BAe 146 Panel Version 4.0 for MS FS2004

Panel Manual

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The BAe PANEL PROJECT

Http://www.baepanelproject.com

Contents

1 Some words about the BAe 146 Panel Version 4.0

If you take a first look at the new version 4.0, you won't establish great changes to the previous version, except for the completely new Pedestal panel. Nevertheless the new panel contents many mostly hidden revisions. The complete autopilot (AFGS) for example is reworked and I finally could realize the TMS (Thrust Modulation System) now which was promised since a long time. Beside the many detail improvements, the possibility of storing the switch positions and system configuration is a big step forward. Due to this expansion the Cold and Dark cockpit is dropped completely. The plane and panel will now always load like it was left before.

Due to a serious innovation of the new panel, there's now a changing concerning the used aeroplanes. Version 4.0 contents now the complete handling of the Lift- and Rollspoilers. Unfortunately the setting of both spoilers is realized differently in the available FS aircraft models. Jon Murchison's new aircraft will have both spoilers. In his model, the setting of the spoilers are realized with a special airbrake control. Paul Hannity's model has also both spoilers but use the controlling of the wingfold for it. In Mike Stone's model, both spoilers are not realized. Because of this, I had to make separate panel versions for each model.

Further innovations I would like to mention here, are the new ground test unit, the fully functional fire handles, the completely revised pressurization system, completely new cockpit inside sounds, a completely new EGPWS, the speedbugs of the airspeed indicator and several other things..

The pedestal panel is completely new done. It corresponds now visually and functionally to the real pedestal panel. Some examples are the new audio unit, the functional moving map / weather radar and the new braking temperature gauge. The brake temperature gauge already works but a too high temperature has currently no effect on the flightdynamics. However, when the new Flight simulator FSX did not content any effect because of a too high brake temperature, I have a function for it already in planning.

Except the still missing GNS (FMS), all reworked parts and new components of the panel base exactly on the real cockpit. Since now all systems and their interactions in operation and function are realized, the panel has grown up to a system trainer. Of course this requires a certain training. However, you should be able to handle all the systems in this panel and in the real aircraft after an intensive study of this manual.

2 Installation

This file is just a panel and did not content any aircraft. Before you install this panel, it's important first to install an aircraft which later uses the panel. A description of how to install the aircraft is not part of this manual but part of the readme text of the aircraft. All necessary folders which are described in this installation procedure do already exist or were created when installing the aircraft.

Like with all other Flight simulator add-ons it's very important, that you exactly follow this installation description step by step. When you start an aircraft with this panel and something didn't work it's mostly the reason of an overlooked part of the installation manual.

The new BAe 146 panel has a different installation procedure for Paul Hannity's aircraft and the models of the other aircraft designers. Because of this it is very important for you to know which aircraft you have installed.

If you found a new aircraft model from another designer and I haven't included replacement FDE's for his model, just drop me a note in the BAe Panel Project forum. Of course I will built a set of flight dynamics for this new model too and upload them on the BAe Panel Project site.

Do not install the Panel and all files of this Panel when the Flight Simulator is running. First exit FS2004 and then follow the next steps!

Another very important thing is NOT to use any automatic Flightsim addon installers or any program which unzips all files automatically to the correct folders!

When you are using Paul Hannity's aircraft, please follow the installation chapters 2.1, 2.1.1 and 2.3.

When you are using a BAe 146 from Jon Murchison, Mike Stone or another aircraft designer, please follow the installation chapter 2.2, 2.2.1, 2.2.2 and 2.3.

When you want to use the panel with the models of different designers, it's important to take care that each model contents the correct panel files. It is not possible to link the panel for different aircraft models.

2.1 Installation of the Panel for Paul Hannity's Aircraft

- Unzip all files of the Panelbitmaps.zip into the panel folder of your BAe 146 aircraft.
- Unzip all files of Panel_Configs_PH.zip into the panel folder of your BAe 146 aircraft. Replace existing files when asked.
- Unzip all files of Gauges.zip into the gauges folder of your FS2004.

  Take care, that you also unzip the file ML-BAe146v40.cab into the gauges folder. Do not unzip the cab file itself. The Flight Simulator unzips this cab file automatically when it needs it. Just take care, that the file is in your gauges folder!

  Also very important is to unzip the files ML-BAe146v40.cfg, ML-BAe146v40_Config.ini and ML-BAe146v40_Config2.ini into the gauges folder. Those files are configuration files which are very important for the functions of the panel. **They MUST be placed directly in the gauges folder**. A separate *.dll file is no longer needed.
- Unzip Sounds.zip into the main sound directory of the Flight Simulator. **Do NOT use the Sound folder of the Aircraft!**

2.1.1 Preparing Paul Hannity's Aircraft for this Panel

Because of the complexity of this panel it was necessary to make some changes in the aircraft.cfg and airfile. If you are using Paul's BAe 146 it's very important to use the replacement files. Otherwise really a lot of panel systems and parts don't work as they should.

The included replacement files for Paul's aircraft are:

Paul Hannity 146-200 Airfiles.ZIP	Replacement FDE files for Paul Hannity's BAe 146-200 aircraft.
Paul Hannity 146-300 Airfiles.ZIP	Replacement FDE files for Paul Hannity's BAe 146-300 aircraft.

Before installing those files please check which model you use. Now make a backup of the already existing aircraft.cfg and the *.air file in your BAe 146 aircraft folder and unzip the correct replacement files into this folder. If you have installed some further repaints for the models, please don't forget to add them once again in the aircraft.cfg.

Do not use the included replacement flight dynamics with my Avro ARJ panel. The reason is, that the ARJ has much smaller EGT temperatures than the old engines of the BAe 146. Of course you must use the same aircraft because the BAe 146 and ARJ models are all the same, but it's important for the panel.

2.2 Installation of the Panel for Jon Murchison's and other Aircraft

- Unzip all files of the Panelbitmaps.zip into the panel folder of your BAe 146 aircraft.
- Unzip all files of Panel_Configs_OT.zip into the panel folder of your BAe 146 aircraft. Replace existing files when asked.
- Unzip all files of Gauges.zip into the gauges folder of your FS2004.

