Airbus A320

FSX Flight Deck Panel

Documentation

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INSTALLATION

If you are reading this you have already unzipped the ZIP file. To install the panel on any aircraft simply copy the panel.cfg and A320V1.cab to the aircraft directory either replacing the existing panel sub-directory or as "panel.XX" where XX is the name on the "panel=" entry in the aircraft.cfg.

Many aircraft.cfg files have errors and omissions which need correction before this panel can be used successfully.

[Electrical]

Max_battery_voltage should = 28 not 24
Generator_alternator_voltage can also 28 although 30 is also OK.

[Flaps]

Most A320 FSX aircraft have only four flap positions but the real aircraft effectively has five. Airbus uses an unusual flaps deployment system where one deployment of the flaps goes immediately to Flaps 1+F (Position 2) which is takeoff configuration. This is correctly modelled in this panel provided the following changes are made.

To achieve a realistic Airbus flaps system the following flaps-position.n text should replace both the Flaps.0 and Flaps.1 flaps-position.n entries in the aircraft.cfg. Other lines under [Flaps] need not be changed.

Under [flaps.0]:
flaps-position.0	= 0	//F0 // degrees
flaps-position.1	= 0	//F1 // degrees
flaps-position.2	= 10	//F1+F // degrees
flaps-position.3	= 15	//F2 // degrees
flaps-position.4	= 20	//F3 // degrees
flaps-position.5	= 35	//F4 // degrees

Under [flaps.1]:
flaps-position.0	= 0
flaps-position.1	= 18
flaps-position.2	= 18
flaps-position.3	= 22
flaps-position.4	= 22
flaps-position.5	= 25

Corrections to the [Flaps] section are essential for the Flaps indication on the E/WD to work correctly.

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[Hydraulic_System]

For the Hydraulic system to work correctly the following lines should be present:
Normal_pressure=3000
Electric_pumps=1
Engine_map=1,1,0,0

[Radios]

The Airbus A320 has two ADF radios for Captain and First Officer. The GPS supplied with this panel can support two ADF radios but only if the following line is added under the [Radios] section:

Adf.2=1

[Autopilot]

Ensure that the autopilot section of the aircraft.cfg has the entry:
```
yaw_damper_gain = 1.0
```

It is also recommended to ensure that default_vertical_speed is set to 1800.

Jetways

Jetways work OK on the default model however for other models such as the iFdg model you need to change the [exits] section to the following:

```
[exits]
number_of_exits = 2
exit.0 = 0.4,  45.50, -6.5, 2.5, 0  //openclose rate percent per second,
longitudinal, lateral, vertical positions from datum (feet), type (0=Main
1=Cargo 2=Emergency)
exit.1 = 0.4, -33.50, 5.85, 0.0, 1  //openclose rate percent per second,
longitudinal, lateral, vertical positions from datum (feet), type (0=Main
1=Cargo 2=Emergency)
```

This can be used for any aircraft even if doors are not defined but the numbers may need adjusting under exit.0 to correctly position the Jetway.

[Fuel]

For the fuel system to work correctly the number_of_tank_selectors must be 2 and electric_pump should equal 1.

Note that although the default aircraft has a fuel_dump_rate parameter, this aircraft does not have a fuel dump feature.

[Deice_system]

For the wing de-icing switch to work ensure that structural_deice_type is greater than zero.

It is recommended to study the instructions before using this complex panel. It may seem daunting however there are many useful hidden features described below.

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The GPSNEW Garmin GPS 500 Replacement

This gauge is supplied as part of this package together with the standard manual that goes with it. The only significant change compared to the gauge that is available separately is the extra ADF radio. If you have this gauge already installed then this gauge can replace the one already installed. If not this gauge (GPSNEW.CAB) can be installed either in the \gauges folder to share with other aircraft or in the \panel folder for this aircraft.

As this gauge is integrated into this panel there is no need to follow the installation instructions in the GPS Manual.

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INSTRUCTIONS

Introduction

This is my first Airbus panel having previously developed all Boeing panels. The different design philosophy of Airbus was very apparent during development and many of the gauges are much less complex than the equivalent Boeing gauges. Airbus design philosophy includes a very high level of automation which means that many functions present in Boeing aircraft panels are hidden in the Airbus panel. Normally on the real Aircraft virtually all functions are controlled through the Flight Management Computer (FMC) however in this simulation the pilot needs to do most of these functions manually (e.g. operate Autopilot, tune radios etc.)

This panel has been developed for the default Airbus A321 and also tested on the Ifdg A321 however should work on any aircraft. The panel itself is based on a partial Airbus A320 Operations Manual as this was the only manual available. There should be very few differences between the A320 and A321. All references following to the A320 also apply if the panel is used with other models.

All gauges are newly designed and specific to the Airbus A320. Features include a full set of ECAM displays, Terrain maps, TAWS maps, and includes a new version of my GPS 500 replacement gauge which has an extra ADF radio tuner.

This panel was developed on FSX Accelerator edition and designed for a 1920X1080 screen but is scaleable to other sizes. Many gauges may be difficult to read on a small screen however and a large screen is recommended.

The panel also includes a Virtual Cockpit which works with the virtual cockpit on the default A321. Note that some gauges have had to be adapted for the Virtual Cockpit and not all features described in this manual will work in the Virtual Cockpit. In particular the mouse functions described under Throttle Quadrant do not work in the Virtual Cockpit.

This panel will switch between kilograms and pounds for fuel weights based on the FSX setting.

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Flight Phases

Airbus defines a series of 10 Flight phases which are used to define each phase of the flight. These flight phases also define when certain messages appear on the E/WD. The beginning of each Flight Phase is defined as follows:

Phase 1:   On ground, Electrical power on, Engines Off
Phase 2:   On ground, First Engine Started
Phase 3:   On ground, Takeoff Power applied
Phase 4:   On ground, 80 knots Airspeed
Phase 5:   Lift Off
Phase 6:   1500 feet Radio Altitude
Phase 7:   800 feet Radio Altitude
Phase 8:   Touchdown
Phase 9:   On ground, 80 knots Airspeed
Phase 10:   Both engines shutdown

Note that as FSX always starts with engines running the initial Flight Phase will be 2. It will revert to Flight Phase 1 when the engines are shut down.

Technical Issues

Exits

FSX allows for up to four exits to be defined in the aircraft.cfg. Internally a variable is provided to test if exits are open called "Exit Open:x" where x can be 1 to 4. This variable works only for Exit 1. The workaround has been to use "local" variables to determine if the door is open – this is how there can be four doors even if less are defined.

Night Lighting

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The Overhead panel backlighting can be switched on and off using the dial marked OVHD INTEG LT on the INT LT sub-panel on the Overhead Panel. Backlighting for the main panel and pedestal come on automatically at night. To switch on the FSX default lighting the DOME switch on the same sub-panel of the Overhead panel can be used.

When switching the Overhead panel backlighting on and off there is a small delay each time it is switched.

Icons

Icons are displayed on the bottom left of the main panel. These icons are the standard icons but with the Radio icon missing. There is no radio Icon as there is a radio on the overhead panel and also on the Virtual Cockpit pedestal. Each of these radio control panels is independent.

An additional Icon is shown at the end which displays the Flight Phase as defined above.

Panel Controls

This panel behaves a little differently than most other panels. In order to operate any of the dials the left button on the mouse is clicked to turn anti-clockwise and the right button is clicked to turn clockwise. Some dials have a centre press function and this is done by pressing the centre button on the mouse (which in many mice is done by pressing the mouse wheel).

This method makes it much easier to operate as there is only one mouse area per dial so any button can be pressed anywhere on the dial.

Simple on/off switches still use the left button as usual as do simple two position dials.

See the Throttle Quadrant section to see how this has been taken a step further to simplify operating the Throttles.

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Main Panel

The main features of the main panel are the five CRT screens with displays as follows:
- Left Outboard: The Captain's Primary Flight Display (PFD)
- Left Inboard: The Captain's Multi-Function Display (MFD)
- Centre Upper Display: The Engine / Warning Display (E/WD)
- Centre Lower Display: The System Synoptics Display (EMC) (partial)
- Right Inboard Display: The First Officer's Multi-Function Display (MFD) (partial)

The functions of each of these displays are further detailed in the following sections.

