which is dependent on the distance from the gate to the runway, and therefore unknown. To correct for this, choose the row that most closely matches your flight scenario, and then move down the appropriate number of rows to include the necessary fuel contingency.

Flight Time (Minutes)	Total Fuel (lbs.)	Left Wing Tank (lbs.)	Right Wing Tank (lbs.)	Center Tank (bls.)	PAX Fwd	PAX Aft	Cargo Fwd (A)	Cargo Fwd (B)	Cargo Mid (C)	Cargo Aft (D)	Payload (lbs.)	CG %MAC	X-Plane CG (in.)
20	1833	266	267	1300	25		500				5325	+19.3	+7.5
40	3667	458	459	2750	25		500				5325	+19.0	+7.0
60	5500	687	688	4125	25		500				5325	+18.8	+6.6
80	7333	916	917	5500	25		500				5325	+18.7	+6.5
100	9167	1146	1146	6875	25		500				5325	+18.5	+6.1
120	11000	1375	1375	8250	25		500				5325	+18.3	+5.8
140	12833	1604	1604	9625	25		500				5325	+18.2	+5.6
160	14667	1833	1834	11000	25		500				5325	+18.0	+5.3
180	16500	2062	2063	12375	25		500				5325	+17.9	+5.1
200	18333	2291	2292	13750	25		500				5325	+17.7	+4.8
220	20166	2521	2521	15124	25		500				5325	+17.6	+4.6
240	22000	2750	2750	16500	25		500				5325	+17.4	+4.33
260	23833	2979	2979	17875	25		500				5325	+17.3	+4.1

Flight Time (Minutes)	Total Fuel (lbs.)	Left Wing Tank (lbs.)	Right Wing Tank (lbs.)	Center Tank (bls.)	PAX Fwd	PAX Aft	Cargo Fwd (A)	Cargo Fwd (B)	Cargo Mid (C)	Cargo Aft (D)	Payload (lbs.)	CG %MAC	X-Plane CG (in.)
20	1833	266	267	1300	25	25	500			500	10650	+23.1	+13.8
40	3667	458	459	2750	25	25	500			500	10650	+22.8	+13.3
60	5500	687	688	4125	25	25	500			500	10650	+22.5	+12.8
80	7333	916	917	5500	25	25	500			500	10650	+22.3	+12.5
100	9167	1146	1146	6875	25	25	500			500	10650	+22.1	+12.1
120	11000	1375	1375	8250	25	25	500			500	10650	+21.8	+11.6
140	12833	1604	1604	9625	25	25	500			500	10650	+21.6	+11.3
160	14667	1833	1834	11000	25	25	500			500	10650	+21.4	+11.0
180	16500	2062	2063	12375	25	25	500			500	10650	+21.2	+10.6
200	18333	2291	2292	13750	25	25	500			500	10650	+21.0	+10.3
220	20166	2521	2521	15124	25	25	500			500	10650	+20.8	+10.0
240	22000	2750	2750	16500	25	25	500			500	10650	+20.7	+9.8
260	23833	2979	2979	17875	25	25	500			500	10650	+20.5	+9.5

Flight Time (Minutes)	Total Fuel (lbs.)	Left Wing Tank (lbs.)	Right Wing Tank (lbs.)	Center Tank (bls.)	PAX Fwd	PAX Aft	Cargo Fwd (A)	Cargo Fwd (B)	Cargo Mid (C)	Cargo Aft (D)	Payload (lbs.)	CG %MAC	X-Plane CG (in.)
20	1833	266	267	1300	50	25	1000			500	15975	+7.6	-12.0
40	3667	458	459	2750	50	25	1000			500	15975	+7.7	-11.8
60	5500	687	688	4125	50	25	1000			500	15975	+7.7	-11.8
80	7333	916	917	5500	50	25	1000			500	15975	+7.7	-11.8
100	9167	1146	1146	6875	50	25	1000			500	15975	+7.8	-11.6
120	11000	1375	1375	8250	50	25	1000			500	15975	+7.8	-11.6
140	12833	1604	1604	9625	50	25	1000			500	15975	+7.9	-11.4
160	14667	1833	1834	11000	50	25	1000			500	15975	+7.9	-11.4
180	16500	2062	2063	12375	50	25	1000			500	15975	+7.9	-11.4
200	18333	2291	2292	13750	50	25	1000			500	15975	+8.0	-11.3
220	20166	2521	2521	15124	50	25	1000			500	15975	+8.0	-11.3
240	22000	2750	2750	16500	50	25	1000			500	15975	+8.0	-11.3
260	23833	2979	2979	17875	50	25	1000			500	15975	+8.1	-11.1