  Take care, that you also unzip the file ML-BAe146v40.cab into the gauges folder. Do not unzip the cab file itself. The Flight Simulator unzips this cab file automatically when it needs it. Just take care, that the file is in your gauges folder!

  Also very important is to unzip the files ML-BAe146v40.cfg, ML-BAe146v40_Config.ini and ML-BAe146v40_Config2.ini into the gauges folder. Those files are configuration files which are very important for the functions of the panel. **They MUST be placed directly in the gauges folder**. A separate *.dll file is no longer needed.
- Unzip Sounds.zip into the main sound directory of the Flight Simulator. **Do NOT use the Sound folder of the Aircraft!**

2.2.1 Preparing Jon Murchison's and Mike Stone's Aircraft for this Panel

Because of the complexity of this panel it was necessary to make some changes in the aircraft.cfg and airfile. If you are using Jon Murchison's or Mike Stone's BAe 146 it's very important to use the replacement files. Otherwise really a lot of panel systems and parts don't work as they should.

The included replacement files are:

Jon Murchison 146-200 Airfiles.ZIP	Replacement FDE files for Jon Murchison's BAe 146-200 aircraft.
Jon Murchison 146-200QT Airfiles.ZIP	Replacement FDE files for Jon Murchison's BAe 146-200 QT (freighter) aircraft.

Jon Murchison 146-300 Airfiles.ZIP	Replacement FDE files for Jon Murchison's BAe 146-300 aircraft.
Jon Murchison 146-300QT Air-files.ZIP	Replacement FDE files for Jon Murchison's BAe 146-300 QT (freighter) aircraft.
Jon Murchison 146STA Airfiles.ZIP	Replacement FDE files for Jon Murchison's BAe 146 STA aircraft.
Mike Stone 146-200 Airfiles.ZIP	Replacement FDE files for Mike Stone's BAe 146-200 aircraft.

Before installing those files please check which model you use. Now make a backup of the already existing aircraft.cfg and the *.air file in your BAe 146 aircraft folder and unzip the correct replacement files into this folder. If you have installed some further repaints for the models, please don't forget to add them once again in the aircraft.cfg.

Do not use the included replacement flight dynamics with my Avro ARJ panel. The reason is, that the ARJ has much smaller EGT temperatures than the old engines of the BAe 146. Of course you must use the same aircraft because the BAe 146 and ARJ models are all the same, but it's important for the panel.

2.2.2 Installing the Panel files for Aircraft with Virtual Cockpits

The Panel Panel_Configs_OT.zip for the models of Jon Murchson, Mike Stone or another aircraft designer except Paul Hannity, contents a second configuration file for aircraft which has a virtual cockpit.

The installation is very easy. After you have unzipped the files of Panel_Configs_OT.zip, delete the panel.cfg from your panel folder and rename the file "Aircraft_with_VC_panel.cfg" into panel.cfg. That's all.

2.3 Necessary changes in the sound.cfg

The new BAe 146 autopilot (automatic flight guidance system AFGS) is very complex. Because of this it was necessary for me to pass some standard autopilot functions. One of this functions is to switch off the standard autopilot without switching off the BAe 146 autopilot. Unfortunately this effects the autopilot disengage sound to come on when it shouldn't. That's why I have included a real BAe 146 autopilot disengage sound which will be actuated from my autopilot gauge. Nevertheless it's important to delete the standard autopilot disengage sound.

For deleting the standard autopilot sound it is very important that you are using an own soundest for your BAe 146. Beside the sound.cfg, the sound folder of your BAe 146 must have some *.wav files. When you just found a sound.cfg, please install a soundest first. You could find some very nice BAe 146 sounds on the established download sites.

When you have installed a soundest, open the sound.cfg with notepad or another ASCII editor. Then search for the entry [AP_DISENGAGE_SOUND] and set the maximum sound volume to zero like in the following example:

```
[AP_DISENGAGE_SOUND]
filename=caapdis
maximum_volume=0
```

Now close the sound.cfg and safe the modifications. If you would like to, you could first make a backup of your original sound.cfg.

That's it. Now you can start FS2004 again.

3 Panel Description

3.1 General Panel Layout

Overhead Panel

Pressurization, TMS, and OAT

Main Panel

Yoke

GPU

Pedestal Panel

ATC	This button opens and close the standard Flight simulator ATC Window
KB	This button opens and close the standard Flight simulator kneeboard
MAP	This button opens and close the standard Flight simulator map.
GPS	This button opens and close the standard Flight simulator GPS.
OHD	This button opens and close the Overhead window.
PED	This button opens and close the pedestal window.
GPU	This button opens and close the GPU unit.
PRS	This button opens and close the window with the TMS, pressurization gauge and OAT.
YK	This button opens and close the Yoke.

Additional Notes

When loading the panel, the overhead and pedestal panel are always visible. This is necessary because of the gauge structure. Once the panel is loaded, you could close both windows with the above described buttons for the overheads and pedestal window.