There are two Electronic Flight Information System (EFIS) control panels on the glareshield – the left one controls the Captain's MFD and the right one controls the First Officer's MFD.

The Autopilot is a fairly standard panel but note that the panel in the VC is slightly different due to the design of the Virtual Cockpit.

More detailed descriptions of the sub-panels appear on the following pages ordered from left to right and top to bottom.

The Master Caution and Warning Lights

The Master Caution and Warning lights have two lights to signal non-normal configuration or emergencies. As there can be a large number of causes for these lights to illuminate further investigation is needed from the E/WD messages.

These lights come on in the following cases:
WARNING: - any Red ALERT message on the E/WD
CAUTION: - any Yellow CAUTION message on the E/WD

See the E/WD section below for more information on E/WD messages.

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The left and right panels are mirror images of each other with the left panel controlling the Captain's MFD and the right controlling the First Officer's MFD. The First Officer's MFD is partially hidden so is of limited use.

EFIS		
Switch	**Function**	**Action**
BARO Display	Displays the current Barometric Pressure setting. It displays in Inches of Mercury or Millibars depending on the setting of the dial below. Note that on the PFD if it is set to standard pressure (29.92 Inches or 1013 Mb) the word STD will be displayed on the bottom left.	On the display left click to decrease or right click to increase the Barometric Pressure.
BARO Dial	This dial switches between Inches of Mercury or Millibars.	Left click for INHG or right click for Mb.
CSTR Button	In this panel this button switches to the different map modes on the MFD: None, Mono, Terrain, and TAWS. This differs from the real aircraft.	Click once to switch to the MONO map, click again for the Terrain Map, and again for the TAWS map. Clicking again returns to no map.
WPT Button	Displays Waypoints on the MFD	Click once to display Waypoints and again to suppress them.
VOR.D	Displays or suppresses NDBs and VORs on the MFD. On the real aircraft this displays only VORs.	Click once to display and again to suppress the NDBs and VORs
NDB Button	On the real aircraft this displays NDBs however in this simulation it is used to display additional textual information.	Click once to display additional information and again to suppress.
ARPT	Display Airports on the MFD	On by default, Click once to suppress airports and again to display them.

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EFIS (continued)		
Switch	**Function**	**Action**
Mode Selection Dial	Select between ILS, VOR, NAV, ARC, or Plan view for display on the MFD. Usually leave on Arc for best detail.	Click on the left to move anti-clockwise or right for clockwise. N.B. Plan view is only available when there is a flight plan.
Range Dial	Alters the range on the MFD from 10 to 320 nautical miles.	Left click to move anti-clockwise or right click for clockwise.
FD Button	Switches the Flight Director on or Off	Click up for On and down for Off.
ILS Button	This button will illuminate if an ILS frequency is tuned	
Left VOR / ADF Switch	Switches between VOR 1, ADF 1, or no display in the bottom left of the MFD	Left click to switch left and right click to switch right.
STD Dial	Increases or decreases the barometric pressure and switches between Millibars and Inches of Mercury (IN) on the PFD and on the Standby Altimeter.	Left click to move anti-clockwise or right click for clockwise. Click in the centre to switch between inHg and Mb.
Right VOR / ADF Switch	Switches between VOR 2, ADF 2, or no display in bottom right of the MFD	Left click to switch left and right click to switch right.

The Autopilot

This is a fairly standard Autopilot similar to those on most Airbus aircraft. Buttons and their functions from left to right are as follows:

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| AUTOPILOT		
Switch	**Function**	**Action**
SPD / MACH Switch	Switches IAS window from Speed display to Mach number display.	Click once to switch from one to the other.
IAS / MACH WINDOW	Displays the desired Indicated Air Speed (IAS) or the Mach Number depending on the setting of the IAS/Mach Switch.	Left click to decrease the desired speed or right click to increase.
IAS Dial	Adjusts the speed shown in the IAS / MACH Window and Activates or Deactivates the Speed Hold function.	Left click to decrease the desired speed or right click to increase. Centre click to activate Speed hold if Autothrottle is armed.
Heading Window	Displays the selected Heading in Degrees (0 to 359).	Right click to rotate the desired heading right or left click to rotate left.
Heading Hold Dial	Rotate the selected heading and Activate or deactivate the Autopilot Heading Hold function which will turn the aircraft to the magnetic heading selected in the Heading window. Also used to activate NAV mode.	Right click to rotate the desired heading right or left click to rotate left. Centre click to activate or deactivate heading mode. Centre click again to activate Navigation (NAV) mode.
LOC Button	When activated the aircraft will fly to the Localiser selected by NAV1 radio but will NOT follow the glideslope.	Click once to engage and again to disengage.
HDG V/S – TRK FPA Switch	Switches the Heading window and PFD between HDG and TRK and the V/S window between V/S and FPA.	Click once to display TRK/FPA and again to return to HDG/VS
A/P 1	Autopilot Master Switch 1. On the real aircraft both Autopilots can be on but as FSX has only one Autopilot either AP 1 or AP 2 can be on.	Click to turn on Autopilot. Click to turn off Autopilot. Does not turn Autothrottle on or off.
A/P 2	Autopilot Master Switch 2. On the real aircraft both Autopilots can be on but as FSX has only one Autopilot either AP 1 or AP 2 can be on.	Click to turn on Autopilot. Click to turn off Autopilot. Does not turn Autothrottle on or off.
A/THR	Arms the Autothrottle before activating.	Click once for on and again for off.
Altitude Window	Displays the Autopilot selected altitude in feet.	Right click increase the desired Altitude or left click to decrease.
Altitude Dial	Adjust the selected Altitude and Activate or deactivate Altitude hold mode.	Left click to decrease or right click to increase selected Altitude. Centre click to Activate or deactivate Altitude Hold mode.

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AUTOPILOT (continued)		
Switch	**Function**	**Action**
EXPED Button	This button is pressed to expedite an Altitude change. In this simulation this will increase the Vertical Speed to 2500 feet per minute up or down.	Click once to engage and once to disengage. Disengagement will not alter the Vertical speed.
V/S Window	Displays the Target Vertical Speed of the aircraft in plus or minus feet per minute or the Flight Path Angle (FPA) in plus or minus degrees depending on the setting of the HDG V/S – TRK FPA Button.	The default for ascent or descent is set in the aircraft.cfg and is usually 1800 feet per minute
METRIC ALT Button	Display altitudes in Metres on the PFD	Click to display metres and click again to switch off.
V/S Dial	Dial up or down to increase or decrease the Vertical speed or FPA and activate or deactivate Altitude hold mode.	Left Click to decrease or right click to increase the VS or FPA. Centre click to activate Altitude hold mode.
APPR Button	When activated the aircraft will fly to the Localiser selected by NAV1 radio then will follow the Approach glideslope.	Click once to engage and again to disengage.

Note that in the Virtual Cockpit there is an additional display and dial for Course setting (CRS). This is not present in the real aircraft but does work on the Virtual Cockpit. The 2D cockpit is a correct reproduction of the Autopilot.
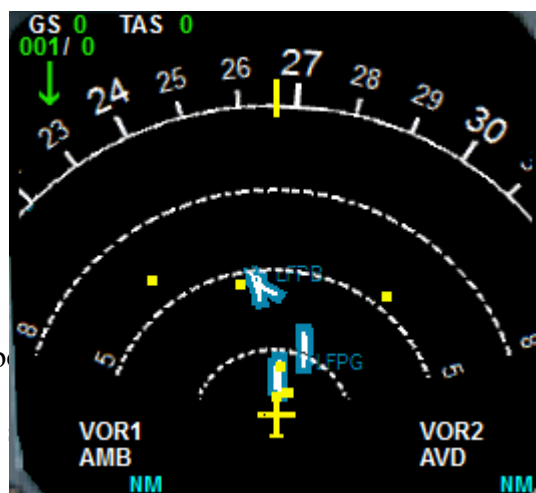
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The Primary Flight Display (PFD)
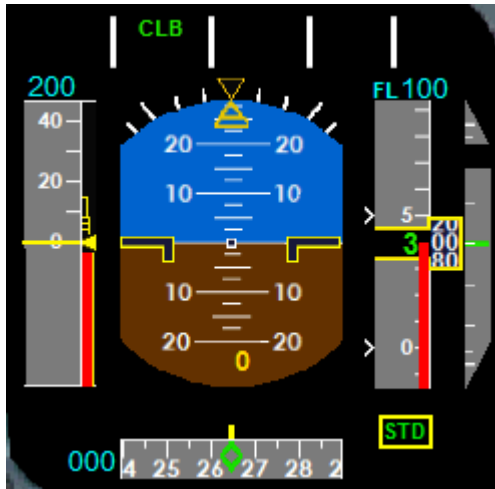
The PFD displays all information about the orientation of the aircraft including Heading, Speed, Attitude, rate of climb, as well as substantially more information. This is a close replica of the appearance of the PFD on the real aircraft.