Flight Time (Minutes)	Total Fuel (lbs.)	Left Wing Tank (lbs.)	Right Wing Tank (lbs.)	Center Tank (bls.)	PAX Fwd	PAX Aft	Cargo Fwd (A)	Cargo Fwd (B)	Cargo Mid (C)	Cargo Aft (D)	Payload (lbs.)	CG %MAC	X-Plane CG (in.)
20	1833	266	267	1300	50	50	1000			1000	21300	+11.7	-5.1
40	3667	458	459	2750	50	50	1000			1000	21300	+11.6	-5.3
60	5500	687	688	4125	50	50	1000			1000	21300	+11.6	-5.3
80	7333	916	917	5500	50	50	1000			1000	21300	+11.6	-5.3
100	9167	1146	1146	6875	50	50	1000			1000	21300	+11.5	-5.4
120	11000	1375	1375	8250	50	50	1000			1000	21300	+11.5	-5.4
140	12833	1604	1604	9625	50	50	1000			1000	21300	+11.5	-5.4
160	14667	1833	1834	11000	50	50	1000			1000	21300	+11.5	-5.4
180	16500	2062	2063	12375	50	50	1000			1000	21300	+11.4	-5.6
200	18333	2291	2292	13750	50	50	1000			1000	21300	+11.4	-5.6
220	20166	2521	2521	15124	50	50	1000			1000	21300	+11.4	-5.6
240	22000	2750	2750	16500	50	50	1000			1000	21300	+11.4	-5.6
260	23833	2979	2979	17875	50	50	1000			1000	21300	+11.4	-5.6

Flight Time (Minutes)	Total Fuel (lbs.)	Left Wing Tank (lbs.)	Right Wing Tank (lbs.)	Center Tank (bls.)	PAX Fwd	PAX Aft	Cargo Fwd (A)	Cargo Fwd (B)	Cargo Mid (C)	Cargo Aft (D)	Payload (lbs.)	CG %MAC	X-Plane CG (in.)
20	1833	266	267	1300	75	50	1000	500		1000	26625		
40	3667	458	459	2750	75	50	1000	500		1000	26625		
60	5500	687	688	4125	75	50	1000	500		1000	26625	-0.8	-26.0
80	7333	916	917	5500	75	50	1000	500		1000	26625	-0.6	-25.6
100	9167	1146	1146	6875	75	50	1000	500		1000	26625	-0.4	-25.3
120	11000	1375	1375	8250	75	50	1000	500		1000	26625	-0.3	-25.1
140	12833	1604	1604	9625	75	50	1000	500		1000	26625	-0.1	-24.8
160	14667	1833	1834	11000	75	50	1000	500		1000	26625	+0.0	-24.6
180	16500	2062	2063	12375	75	50	1000	500		1000	26625	+0.2	-24.3
200	18333	2291	2292	13750	75	50	1000	500		1000	26625	+0.3	-24.1
220	20166	2521	2521	15124	75	50	1000	500		1000	26625	+0.5	-23.8
240	22000	2750	2750	16500	75	50	1000	500		1000	26625	+0.6	-23.6
260	23833	2979	2979	17875	75	50	1000	500		1000	26625	+0.7	-23.4