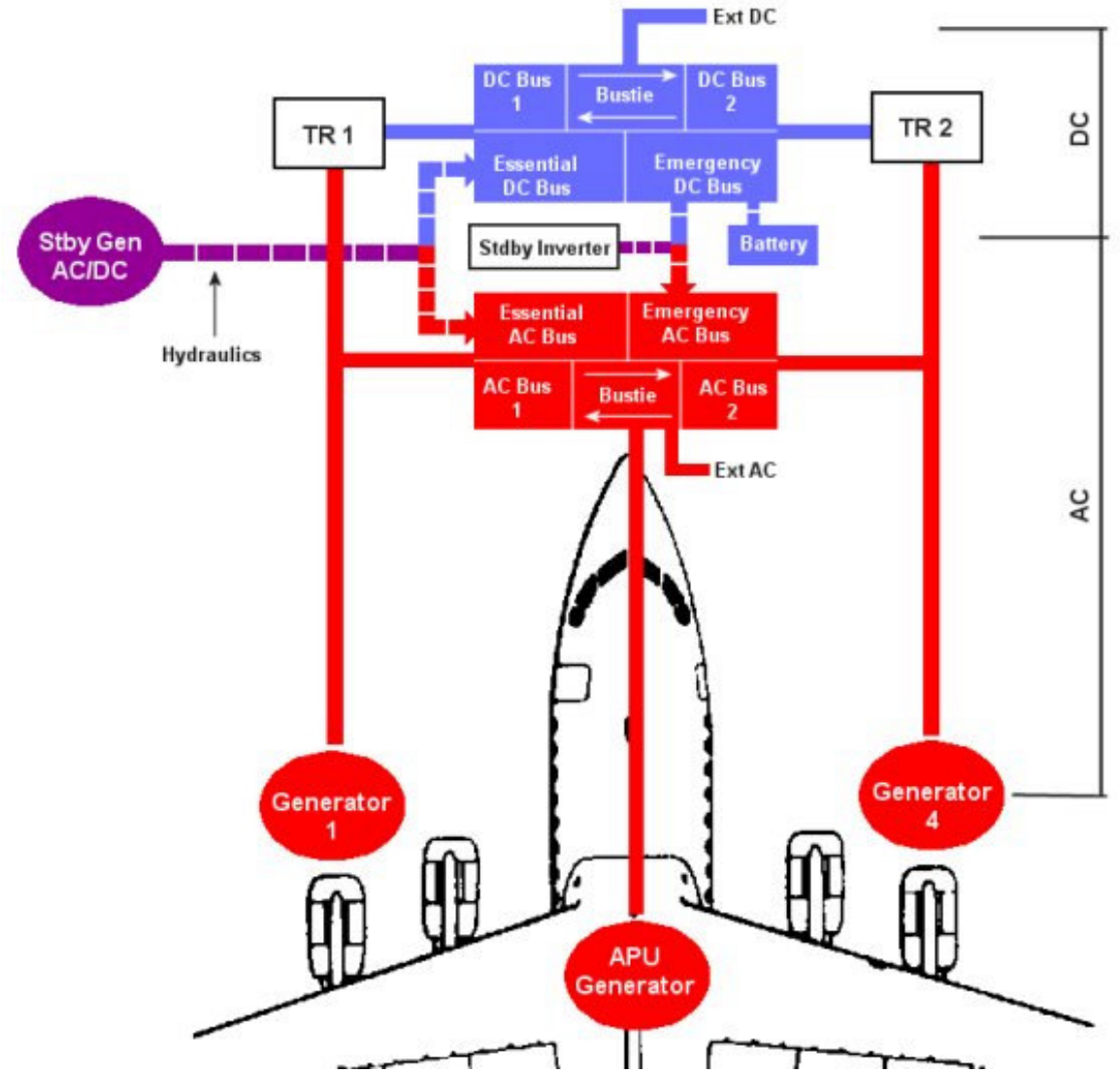
3.2 The Electric System

When installing the replacement flight dynamics, the Aircraft.cfg contents the line “electric_always_available = 1”. Normally this means that you always have electricity no matter if the battery is empty or not. Take care because this doesn’t apply to this panel as it comes with an own integrated electrical system. The “electric_always_available = 1” is just added to disconnect the BAe 146 panel from the electrical system of the Flightsimulator. You will lost electrical power with this panel regardless of what you have selected in the FS or with FSUIPC.

The complete electrical system based exactly on the electrical system of the real BAe 146. Because of the fact that I’ve programmed an own integrated electrical system, I could also realize a fully working APU and GPU which are not just dummies. Also I could gave both integrated Batteries a lifetime of about 20 minutes.

As written, all systems base very closely on the real aircraft. If there were any deviations to the real thing I wrote it in this manual. So you could compare all functions with the real BAe 146.

3.2.1 Electrical System Overview



The above picture (based on the real BAe 146) gives an overview of the complete BAe 146 electrical system and shows which busses are fed from which electrical source. Version 3.0 of the BAe 146 panel contents now all of the pictured busses and sources and it is possible to see the coherences and how they work together.

Some technical background:

All following descriptions based on the real BAe 146 and are fully implemented in version 4.0 of the BAe 146 panel.

The main electrical power source is a 40 kVA integrated-drive AC generator on each outboard engine. An identical generator is also driven by the APU (APU generator). This AC is fed to two busbars from which the AC services are taken. It is also fed two TR's (transformer/rectifiers) which convert it to 28V DC for the two DC busbars.

Both AC and DC busbars can be tied together with the AC and DC bus ties. If the bus tie switches are set to "Auto" and just engine 1 is running and the generator of engine 1 is on, AC 2 and DC 2 are provided with electrical power via the bus ties from AC 1 and DC 1.

In normal mode the essential AC (SAC) and DC (SDC) bus is provided with electrical power from AC 1 and DC 1. If generator 1 and generator 2 faults the essential bus has another electrical source. A hydraulically driven (and thus not time limited) standby generator provides 5 kVA of AC power and 50 amps DC and this will power the essential and emergency AC and DC busbars. The standby generator required a running engine 3 and working hydraulic pump of engine 3. It is not possible to fed the standby generator just with engine 2 and an opened PTU valve as the standby generator needs at least a pressure of 2800 psi and the PTU just allows a transfer of 2600 psi from engine 2.

The final backup, if the standby generator also has failed, is from the aircraft batteries. This DC source (MDC) will supply a solid state standby inverter for emergency AC (MAC). All other busses are isolated now and only the emergency servitudes are available. MAC is just activated if the standby inverter switch is set to "Arm".