The PFD Radio Altimeter measures altitude from its antenna to the ground but should display altitude with wheels down from its wheels to the ground. A correction factor equal to the height of the antenna above the ground is automatically applied by this panel at startup which will be correct for any aircraft if it is on the ground. If not on the ground a correction factor of 11 feet is applied. Unfortunately some aircraft load a few feet above or below the ground making this inaccurate. Reloading the aircraft fixes this problem.

The MFD Display

on b   0.
anel   lay in
not

For the VORs "NS" appears when there is No signal. This is to prevent confusion when the VOR has been tuned but not detected.
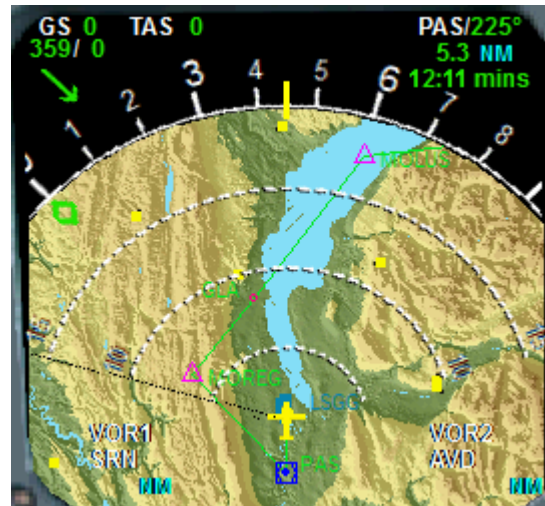
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The colouring for the Terrain map gives it more contrast based on the Garmin colouring and Map shadowing (see below). On the real aircraft the terrain map is actually a TAWS map but this map is included as well as the TAWS map as it would be more familiar to the FSX user.

The TAWS Map
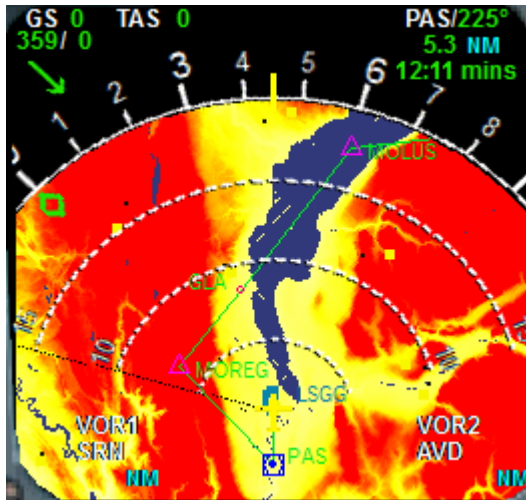
TAWS Map

Terrain Map

The Terrain Awareness (TAWS) Map is a map which measures terrain altitudes from the height of the aircraft rather than from sea level. The system used on this aircraft follows the Honeywell colour scheme which matches the Airbus specification. This model however does not have the same accuracy as colours can only be defined in FSX per 1000 feet instead of 250 feet as needed by the specification.

This TAWS map shows terrain from 2000 feet below the aircraft to 1000 feet below the aircraft in Green, from 1000 feet below to 2000 above the aircraft as Yellow, and Terrain more than 2000 feet above the aircraft as Red. Other terrain is not shown. The map above is what you see if the aircraft is on the ground. The specification states that the Green should extend to 500 feet below the aircraft (or 250 feet if gear extended) and the Yellow above that.

The map refreshes at every 500 feet change in altitude. This can take several seconds. When switching between maps wait until each map displays before switching to the next one.

Note that this TAWS map does not support look ahead terrain as this is not modelled in FSX.
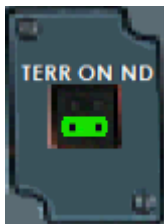
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The Standby Gauges

The Standby Airspeed, Altimeter, and Attitude Indicator are based on the original Airbus gauges and perform pretty much the same functions.

The TERR ON ND Light

This light comes on when the Terrain or TAWS map is selected on the MFD. It is useful when the TAWS map is on as, at altitude, the TAWS map appears the same as no map.
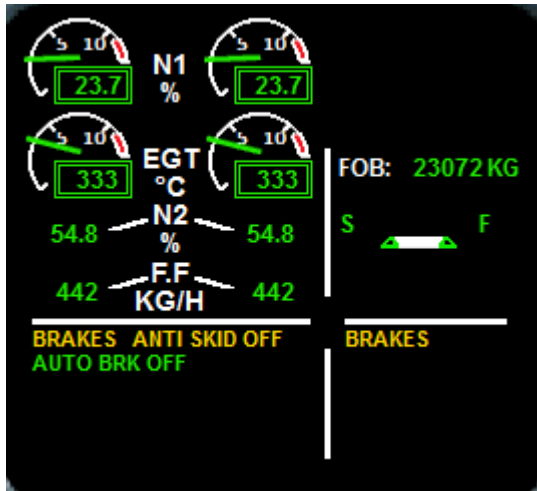
Digital Distance and Radio Magnetic Indicator (DDRMI)

This gauge shows the direction and distance for VOR1 and VOR2. It can be switched to ADF1 and ADF2 using the switches at the bottom of the gauge.

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The Engine / Warning Display (E/WD) Panel

The E/WD Panel always appears in the Upper Centre CRT. It displays detailed information on the engines. The bottom portion of the panel displays prioritised messages. In the absence of any important messages, checklists display during takeoff and landing phases.

The bottom right of the screen displays a list of error message categories in case all of the messages can not fit on a single screen.

The E/WD also displays the Flaps settings.

E/WD Messages

There is an extensive library of possible messages which are listed below. All of the messages follow the specifications in the Airbus Operations Manual as far as possible but only a subset of messages are available as many messages are for functions not supported in FSX. Messages are prioritised as follows with the highest priority appearing first:

WARNING (Red):
The highest priority; reporting an abnormal condition which is a threat to the safety of the aircraft and requiring immediate attention.

ALERT (Yellow):
Caution Messages are the next highest priority after Warning messages. They indicate a condition that is not an immediate threat to the safety of the aircraft.

MEMO (White):
Reminder messages of the state of controls or systems.

Note that many messages are accompanied by aural warning however these are beyond the scope of this panel.

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The following table lists the messages that can be seen in this panel:

E/WD MESSAGES			
Message	**Cat.**	**Level**	**Message Logic**
ALERTS			
ENG n FIRE	ENG	Alert	Fire in Engine n
APU FIRE	APU	Alert	Fire in APU
CONFIG FLAPS/SLATS	CONFIG	Alert	Flight Phase 3 or 4 and Flaps not set to Take off configuration (1+F, 2, or 3)
CONFIG SPEED BRAKE	CONFIG	Alert	Flight Phase 3 or 4 and Spoilers are deployed
CONFIG PARK BRAKE ON	CONFIG	Alert	Flight Phase 3 or 4 and Parking brake is on.
CONFIG DOORS	CONFIG	Alert	Flight Phase 3 or 4 and a Door is open.
EXCESS CAB ALT	PRESS	Alert	Cabin Altitude is greater than 9550 feet
GEAR NOT DOWN	GEAR	Alert	Flight Phase 6, gear is up, altitude is less than 750 feet AND: Flaps are deployed OR Both engines have N1 < 75%
AP OFF	AP	Alert	The Autopilot has been disconnected
FLAPS NOT ZERO	FLAPS	Alert	Flight Phase 6 AND Flaps are deployed
OVERSPEED	NAV	Alert	Airspeed is over the limit.
STALL WARNING	NAV	Alert	Stall Warning is normally the stick shaker but since many FSX users do not have one this message is displayed instead.
Y + G SYS LO PR	HYD	Alert	Hydraulic pressure in both systems is below 1450 psi
ENG n OIL LO PR	ENG	Alert	Oil pressure in Engine n is less than 13 psi.