Flight Time (Minutes)	Total Fuel (lbs.)	Left Wing Tank (lbs.)	Right Wing Tank (lbs.)	Center Tank (bls.)	PAX Fwd	PAX Aft	Cargo Fwd (A)	Cargo Fwd (B)	Cargo Mid (C)	Cargo Aft (D)	Payload (lbs.)	CG %MAC	X-Plane CG (in.)
20	1833	266	267	1300	75	75	1000	1000		1000	31950	+1.0	-22.9
40	3667	458	459	2750	75	75	1000	1000		1000	31950	+1.1	-22.8
60	5500	687	688	4125	75	75	1000	1000		1000	31950	+1.2	-22.6
80	7333	916	917	5500	75	75	1000	1000		1000	31950	+1.4	-22.3
100	9167	1146	1146	6875	75	75	1000	1000		1000	31950	+1.5	-22.1
120	11000	1375	1375	8250	75	75	1000	1000		1000	31950	+1.6	-21.9
140	12833	1604	1604	9625	75	75	1000	1000		1000	31950	+1.8	-21.6
160	14667	1833	1834	11000	75	75	1000	1000		1000	31950	+1.9	-21.4
180	16500	2062	2063	12375	75	75	1000	1000		1000	31950	+2.0	-21.3
200	18333	2291	2292	13750	75	75	1000	1000		1000	31950	+2.1	-21.1
220	20166	2521	2521	15124	75	75	1000	1000		1000	31950	+2.2	-20.9
240	22000	2750	2750	16500	75	75	1000	1000		1000	31950	+2.3	-20.8
260	23833	2979	2979	17875	75	75	1000	1000		1000	31950	+2.4	-20.6

Flight Time (Minutes)	Total Fuel (lbs.)	Left Wing Tank (lbs.)	Right Wing Tank (lbs.)	Center Tank (bls.)	PAX Fwd	PAX Aft	Cargo Fwd (A)	Cargo Fwd (B)	Cargo Mid (C)	Cargo Aft (D)	Payload (lbs.)	CG %MAC	X-Plane CG (in.)
20	1833	266	267	1300	85	80		300	1000	2000	35145	+2.6	-20.3
40	3667	458	459	2750	85	80		300	1000	2000	35145	+2.7	-20.1
60	5500	687	688	4125	85	80		300	1000	2000	35145	+2.8	-19.9
80	7333	916	917	5500	85	80		300	1000	2000	35145	+3.0	-19.6
100	9167	1146	1146	6875	85	80		300	1000	2000	35145	+3.1	-19.4
120	11000	1375	1375	8250	85	80		300	1000	2000	35145	+3.2	-19.3
140	12833	1604	1604	9625	85	80		300	1000	2000	35145	+3.3	-19.1
160	14667	1833	1834	11000	85	80		300	1000	2000	35145	+3.4	-18.9
180	16500	2062	2063	12375	85	80		300	1000	2000	35145	+3.5	-18.8
200	18333	2291	2292	13750	85	80		300	1000	2000	35145	+3.5	-18.8
220	20166	2521	2521	15124	85	80		300	1000	2000	35145	+3.6	-18.6
240	22000	2750	2750	16500	85	80		300	1000	2000	35145	+3.7	-18.4
260	23833	2979	2979	17875	85	80		300	1000	2000	35145	+3.8	-18.3

Setting the Weight, Balance and Fuel in X-Plane

After calculating your fuel requirements (see Fuel Calculation) and referencing the Load Sheet Tables, you are ready to configure the weight, balance and fuel for your upcoming flight. Select the MD-82 from the flight menu, and click on the 'Customize' button, followed by the 'Weight, Balance & Fuel' button. Now input the Center of Gravity, Payload Weight, Fuel Weight (Fuel Tank 1) and Fuel Weight (Fuel Tank 2) and Fuel Weight (Fuel Tank 3).

The example below is for the scenario highlighted in blue in the Load Sheet Tables.

Checklists

The following check lists are designed with the convenience of the simulation pilot in mind, and customized to the X-Plane MD-82 aircraft. These differ from those of the real aircraft.