3.2.2 Electrical allocation of the gauges

Hot Battery Bus

- Clock
- Battery Ammeter

Battery Bus

- Antiskid (if in Battery mode)
- DC pump (if in Battery mode)

Emergency AC Bus (MAC)

- ADF
- Yellow Brake Pressure Indicator
- HSI
- Servo Altimeter
- Slave Compass
- Airspeed Mach numbers
- DBI (RMI) ADF indication

Emergency DC Bus (MDC)

- Aux pitot heat
- Pitot heat annunciators
- Engine Air 2 and 3 Valve
- APU Air Valve
- Pack 1 and 2
- Manual Pressurization
- Common Feed Valves
- Comm 1
- DBI (RMI)
- Standby Attitude
- TGT Indicators
- N2 Indicators
- Stall Ident Valve Annunciators
- Lift- and Rollspoiler
- Fire extinguishing
- DBI (RMI) VOR indication

Essential AC Bus (SAC)

- Rotary Beacon Light
- Landing Lights
- Taxi Lights
- Left main pitot heat
- Automatic Pressurization
- Temperature indicators
- Nav 1 (Battery 1 as backup)
- Transponder
- Radio Altimeter
- Decision Height
- Comm 2
- Flap Indicator
- ADI
- Engine Vibration Indicators
- EGPWS

Essential DC Bus (SDC)

- Navigation Lights (see also GPU)
- Cockpit Flood Lights
- Engine Anti-ice Annunciators
- Pack Annunciators
- Feed Tank Indicators
- Nav 2
- OAT
- Oil Indicators
- N1 Indicators
- Fuelflow Indicators
- Fuel Quantity Indicators (MDC if Fuel Quantity switch is pressed)

AC Bus 1

- Panel and Instrument Lights (also MDC when Flight Deck emergency lights are armed or on)
- Engine 1 and 3 electrical fuel pump valves
- Audio Transmitting
- Moving Map and Weather Radar
- Brake Fans (crossed with AC2)
- Manual cabin temperature control
- Auto Flight Deck temperature control
- Manual Flight Deck temperature control

AC Bus 2

- Strobes
- Logo Lights
- Right main pitot heat
- Engine 2 and 4 electrical fuel pump valves
- Green Brake Pressure Indicator
- Brake Fans (crossed with AC1)
- Auto cabin temperature control
- Cabin Fan
- Flight Deck Fan

DC Bus 1

- Engine Anti-ice 1 and 3
- Engine Air 1 Valve
- Inner Wing Anti-ice Valve
- Left standby pump
- Spoiler Indicators
- Brake Temperature Indicator
- Thrust Modulation System (TMS)

DC Bus 2

- Engine Anti-ice 2 and 4
- Engine Air 4 Valve
- Outer Wing Anti-ice Valve
- X-Feed Valve
- Right standby pump
- Fuel Temp Indicator
- Fasten Seat Belt
- No Smoking
- Gear Indicators
- Antiskid (if not in Battery mode)

Additional Notes

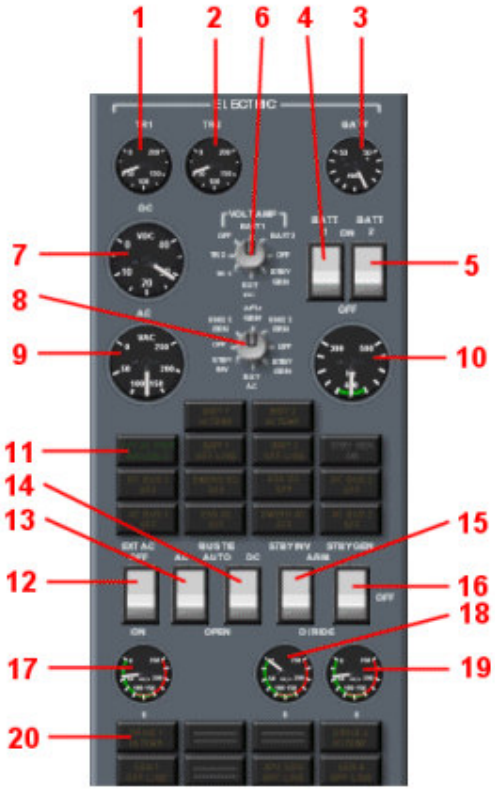
The Airspeed Indicator needle, VSI, standby Altimeter and trim indicators are pure mechanical instruments.

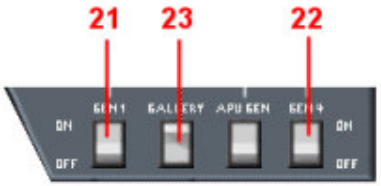
The MWS and AFGS annunciators have different electrical sources. You will find them in the corresponding chapter of this manual.

3.2.3 Activation of the Electrical Busses

Hot Battery Bus	The Hot Battery Bus is always available as long as the Battery is full.
Battery Bus	The Battery Bus is available when Battery 1 and/or Battery 2 is switched on.
Emergency AC Bus (MAC)	The MAC Bus is available when the Battery Bus, the Generators, the APU or the GPU is available and the standby Inverter is switched on.
Emergency DC Bus (MDC)	The MDC Bus is available when the Battery Bus, the APU, the GPU, DC1 or SDC is available.
Essential AC Bus (SAC)	The SAC Bus is available when AC 1, the APU or the GPU is available. SAC is also available when the green hydraulic system is available and the Standby Generator is switched on.
Essential DC Bus (SDC)	The SDC Bus is available when the APU, the GPU or Generator 1 is available. SDC is also available when Generator 4 together with the DC Bustie switch is on or when the green hydraulic system is available and the Standby Generator is switched on.
AC 1 Bus	AC 1 is available when the APU, the GPU or Generator 1 is available. AC 1 is also available when Generator 4 is available and the AC Bustie switch is on.
AC 2 Bus	AC 2 is available when the GPU or Generator 4 is available. AC 2 is also available when the aircraft is on ground and the APU is on or when Generator 1 is available and the AC Bustie switch is on.
DC 1 Bus	DC 1 is only available when the start power switch is not set to cold. Then DC 1 is available when the APU, the GPU or AC 1 is available or when Generator 4 is available and the DC Bustie switch is on.
DC 2 Bus	DC 2 is only available when the start power switch is not set to cold. Then DC 2 is available when the GPU or AC 2 is available or when Generator 1 is available and the DC Bustie switch is on. DC 2 is also available when the aircraft is on ground and the APU is available.