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E/WD MESSAGES			
Message	**Cat.**	**Level**	**Message Logic**
CAUTION			
ENG n SHUTDOWN	ENG	Caution	Engine n has shut down in Flight phase 3 - 8
A/THR OFF	AP	Caution	Autothrottle is disarmed in Flight phase 5 - 7.
L or R FWD CABIN	DOORS	Caution	Left or Right Forward Main door is open.
L or R AFT CABIN	DOORS	Caution	Left or Right Rear Main door is open.
FWD CARGO	DOORS	Caution	Forward Cargo Door is open
AFT CARGO	DOORS	Caution	Rear Cargo door is open
GEN n OFF	ELEC	Caution	Engine n Generator is off
CTR TK PUMPS OFF	FUEL	Caution	Both Centre tank Fuel pumps are off
L or R WING TK LO LVL	FUEL	Caution	Left or Right Wing Fuel tank has less than 1650 pounds (750 kgs) of fuel
G or Y SYS LO PR	HYD	Caution	Green or Yellow Hydraulic system pressure is under 1750 psi.
WING A.ICE OPEN	BLEED	Caution	Wing Anti-ice is switched on on the ground
ANTI SKID OFF	BRAKES	Caution	Anti skid Brakes are off
BLEED n OFF	BLEED	Caution	Air Bleed switch for Engine n is off
ENGn OIL HI TEMP	ENG	Caution	Oil temperature in Engine n is > 140° C
ENGn N1 OVER LIM	ENG	Caution	N1 in Engine n is > 104%
ENGn N2 OVER LIM	ENG	Caution	N2 in Engine n is > 105%
ENGn EGT OVER LM	ENG	Caution	EGT in Engine n is > 950° C

E/WD MESSAGES			
Message	Cat.	Level	Message Logic
MEMOS			
APU AVAIL		Memo	APU is running
SPEED BRK		Memo	Spoilers are deployed in Flight phase 2 - 7
GND SPLRS ARM		Memo	Spoilers are armed on the ground
FUEL X FEED		Memo	Fuel Cross Feed is on
RAT OUT		Memo	The RAM Air turbine is deployed
HYD PTU		Memo	The difference in hydraulic pressure between the 2 engines is > 500 psi and the PTU switch is on.
WING A. ICE		Memo	Wing Anti-Ice is on
ENG A. ICE		Memo	Both engines' Anti-Ice is on
GPWS FLAP 3		Memo	The LDG FLAP 3 button on the Overhead GPWS panel is on
GPWS FLAP MODE		Memo	The FLAP MODE button on the Overhead GPWS panel is off.
APU BLEED		Memo	The APU is running and the APU BLEED switch on the Overhead AIR COND panel is on.
IGNITION		Memo	An engine starter is on
BAT n OFF		Memo	Flight Phase 2 or 6, Battery n is off
SEAT BELTS		Memo	Seat Belts signs are on, No Smoking signs are off
NO SMOKING		Memo	No Smoking signs are on, Seat Belt signs are off
SIGNS ON		Memo	Seat Belts and No Smoking signs are on
STROBE LT OFF		Memo	Strobe lights are off when airborne.
PARK BRK		Memo	Parking Brake is on in Flight Phase 1
LDG LT		Memo	Landing Lights are on
AUTO BRK OFF		Memo	In Flight Phase 2 – 4 and 7, Autobrakes are off
AUTO BRK LO		Memo	Autobrakes are set to Low
AUTO BRK MED		Memo	Autobrakes are set to Medium
AUTO BRK MAX		Memo	Autobrakes are set to Maximum

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The Clock

This clock is copied from the standard Airbus clock and works mostly the same way but with some differences useful in FSX.

The top CHR panel displays the stopwatch time when activated.

The middle panel displays the UTC or GMT time but can be switched to display the date using the SET DATE button.

The bottom panel displays the elapsed time for the flight and automatically starts when the aircraft wheels leave the ground. It stops again 30 seconds after the wheels touch the ground.

The RST button resets the stopwatch in the top window back to zero while the CHR button starts the stopwatch. The CHR button is also used to stop the stopwatch and restart again.

The GPS button can be used to set FSX to run at 16 times normal speed. Right click to set the speed to 16 times and left click to set back to normal time.

The RUN button at the bottom right can be used to reset the elapsed time by right clicking then left click to restart elapsed time.

The Landing Gear Panel

The landing gear panel incorporates a display of the landing gear status – downward green triangles for gear down. It also includes the controls for autobrakes and anti-skid brakes. Autobrakes have three settings – Low, Medium, or Maximum – any of which can be set for landing but only Max is used for takeoff.

The TERR ON ND light works the same as the left side one but works for the First Officer's ND.

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** Notes on Autobrake function

In FSX the standard Autobrake function applies brakes on touchdown and maintains the brakes until the aircraft is stopped. This is not a realistic scenario as normally brakes are not applied at high speed and normally the pilot does not wish to completely stop the aircraft.

This panel replaces the FSX standard Autobrake function with deploying reversers and spoilers on touchdown and maintaining them until the speed falls below 30 knots. The Autobrake function will then return to off. The pilot may also manually apply brakes at his option during or after the Autobrake sequence. The power of the reverser varies according to the Autobrake selection made by the pilot (Lo, Med, or Max). Spoilers are deployed in each case. The same system applies to aborted takeoff (MAX setting) when maximum reverse thrust is applied. On takeoff the MAX function will activate when throttles are retarded to idle.

The Landing Gear Lever
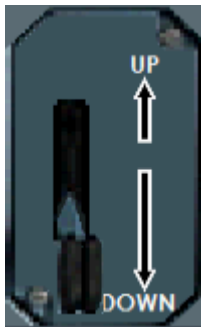
The Landing Gear can be retracted or lowered by left clicking on this gear lever or using the standard "G" function. The arrows on the right display progress in raising or lowering the gear. This can also be seen on the Landing gear synoptic panel.

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EMC Display Panels

There are 12 different Panels that can be selected to display in the lower centre display panel. As this panel is only partially visible, clicking anywhere on this panel will display a full-sized display together with the controls to switch the displays.

The display will display a default display depending on the current flight phase and sometimes on other factors. These are based on the Airbus defaults but do not take into account faults. The default displays are as follows:

Flight Phase	Display Screen
1	Doors
2	Wheels
3,4,5	Engines
6	Cruise
7,8,9	Wheels
10	Doors

The above defaults are overridden if the APU is running when the APU panel displays.

Similarly when Engine 1 starter is on the Flight Control panel displays. If Engine 2 starter is on the Engines panel displays. All of these defaults can be overridden by selection for the control panel.

The Control Panel

This panel controls the displays appearing in the lower centre panel and in the pop-up full-sized panel.