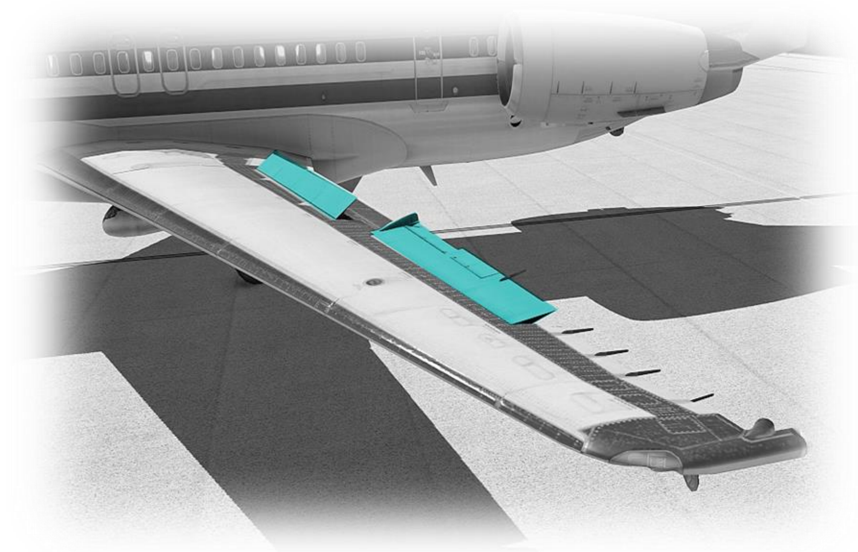
Pre-Flight Exterior Inspection

A Pre-Flight Inspection should always precede flight in any aircraft. The purpose of this inspection is to ensure the aircraft is in a state of readiness for the upcoming flight.

In X-Plane, a pre-flight inspection is not merely undertaken to simulate reality, but does in fact have real purpose, because the control surfaces of the aircraft interact directly with the airflow over and around them, just as in real life. As such, correct movement of all control surfaces is necessary for normal flight.

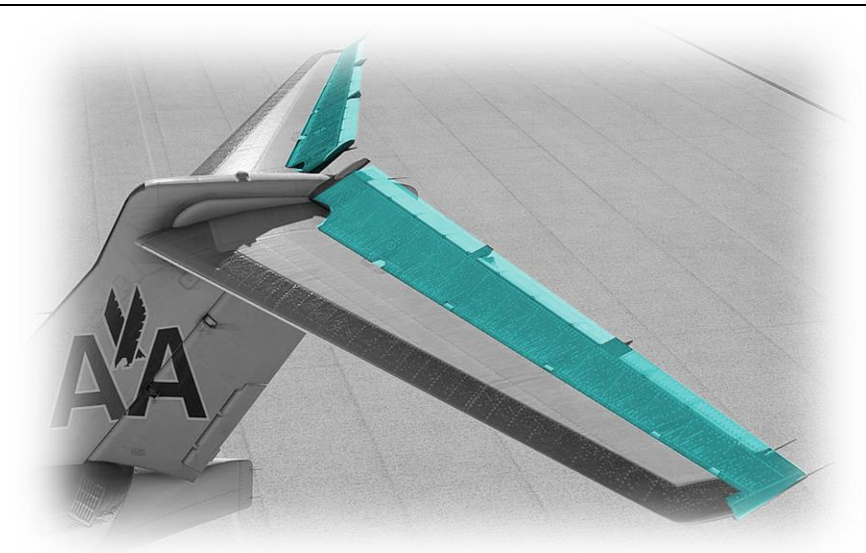
Hold roll axis at full deflection.

Visually check corresponding movement of ailerons and speed-brakes.