3.2.4 The Electric Unit





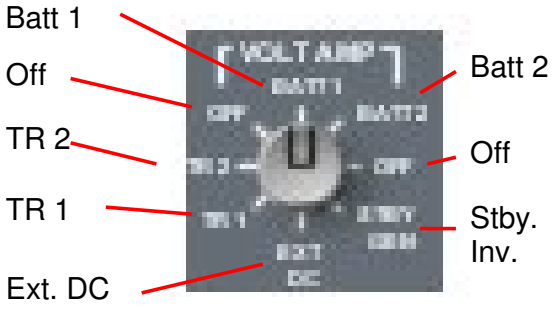
1	TR1 Ammeter (transformer/rectifier). This indicator continually monitors the TRU (transformer/rectifier unit) output (amperes) of TR1.
2	TR2 Ammeter (transformer/rectifier). This indicator continually monitors the TRU (transformer/rectifier unit) output (amperes) of TR2.

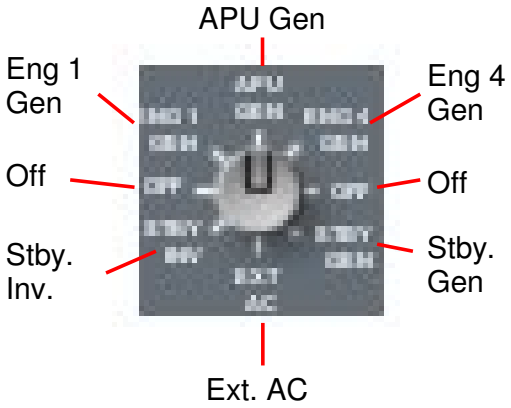
3	Battery Ammeter of Battery 1 or 2 in the case of what is selected with the DC selector pos. 6.
4	Battery 1 master switch
5	Battery 2 master switch
6	DC selector. Please see below for a more detailed description.
7	DC Voltmeter. Reads 28 volts except when Battery 1 or 2 is selected with the DC selector pos. 6 or when cold start is in use. When cold start is in use the DC voltmeter shows 36 volts for TRU 1 or TRU 2.
8	AC selector. Please see below for a more detailed description.
9	AC Voltmeter. Reads 115 volts in all selected positions.
10	Frequency meter. Reads 400 HZ in all selected positions.
11	Electrical master annunciator. Please see below for a description of the annunciator lights.
12	External AC master witch. If a GPU is possible and the external AC is connected to the aircraft, this switch will activate the external AC. The switch has no function if no GPU is available.
13	AC Bus Tie switch. When in “Auto” position the bus tie is opened and AC 2 could be provided with power from AC 1 and reverse.
14	DC Bus Tie switch. When in “Auto” position the bus tie is opened and AC 2 could be provided with power from AC 1 and reverse.
15	Standby inverter switch. If the battery is on this switch is set to “Arm” the emergency AC bus is activated.
16	Standby generator switch. If engine 3 is running, hydraulic pump 3 is on and this switch is set to “Arm” the aircraft is provided with electrical power for the essential busses from the standby generator in a loss of AC and DC from the generators and APU generator. When the standby generator is activated both batteries are disconnected.
17	Generator 1 Ammeter.
18	APU Generator Ammeter. This gauge shows the amperes of the APU generator when it is in use. The APU generator is not in use if the generators of engine 1 and 4 are activated. If one engine generator fails or is switched off the APU generator will automatically be connected when available.

19	Generator 4 Ammeter.
20	Generator Annunciator. Please see below for a detailed description of the annunciator lights.
21	Generator 1 master switch.
22	Generator 4 master switch.
23	Galley / Shed switch (just a dummy switch without any function).

The AC and DC selectors (Pos. 6 and Pos. 8)

The letters of the AC and DC selectors are very small in the BAe 146 panel. That's why I show here an enlarged picture of both selectors:





The Electric Master Annunciator

The above picture shows the warning lights of the electrical annunciator. The amber “Off” lights came up if the corresponding bus is not available. For example: The “DC Bus 1 Off” light came up if DC bus 1 is not provided with electrical power.

The green “Ext AC PWR Available” light came up if a GPU AC is connected to the aircraft. If you now switch on the external AC master witch (pos. 12) the aircraft is fed with electrical power from the GPU.

The Batt 1 and Batt 2 Off Line lamps came up if the batteries are switched off but the aircraft has electrical power from the generators for example and so the batteries are not charged. The lights came also up when the batteries are disconnected by the standby generator for example.

The “STBY GEN ON” light came up when the standby generator is available and activated. The standby generator is available when engine 3 is running and the hydraulic pump of engine 3 is on. It will be switched on automatically when the standby generator master switch is set to “Arm” (pos. 16) and the AC or DC connection from the generators and APU generator fault or are switched off.

The Battery 1 and Battery 2 Hi Temp lamps have no function in the BAe 146 panel.

The complete electrical master annunciator is provided with electrical power from the MAC bus. That’s why those lights are already visible after activating one of the batteries.

The Generator Annunciator

The Gen 1 and Gen 4 Off Line lamps illuminate if the corresponding generator is off or disconnected. For example: When the Start Master switch is on the DC busses are disconnected and so the generators 1 and 4 off line.

The APU generator lamp illuminates when the APU generator is offline (see next chapter).

The electrical power source of the Generator 1 and 4 off line annunciators is SDC. The Drive 1 and 4 Hi Temp annunciators have no function in the BAe 146 panel.