Airbus A320 Panel

Control Panel		
Switch	**Function**	**Action**
T.O. CONFIG	Displays Take Off configuration faults on the E/WD messages screen	Click to display Take Off configuration error messages. If the configuration is correct then the Takeoff checklist will display instead.
EMER CANC	Switches off the Master Alarm	Click to switch of the Master Alarm warning display.
ENG	Displays the Engines Panel on the EMC Display.	Click to display the Engines panel and click again to revert to the default panel.
BLEED	Displays the Air Bleed Panel on the EMC display.	Click to display the Air Bleed panel and click again to revert to the default panel.
PRESS	Displays the Pressurisation Panel on the EMC display.	Click to display the Pressurisation panel and click again to revert to the default panel.
ELEC	Displays the Electrical Panel on the EMC display.	Click to display the Electrical panel and click again to revert to the default panel.
HYD	Displays the Hydraulics Panel on the EMC display.	Click to display the Hydraulics panel and click again to revert to the default panel.
FUEL	Displays the Fuel Panel on the EMC display.	Click to display the Fuel panel and click again to revert to the default panel.
APU	Displays the APU Panel on the EMC display.	Click to display the APU panel and click again to revert to the default panel.
COND	Displays the Air Conditioning Panel on the EMC display.	Click to display the Air Conditioning panel and click again to revert to the default panel.
DOOR	Displays the Doors Panel on the EMC display.	Click to display the Air Conditioning panel and click again to revert to the default panel.
WHEEL	Displays the Landing Gear Panel on the EMC display.	Click to display the Landing Gear panel and click again to revert to the default panel.
F/CTL	Displays the Flight Controls Panel on the EMC display.	Click to display the Flight Controls panel and click again to revert to the default panel.
ALL	Displays the next sequential panel or the CRUISE panel if positioned on the Flight Controls panel.	Click to display the next panel

Airbus A320 Panel

Control Panel (continued)		
Switch	**Function**	**Action**
CLR	Scrolls down through the messages on the E/WD screen	Click to display the next page or to clear all non-Alert messages. Click again to restore the display.
STS	Displays a Status screen in the partial lower centre panel only (it does not affect the full-size display). Unfortunately I have been unable to find the layout of this screen although it does display "Normal" when there are no messages. As Status messages almost invariably relate to functions not reproducible in FSX, this screen always displays "Normal".	Click to display "NORMAL" in the partial EMC screen only and again to revert to the previous screen.
RCL	Clicking on this button recalls all messages on the E/WD screen	Click once to recall messages.

All of the 12 panels have the same information at the bottom of the screen:

TAT: Total Air Temperature
SAT: Standard ATM Temperature
Local Time
G.W.: Current Gross Weight (Pounds or Kilograms)

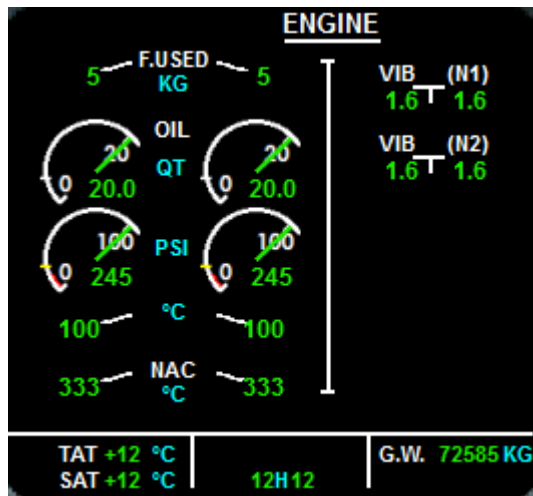In addition the G Load will display in the centre if the G force exceeds 1.4Gs or is less than 0.7 Gs.

Alternatively if the G force is within the acceptable range and metric altitude is selected then the Autopilot selected Altitude in metres will display.

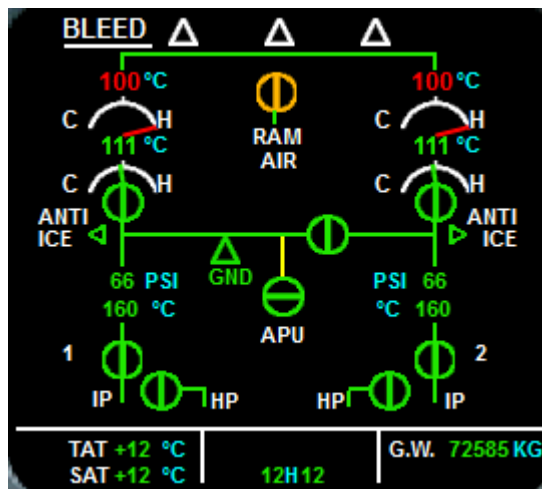Detailed descriptions of the 12 Panels follow.

Airbus A320 Panel

The Engines Panel

This panel displays information on Engine operation additional to the information shown on the E/WD screen
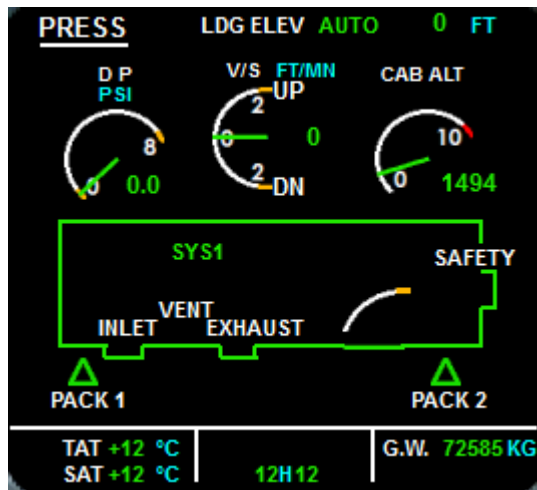
The Air Bleed Panel

This panel displays information on the air bleed temperature from the engines. Much of the data is dummy or artificial.
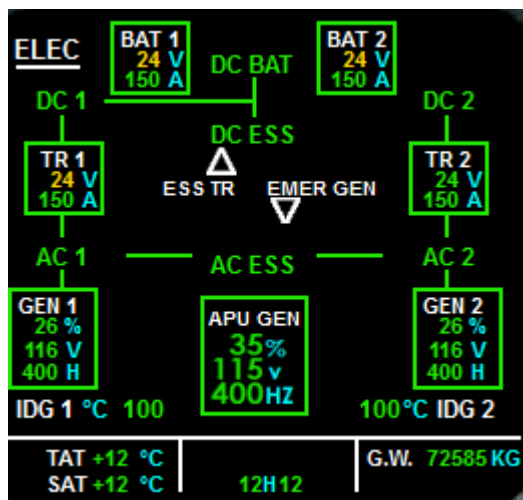
Airbus A320 Panel

The Pressurisation Panel

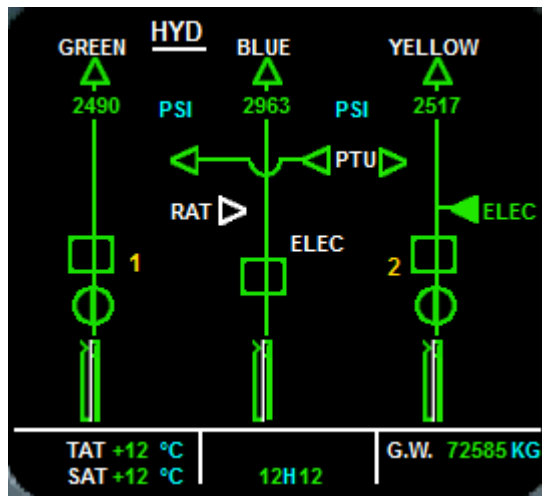This panel displays information on the pressurisation of the aircraft.

The Electrical Panel

Most of the information on this panel is dummy although the voltages are taken from FSX. Note that the actual voltage used on the Airbus A320 is 28V while most aircraft.cfg s show 24V.
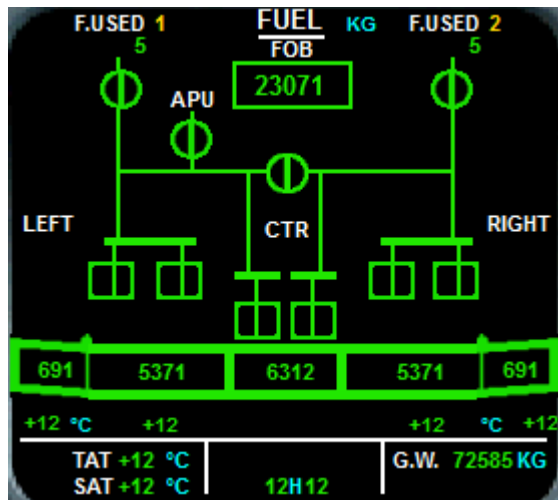
Airbus A320 Panel

The Hydraulics Panel

This panel shows information on the three Hydraulics systems in the aircraft. Note that FSX only allows one Hydraulic system per engine so in this simulation the Blue system figures are the average of the two engine systems.