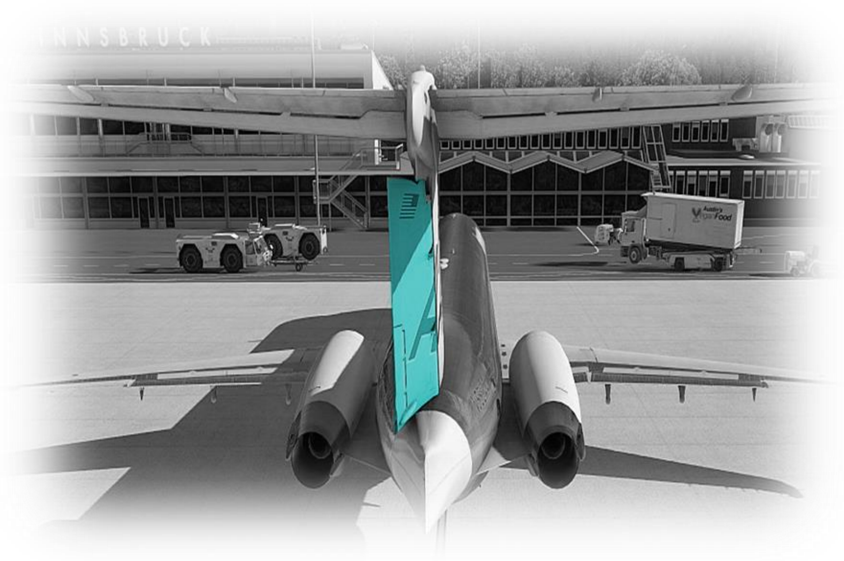
Hold pitch axis at full deflection.

Visually check corresponding movement of elevators.



Hold yaw axis at full deflection.

Visually check corresponding movement of rudder.



Visually check cargo doors are closed.

Cargo doors are opened and closed via the overhead panel.

See: Cargo Doors Control Panel

Visually check main (outer) door is closed.

This is actuated using the lever on the inside of the door.

Entry to the cabin is facilitated by unlocking the cockpit door.

See: Miscellaneous Panel

Cold and Dark to Engine Start

PARKING BRAKE – CHECK ON (UP) See: Tiller and Parking Brake	
BATTERY MASTER – ON See: Battery Master / APU Control Panel	
ENGINE START PUMP – ON See: Engine and Fuel Pumps / Engine Start Panel	
APU MASTER – START (then RUN) See: Battery Master / APU Control Panel	

Wait for ‘APU Power Available’ illumination See: APU / External Power Bus Panel	
APU LEFT BUS – ON APU RIGHT BUS – ON See: APU / External Power Bus Panel	
LEFT GENERATOR – ON RIGHT GENERATOR – ON See: Electrical Panel	
APU (BLEED) AIR – ON See: Battery Master / APU Control Panel	

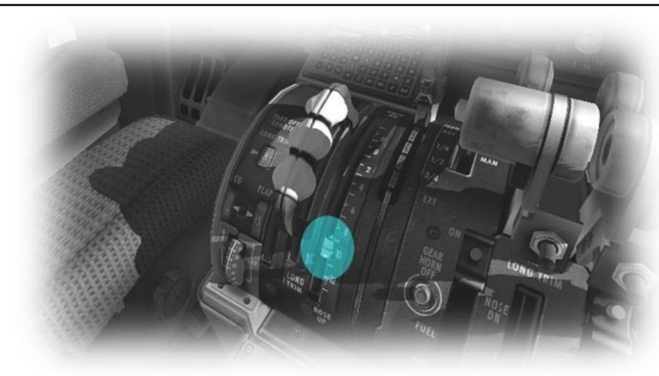
PNEUMATIC CROSS VALVES – OPEN (UP) See: Left and Right Pneumatic Cross-Feed Valve Levers	
AUX TRANSFER PUMP – ON	
LEFT FUEL PUMPS – ON CENTER FUEL PUMPS – ON RIGHT FUEL PUMPS – ON	
ENGINE START SYSTEM – SELECT (A or B) See: Engine and Fuel Pumps / Engine Start Panel	

RIGHT ENGINE – START (HOLD for 20% N2 Rotation) 	
RIGHT FUEL CONTROL LEVER – UP (ON)	
LEFT ENGINE – START (HOLD for 20% N2 Rotation) 	
LEFT FUEL CONTROL LEVER – UP (ON)	