Additional Notes for the electrical system

As written the complete electrical system base very close on the real BAe 146 aircraft. To realize this it was necessary to program a close system in which every part exactly works together with a respective other part. All systems frame a closed unit. Because of this there are some important things which are necessary to know:

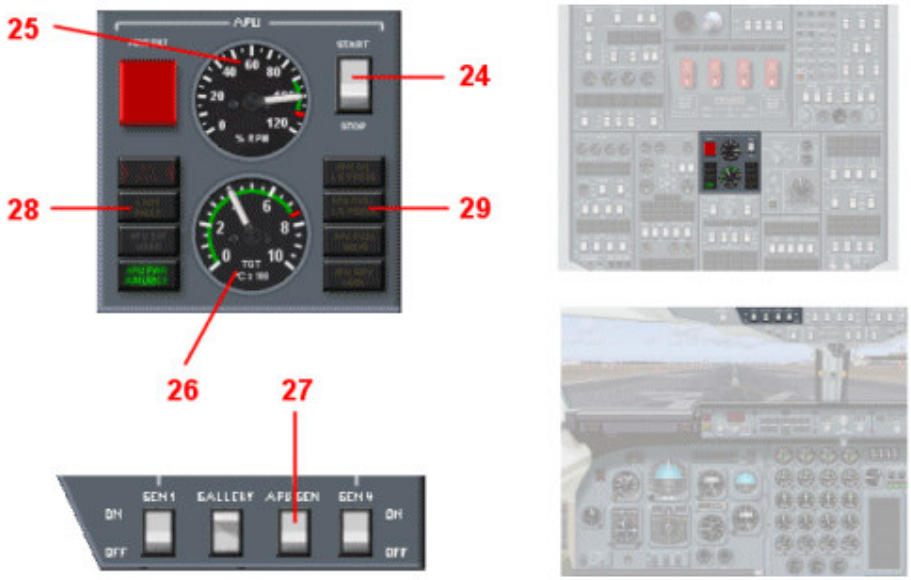
- If just the batteries are activated and you have no electrical power from the APU, GPU or the generators the batteries discharge. You have about 20 minutes electrical power from each battery.

- As soon as the generators, the APU or GPU is active, the batteries will be charged.

- When the standby generator is active the batteries are disconnected and will discharge.

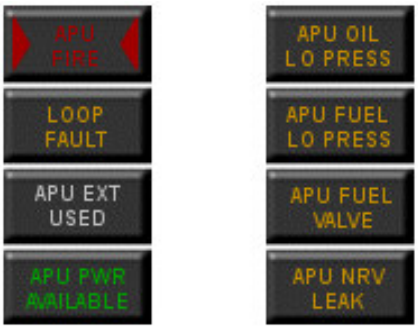
You will find more information about the electrical backup systems in the corresponding chapters of this manual. Because of this take care also to read the hydraulic section as you find here some more details about the standby generator or to read the fuel section of how to find out more about the fuel feed of the APU and how to use alternatives if the electrical fuel pump 2 is not possible.

3.2.5 The APU Unit



24	APU master switch. Activates the APU engine if the Battery is on and not disconnected (by the standby generator for example).
25	APU RPM indicator displays APU engine speed.
26	APU engine TGT indicator.
27	APU Generator master switch.
28	Left APU Annunciators
29	Right APU Annunciators

The APU Annunciators (Pos. 28 and Pos. 29)



The red APU Fire lamp came on when the system detects an APU fire or when the APU fire of the ground test unit is pressed.

The amber APU loop fault is not realized with this panel.

The white “APU EXT USED” just came on when the fire extinguishing test of the ground test unit is pressed, because an APU fire extinguishing is not realized with this panel.

The green “APU PWR AVAILABLE” lamp came on when the APU is available.

The “APU Oil Lo Press” lamp came up after the APU was started and before the APU engine has enough RPM. The light should go out at about 40% RPM.

The “APU Fuel Lo Press” light came up when the APU is started from a cold and dark cockpit, with no GPU available. In this case the APU is started on batteries and since the AC busses are de-powered well the fuel pumps as well. Nevertheless, the APU will start but indicating fuel lo press.

The “APU Fuel Valve” and “APU NRV Leak” lamps have no function yet.

Additional Notes for the APU

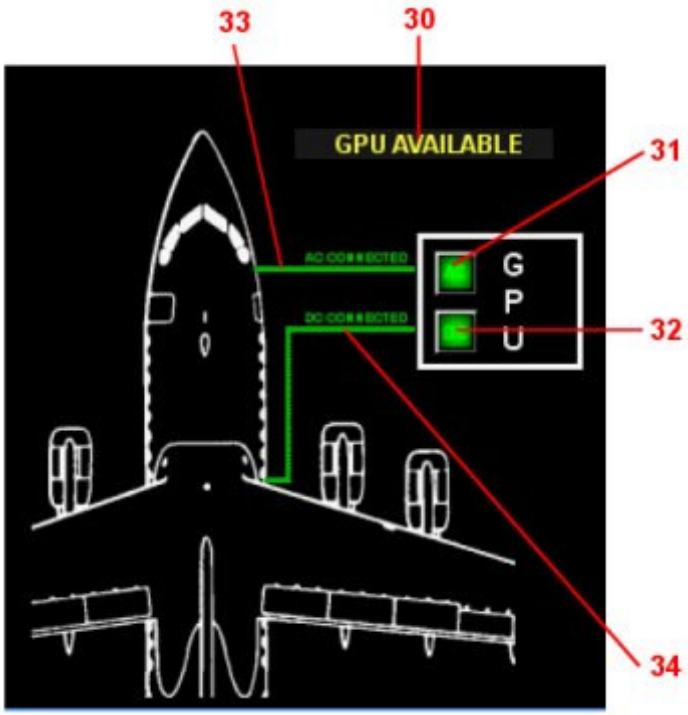
The APU could just be started when the battery is on and not disconnected. To get electrical power from the APU (AC and DC) it's necessary to switch on the APU generator and to supply fuel to the APU with the electrical fuel pump 2.

Like in the real aircraft, it is also not possible to start the APU when the standby generator is active.

The APU did not support AC 2 when both generators are off and you're airborne. In this case you will lost AC 2. DC 2 could be supported with the DC bus tie.

3.2.6 The GPU Unit

The GPU is placed in a separate panel window of the BAe 146 panel. You could open it directly with the corresponding GPU window toggle on the left side of the main panel.



30	This text shows if the GPU is available (yellow text) or not available (red text).
31	GPU AC connection button. If the GPU is available you connect the aircraft with the GPU AC when clicking on this button. The button lights up if the AC connection is active.

32	GPU DC connection button. If the GPU is available you connect the aircraft with the GPU DC when clicking on this button. The button lights up if the DC connection is active.
33	This line is visible when the GPU is available and the AC connection is active.
34	This line is visible when the GPU is available and the DC connection is active.