The Fuel Panel

This panel displays the fuel status of all the fuel tanks. On the real aircraft the fuel from the outer wing tanks is automatically pumped into the inner wing tanks as it is used. This diagram uses an algorithm to simulate this function. The fuel temperatures shown are just based on TAT as FSX does not support fuel temperatures.
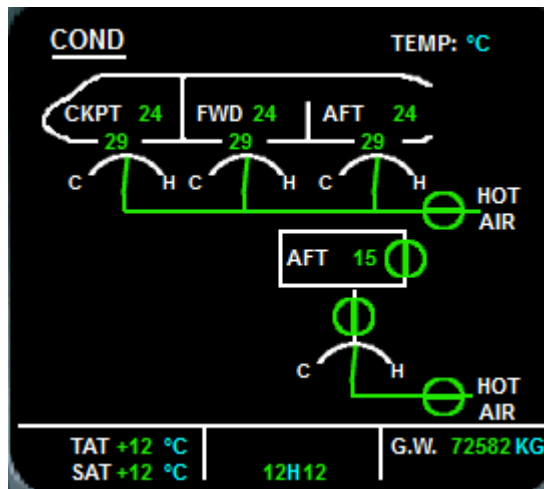
Airbus A320 Panel

The APU Panel
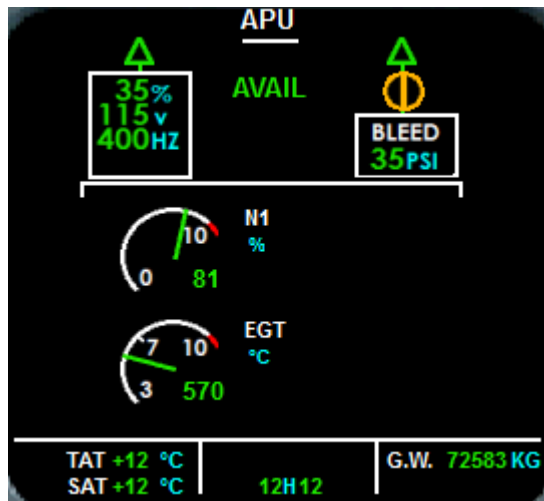
This panel remains mostly blank when the APU is not operating but displays when the APU is switched on. Most of the numbers are derived since data about APUs are not supported in FSX.
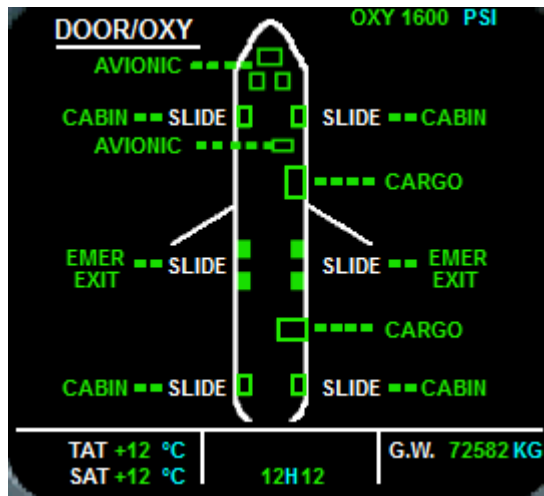
The Air Conditioning Panel

Temperature figures in this panel are fanciful as there are none in FSX. Nevertheless they can be adjusted from the Overhead AIR COND panel.
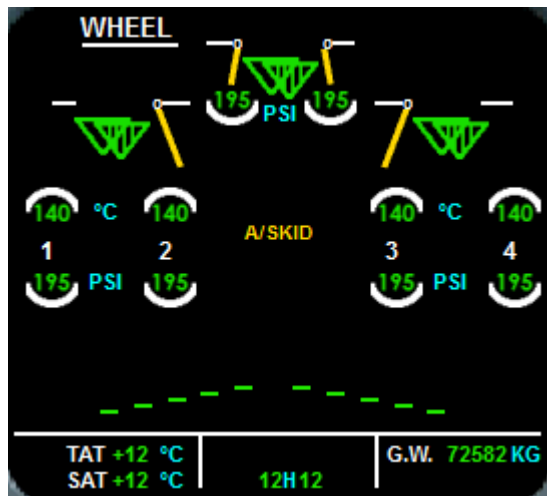
Airbus A320 Panel

The Doors Panel

This diagram shows all of the doors as per the original Airbus panel. It shows some doors as open when they are opened from the Ground Handling panel. Which doors open depends on the aircraft model used. This diagram is designed around the default A321 model.
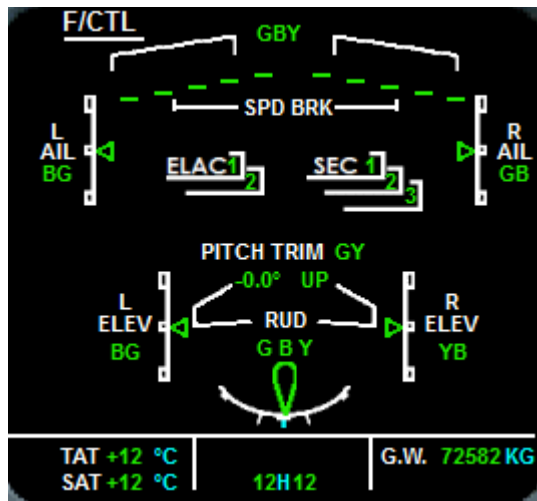
The Wheels Panel

This panel shows the status of the landing gear and animates when the gear is raised or lowered. Tyre temperatures and pressures are dummy as these are not supported in FSX.

Airbus A320 Panel

The Flight Controls Panel

This panel shows the position of all the flight controls in the same way as on the real aircraft. The ELAC and SEC switches also work however have no effect on the simulation.

The Cruise Panel

The Cruise Panel appears automatically during the Cruise Phase of the flight (Phase 6). It contains a summary of information appearing on several other panels.

It can be manually displayed by selecting the FLT CTL panel then clicking ALL.

Airbus A320 Panel

Overhead Panel
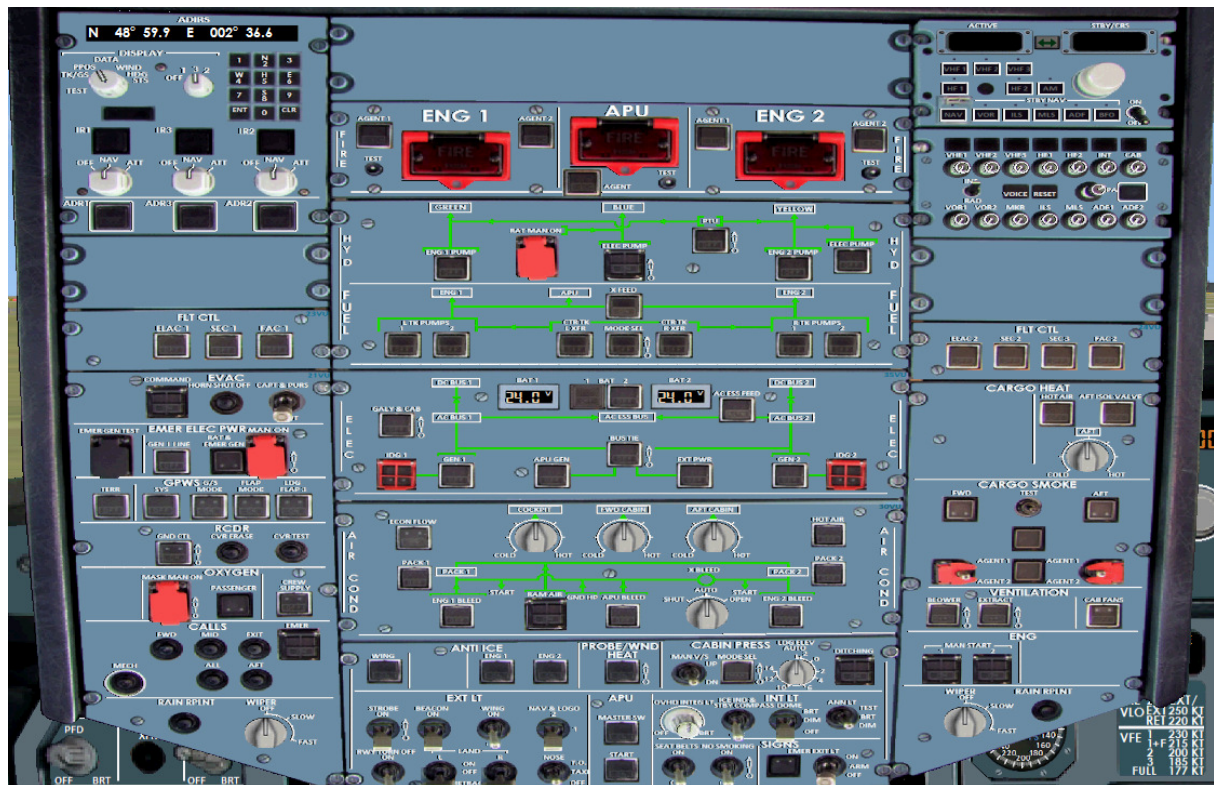
The Overhead panel is a fair replica of the Airbus overhead panel with most switches working although many perform no function.