ENGINE START PUMP – OFF See: Engine and Fuel Pumps / Engine Start Panel	
AC BUS X-TIE - AUTO	
APU BUS LEFT-OFF APU BUS RIGHT-OFF	
APU (BLEED) AIR – OFF See: Battery Master / APU Control Panel	

APU MASTER – OFF See: Battery Master / APU Control Panel	

Before Taxi

SEATBELT SIGN - ON	
ELEVATOR TRIM – SET FOR TAKEOFF (+ 10 Degrees) See: Assigning peripheral devices	
FLAPS – SET (15 Degrees)	
FLIGHT CONTROLS – CHECKED (Pitch / Roll / Yaw) See: Assigning peripheral devices	

SPEED BUGS – SET (Mouse-click and drag the bugs) V1 = 125 KIAS VR = 130 KIAS V2 = 139 KIAS V (Flaps Up) = 150 KIAS See: Airspeed Indicator	
NOSE / TAXI LIGHTS - ON	
TRANSPONDER - STBY	

PITOT HEAT – CAPT	
PARKING BRAKE – OFF See: Tiller and Parking Brake	

Before Takeoff

ALTIMETER - SET	
ENGINE START SYSTEM – OVERRIDE See: Engine and Fuel Pumps / Engine Start Panel	
ANNUNCIATOR PANEL – CHECKED See: Annunciator Panel	

<table>
<tr>
<td>TRANSPONDER - XPDR</td>
<td></td>
</tr>
<tr>
<td>WING / LANDING LIGHTS – ON

NOSE / TAXI LIGHTS – OFF</td>
<td>
</td>
</tr>
</table>

After Takeoff

LANDING GEAR – UP	
FLAPS – RETRACTED	
THRUST – SET AS REQUIRED	
ENGINE START SYSTEM – OFF [See: Engine and Fuel Pumps / Engine Start Panel]()	

Cruise

<table>
<tr><td>SEATBELT SIGN - OFF</td><td></td></tr>
<tr><td>WING / LANDING LIGHTS - OFF</td><td>
</td></tr>
<tr><td>ALTIMETER - SET</td><td>
</td></tr>
</table>

Before Landing

SEATBELT SIGN - ON	
ALTIMETER - SET	
WING / LANDING LIGHTS - ON	

NAV RADIOS – SET	

Landing

SPEED BRAKES – SET AS REQUIRED	
FLAPS – SET AS REQUIRED	
LANDING GEAR – DOWN	

<table>
<tr>
<td>ENGINE START SYSTEM – OVRD

See: Engine and Fuel Pumps / Engine Start Panel</td>
<td>
</td>
</tr>
<tr>
<td>ANNUNCIATOR PANEL – CHECKED

See: Annunciator Panel</td>
<td></td>
</tr>
</table>

After Landing

FLAPS – SET (15 Degrees)	
SPEED BRAKES – RETRACTED	
WING / LANDING LIGHTS – OFF NOSE / TAXI LIGHTS – ON	
TRANSPONDER - STBY	

Parking

PARKING BRAKE – ON See: Tiller and Parking Brake	
SEATBELT SIGN - OFF	
FLAPS – RETRACTED	
FUEL CONTROL LEVERS – DOWN (OFF)	

LEFT FUEL PUMPS – OFF CENTER FUEL PUMPS – OFF RIGHT FUEL PUMPS – OFF3	
AUX TRANSFER PUMP – OFF	
AC BUS X-TIE - OPEN	
PNEUMATIC CROSS VALVES – CLOSED (DOWN) See: Left and Right Pneumatic Cross-Feed Valve Levers	

PITOT HEAT – OFF	
ENGINE START SYSTEM – OFF See: Engine and Fuel Pumps / Engine Start Panel	
LEFT GENERATOR – OFF RIGHT GENERATOR – OFF See: Electrical Panel	
BATTERY MASTER – OFF See: Battery Master / APU Control Panel