Additional Notes for the GPU

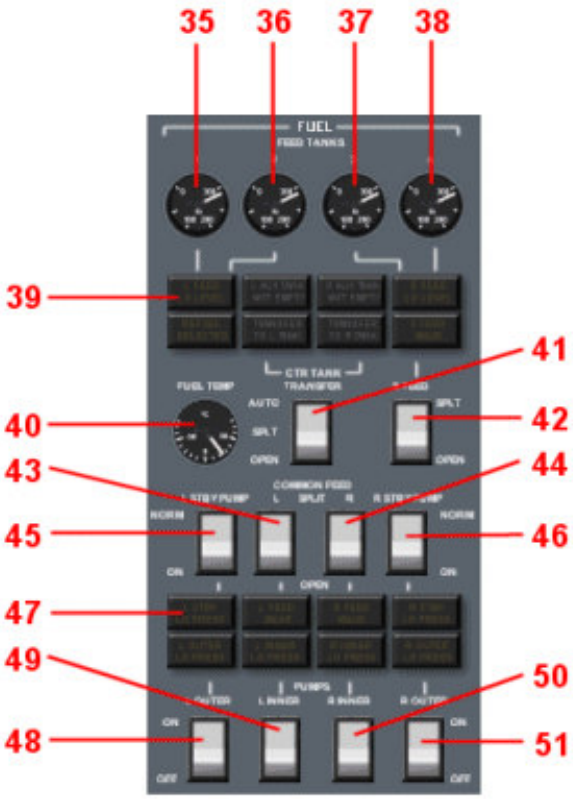
The GPU is available when the aircraft is on ground and the aircraft is not moving.

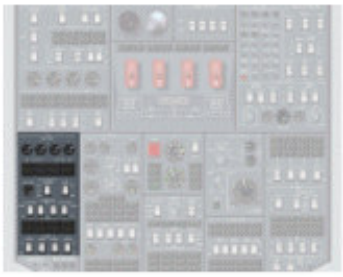
You activate the GPU when available by clicking on the AC and/or DC buttons (pos. 31 and 32) in the GPU window. After that you could see the two green electrical lines (pos. 33 and 34) going from the GPU unit to the aircraft. Now you have to switch on the GPU with the GPU AC switch (pos. 12). The GPU provides the aircraft now with AC from the GPU and DC via the TR's.

The external DC is just necessary when starting the engines with external DC. The corresponding switch in the starter unit has to be set to "Ext DC".

3.3 The Fuel System

3.3.1 The Fuel Unit in the Overhead Panel





35	Fuel quantity of the left outer feed tank (max. 600 lbs.).
36	Fuel quantity of the left inner feed tank (max. 600 lbs.).
37	Fuel quantity of the right inner feed tank (max. 600 lbs.).
38	Fuel quantity of the right outer feed tank (max. 600 lbs.).
39	Fuel Transfer and Feed Tank Annunciator. Please see detailed description below.
40	Fuel temperature of the right wing tank.

41	Center fuel transfer switch. The switch has three positions. If the switch is in the "Auto" position (switch up) and the aircraft is airborne fuel is used from the wing tanks until they reach 7470 lbs. After that an electrical pump transfers fuel from the center tank to the wing tanks to keep them at 7470 lbs. Until the center tank is empty. After that fuel is automatically used from the wing tanks. The "Auto" mode did not work if the aircraft is on ground. If the centertransfer switch is in the shut position (center position) fuel is just used from the wing tanks. The "Open" (lower) position of the switch has almost the same function than the "Auto" position except the fact that this position always transfers fuel from the center tank to the wing tank no matter if the aircraft is on ground or not.
42	X-Feed valve switch. The X-Feed valve is positioned between the left and right wing and enables all four engines to be pressure-fed by the pumps in one wing when opened.
43	Left common feed valve. The left common feed valve enables the two left engines to be supplied from one of the left pumps.
44	Right common feed valve. The right common feed valve enables the two right engines to be supplied from one of the right pumps.
45	Left standby pump. This switch activates the left hydraulically driven standby pump to keep the left feed tanks fuel.
46	Right standby pump. This switch activates the right hydraulically driven standby pump to keep the right feed tanks fuel.
47	Fuel Pump and Feed Annunciators. Please see detailed description below.
48	Electrical fuel pump for the left outer feed tank and Engine 1.
49	Electrical fuel pump for the left inner feed tank and Engine 2.
50	Electrical fuel pump for the right inner feed tank and Engine 3.
51	Electrical fuel pump for the right outer feed tank and Engine 4.

Additional Notes

For starting the Engines it's not necessary to switch on the corresponding electrical fuel pump. Nevertheless it's a standard procedure to switch on the electric fuel pumps before starting each engine.

When it is necessary to restart an engine in flight (after an engine failure for example) you must switch on the corresponding electrical fuel pump when flying above 20000 feet. Without the running fuel pump it is not possible to restart the engine above 20000 feet.

An engine could also be feed with fuel from another pump and an opened common feed or opened X-Feed valve (when using an electrical fuel pump from the other wing).

The fuel flow of the BAe 146 is normally given by gravity and the wing's anhedral. That's why it is not imperative to have the electrical fuel pumps on in flight or after the engines are started. Nevertheless there are a couple of reasons why you should do it. The first reason is that you need the electrical fuel pumps in high altitudes (above 20.000 feet) or in abnormal situations to ensure the fuel flow. The second reason is that if the outer feed tanks are empty (this could happen when the wing tanks are almost empty and the outer fuel pumps are off) you have no possibility to refuel the outer feed tanks and so no possibility to restart the engines after the shutdown because of low fuel. That's why I highly recommend to leave the electrical fuel pumps on for the complete flight.

Fuel Transfer and Feed Tank Annunciator (pos. 39)

The L Feed and R Feed Lo Level lights came up if one of the left or right feed tanks is below 600 lbs. The X-Feed Valve light is just a "not in position" light which illuminates for a short time after pressing the X-Feed valve switch. The white Transfer to L and R Tank lights came up when the center transfer mode is active and so fuel from the center tank is pumped to the wing tanks.