The Overhead Panel is divided into several sub-panels some of which are linked to the EMC displays. The following sections detail the sub-panels and their functions from top to bottom, left to right:

Airbus A320 Panel

Overhead Standby ADIRS Panel

This panel is used for Inertial Navigation settings. The display screen can display 4 of the displays as on the real aircraft using the Display select knob with the left and right mouse buttons to change to different displays. Displays available are:

TK/GS: Current Track and Ground Speed
PPOS: Present Position
WIND: Wind direction and speed
HDG: Current True Heading

The default is to show the current position.

Other switches on this sub-panel do not function except for the ADR1, ADR3, and ADR2 switches which do not perform any function in FSX.

Overhead Flight Control Panels

The panel on the left controls ELAC1, SEC1, and FAC1 whilst the almost identical panel on the right of the Overhead controls ELAC2, SEC2, SEC3, and FAC2. These buttons do not perform any function in FSX.

Overhead EVAC Panel

This panel contains the Evacuation Command switch, the Evacuation horn shutoff button, and a switch to switch the Evacuation control to the Purser. The first and third switches are active but perform no function in FSX.

Airbus A320 Panel

Overhead EMER ELEC PWR Panel

This panel controls Emergency Electrical Power. Although three of the four buttons are active they perform no function in FSX.

Overhead GPWS Panel

This panel is to switch off various GPWS functions. Whilst all the buttons work their only effect is for the FLAP MODE and LDG FLAP 3 buttons to generate a Memo on the E/WD.

Overhead RCDR Panel

This panel controls the Cockpit Voice Recorder. Only the GRD CTL works but performs no function in FSX.

Overhead Oxygen Panel

This panel controls the Emergency Oxygen supply. Whilst the buttons do work they perform no function in FSX. Note that once the Passenger Oxygen masks are deployed the switch can not be reversed.
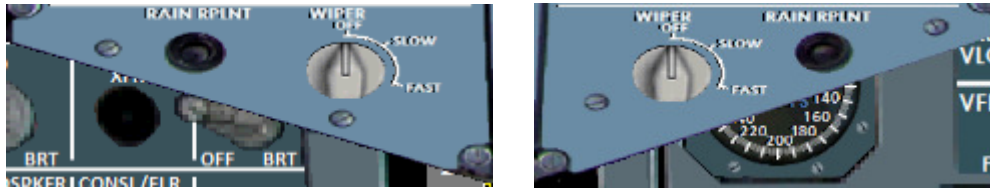
Overhead CALLS Panel
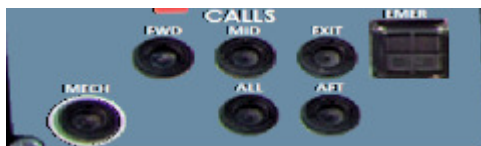
This panel controls internal aircraft communication. The EMER button works but performs no function in FSX.

Airbus A320 Panel

Overhead Rain Panels

The left and right Rain panels control the left and right windscreen wipers. Although the Wiper dials work using the left and right mouse buttons, there are no animated windscreen wipers.

Overhead Fire Panel

This sub-panel display Fire indications in the Engines and APU. Each fire button can be activated either by a fire or by clicking on the Test button after which each of the squibs can be discharged. Pressing the test button again restores the original state.

Overhead Hydraulics Panel

This panel controls the three hydraulics systems in the aircraft. Resetting the buttons will show in the corresponding EMC Hydraulics display. A recent discovery about FSX means that this panel and FSX do support three hydraulics systems so switching off the various pumps will result in actual hydraulics pressure loss.

Note that when an engine is shutdown the corresponding Engine pump will display "Fault" in amber.

Airbus A320 Panel

Overhead Fuel Panel

This panel follows the Airbus fuel management system with fuel feeding the engines from the Centre tank first before taking fuel from the wing tanks. If no buttons are pressed this sequence will occur automatically. It can be overridden by resetting the buttons however note that this can potentially result in an aircraft weight imbalance which can be difficult to correct in this simulation.

Note that when an engine is shutdown the corresponding Engine Fuel pumps will display "Fault" in amber.

The Airbus A320 has no fuel jettison function.

Overhead Electrical Panel
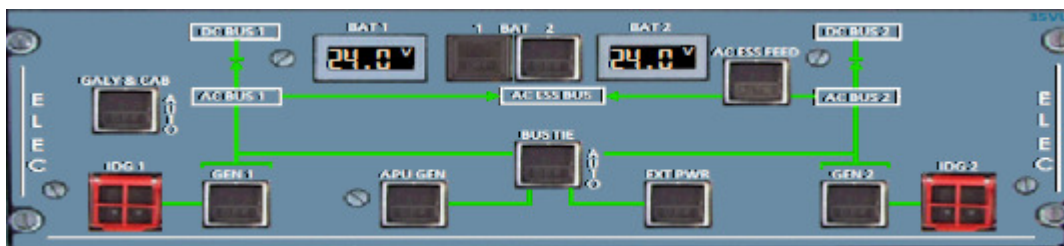
The Electrical Panel Buttons control the functions displayed on the Electrical Panel Display selected from the EMC Control panel.

Note that clicking on the IDG 1 or 2 buttons will irreversibly shut down the generator which is usually highly undesirable and only done in reality if there is a malfunction. It must be reset again by ground engineers. Clicking again on the IDG button will not restart the generator.

Overhead Air Conditioning Panel

Although all of the buttons in this panel function, mostly they have no effect on the simulation. The dials can be rotated which will alter the temperatures shown in the EMC Cond display and switching off the Bleed air will alter the Bleed air display.
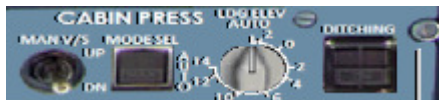
Airbus A320 Panel

Overhead Anti-Ice and Probe/Window Heat Panel

Each of the buttons switches the Wing and Engine anti-ice function on and off. The Probe/Window Heat button can only be pressed when both engines are not running. When engines are running the Pitot and Window heat functions are automatic.

Overhead Cabin Pressure Panel

Switching on the Manual Landing Altitude will enable the LDG ELEV dial to be adjusted to the expected landing altitude in increments on 1000 feet. The DITCHING button dumps the cabin pressurisation and reduces cabin pressure to the outside air pressure.

Overhead External Lighting Panel

Each of the switches on this panel switches on the corresponding lights. Which buttons work depends on which aircraft model is being used. The following table shows which buttons work on the two models tested.

Switch	Default A321	iFdg A321
Strobe	Yes – Wingtips	Switches logo and cabin lights on
Beacon	Yes – top of fuselage	Switches logo and cabin lights on
Wing	No	Switches logo and cabin lights on
Nav & Logo	Nav Lights Yes, Logo lights No	Switches logo and cabin lights on
Rwy Turn Off	No – dummy	No
Landing Lights	Yes	Switches landing lights, logo, and cabin lights on.
Nose	No	Switches nose, logo, and cabin lights on.

Airbus A320 Panel

Overhead APU Panel

Pressing the START button on the panel will start the APU. The light on the START switch will go out when the APU is running. Pressing the MASTER SW will shut down the APU.

Overhead Interior Lighting and Signs Panel

All of the switches on these panels work according to the following table:

Switch	Function	Action
OVHD INTEG LT	Switches on Overhead Panel back lighting at night	Right click to rotate dial right to switch on. Left click to rotate left.
ICE IND	Switches Ice and Standby Compass lights	Dummy switch
DOME	Switches the default FSX panel lighting on or off	Left click to switch on. Left click twice to switch off.
SEAT BELTS	Switch Seat Belts sign on or off	Click once to switch on or off. A message will appear in the E/WD when on.
NO SMOKING	Switch No Smoking signs on or off	Click once to switch on or off. A message will appear in the E/WD when on.
EMER EXIT LT	Switch Emergency exit lights on or off.	On by default. No effect in FSX.
Emergency Lighting	Switch Emergency lights on or off	Dummy switch

Airbus A320 Panel

Overhead Radio Panel

This radio panel is fully functional for VHF frequencies only.

There are three VHF radios, each with a standby, labelled VHF1, VHF2, and VHF3.

VHF1 is used only for voice communication and is COM 1 in FSX terms.

VHF2 and VHF3 can be used for both voice and data but for FSX they are designated NAV 1 and NAV 2.

The Radio panel is initially OFF and must be switched on using the On/Off switch. After switching on click on VHF1, VHF2, or VHF3 buttons to select a radio.

Note that although the radios have three decimal places FSX supports only two.

Radio frequencies can be set by Incrementing or Decrementing an existing Frequency on a STBY Radio then swapping that frequency with the active radio:
   a)   To change the whole number of the frequency position the cursor on the number and left click to decrease or right click to increase the number.
   b)   To change the decimal of the frequency position the cursor on the decimal portion and left click to decrease or right click to increase.
   c)   Note that the decimal will click over the whole number when increasing or decreasing over zero
   d)   To swap the STBY frequency with the active frequency click on the ⬌ button

An alternative way to alter the frequency is to use the dial below the STBY window. This dial can be rotated using left and right clicks. It can be switched between whole numbers and decimals by using the centre click button.

Clicking on the NAV button enables the VOR and ILS buttons to be activated. When activated clicking on the VOR button will tune NAV1 to the nearest VOR. Clicking on the ILS button will tune NAV1 to the ILS frequency provided that the Autopilot is in Approach mode and an ILS has already been selected. Generally these functions are best performed using the GPS which has more extensive features.

The communications panel below the Radio panel is non-functioning as its function is not supported in FSX.

Airbus A320 Panel

Overhead Cargo Heat Panel

The buttons on this panel are dummy switches but the Cargo temperature dial does rotate and change the cargo temperature shown on the EMC COND panel.

Overhead Cargo Smoke Panel

Cargo fires are not supported in FSX however the TEST button on this panel will simulate a cargo fire and allow the discharge of the fire extinguishers. Pressing TEST again will reset the panel.

Overhead Ventilation Panel

The switches on this panel do operate but perform no function.

Overhead Engines Panel

This panel is used to start the engines individually using the corresponding button. Note that as FSX starts with engines running, they must be shut down first in order to start.

Airbus A320 Panel

Throttle Quadrant

Throttle Operation

The Mouse grip function commonly used on other panels can be unpredictable. This panel uses a simpler way of controlling the throttle quadrant with the mouse wheel and both mouse buttons.

All levers are operated with left and right mouse clicks: left click to pull the lever and right click to push the lever. This can be done anywhere in the single mouse area for each lever. The Throttle itself is operated with the mouse wheel in a similar way to the slider on a joystick. More details are given under throttles.

Airbus A320 Panel

THROTTLE QUADRANT		
Switch	**Function**	**Action**
Pitch Trim	Moving the Pitch Trim alters the Elevator Trim according to the Gauge next to the wheel. The left or right wheels can be used.	Use the mouse wheel to move the Pitch Trim lever in either direction.
Throttles	The main Throttle levers for the two engines.	See below for details of how to operate the throttles.
Speed Brake	This lever deploys Spoilers but the function varies depending on whether the aircraft is on the ground or not.	Click once to arm the spoilers and again to fully deploy them. Right click retracts the spoilers from either position.
Fuel Control	When engines are running these will be in the RUN position. To shut down engines move to CUTOFF.	Click on each switch once to shut down engines. To restart engines the Start buttons on the Overhead Panel must be used.
Fire	The Fire light will illuminate if there is a Fire in the engine or if the fire test button is pressed on the overhead fire panel.	
Mode	This dial can be used to automatically start both engines. It is equivalent to Ctrl+E in FSX.	Right click to automatically start both engines sequentially.
Flaps Lever	Moving this lever will deploy flaps to the degrees indicated on the Pedestal	Left click to incrementally deploy flaps and right click to incrementally retract them.
Rudder Trim	Rotating the dial adjusts the rudder trim. The reset button resets the trim to zero.	Left and right click to rotate the trim dial. Click once on Reset to set back to zero
Parking Brake	The Parking Brake for use on the Ground.	Click to set the brake and click again to release the brake. The Parking Brake can also be set using the "." Key and also from the Ground Handling window.
Gravity Gear Extension	Clicking on this handle activates the emergency gear release function in FSX. The effect of this will vary according to the model used.	Click once to manually deploy landing gear. Clicking again reverses this on some models.

Airbus A320 Panel

Throttles and Reversers

The Throttles have a simple up and down sliding action. The use of the mouse may take a little getting used to but is very simple in practice.

Moving the mouse wheel up while positioned on either Throttle mouse area will increase the throttles and moving the wheel down will decrease them. By default moving the mouse wheel will move both throttles together.

To move an individual engine throttle right click anywhere in either throttle mouse area. Following the right click only the engine on which the mouse is positioned will move when the mouse wheel is turned. Moving the mouse to the other engine will also move that engine individually. To return to synchronised engine movement right click again however note that Engine 1 throttle will move to the same position as Engine 2 on clicking the right button again.

Left click to return engines to idle either individually or together.

If you are reducing throttle with the mouse the throttles will stop at idle. To activate reverse thrust using the mouse then centre click when the throttles are at idle. This will then allow the throttles to be moved into reverse using the mouse. Left click to return to idle from any position.

The use of the mouse wheel is fairly smooth however note that each click of the wheel increases or decreases the throttle by 10%. For the reversers each click increases or decreases the reverse thrust by 20% of the maximum reverse thrust of 25% of the forward thrust (so 5 clicks to the maximum reverse thrust).

Airbus A320 Panel

Ground Handling Panel

This is a small heads-up display that appears only when the left engine is shut down. Parking Brakes must be applied before any of the other functions work: clicking on the Parking Brakes switch on the panel is one way to apply them.

Where there is a Jetway it can be connected by clicking on the "Press for Jetway" Switch. Note that Jetways will generally only be visible if Scenery Complexity is set to "Dense" or more and not in FS9.

Up to 4 doors can be opened individually by clicking on "M" (Main) "2" (2nd), "R" (Rear), and "C" (Cargo) Buttons under Exits. The 4 Exits open can be seen on the Door display panel selected from the Buttons Panel. These will display even if the FSX aircraft does not have all animated opening doors.

The effect of these buttons will vary according to the model used. The following table describes the effect on the two models tested:

Switch	Default A321	iFdg A321
M	Opens front left passenger door	Opens front left passenger door
2	Opens all other passenger doors (3 on the left and 4 on the right)	No effect
R	No effect	No effect
C	Opens front and rear cargo doors on the right.	Opens right front and rear plus left rear passenger doors.

The DOOR display on the EMC and the messages on the E/WD however will always shows what doors are supposed to be open regardless of what model is used.

The door opening function should not be used when the simulator is Paused as it becomes confused about which doors are open. Due to the method used by FSX to operate doors they can be quite temperamental and the buttons need to be pressed with a pause between each one.

A Fuel Truck can be requested by clicking on the "Not Requested" button.

Finally pushback can be easily done first by selecting the direction required then clicking on "Pushback Off".

Airbus A320 Panel

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