The "Refuel Selected" and Aux Tank lights have no function yet.

Fuel Pump and Feed Valve Annunciator (pos. 47)

The L stby lo press light has two functions. The first function is a “not in position” light which came up a shot time after the left standby pump is switched on or off. The light is also on if the right standby pump is active and the left standby pump is off. The R stby lo press light has the same functions than the left light.

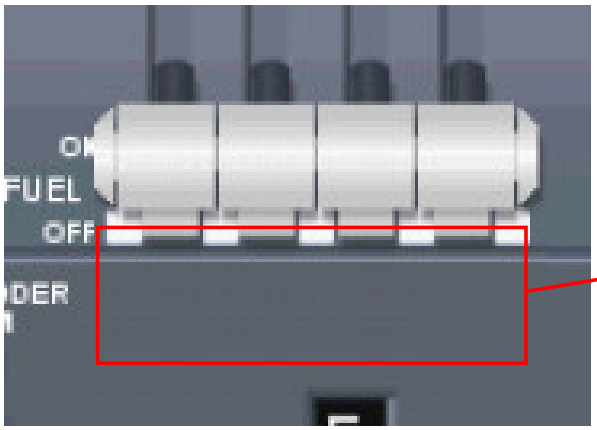
The L Feed and R Feed Valve lights are just “not in position” lights. They illuminate for a short time after the left or right common feed valves are opened or closed.

The L and R outer and L and R inner Lo Press lights illuminate if the corresponding feed tank has no fuel and the electrical fuel pump is on. The lights will also illuminate when the corresponding fuel pump is off and the system is completely supported with electrical power.

3.3.2 Throttle and High Pressure (HP) Fuel Valves

Each engine thrust is controlled from a separate throttle in the pedestal panel. The throttles have no reverser, because the real BAe 146 did not content any reverse thrust.

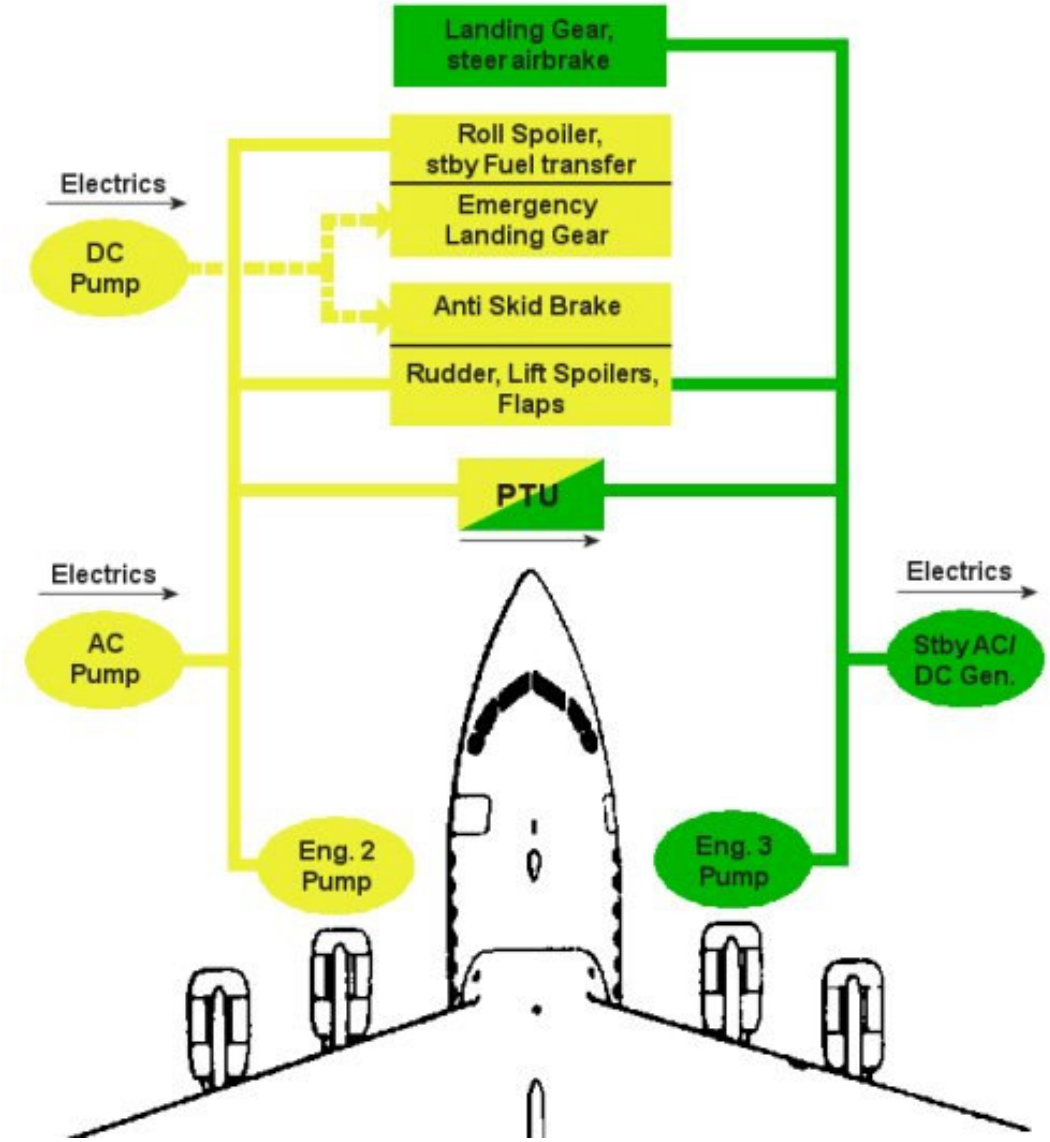
The switches for the HP fuel valves are placed at the lower side of the throttles. The function of this fuel cut-off valve is very simple. Just move the throttle completely back. After this you can click below each throttle to close the HP valve of the corresponding engine. If the engine is switched off and the Throttle is in the fuel cut-off position you see no movement of the Throttle also when using any hardware throttle.



Mouseclick area to move the Throttle to it's HP fuel cut-off position and back.

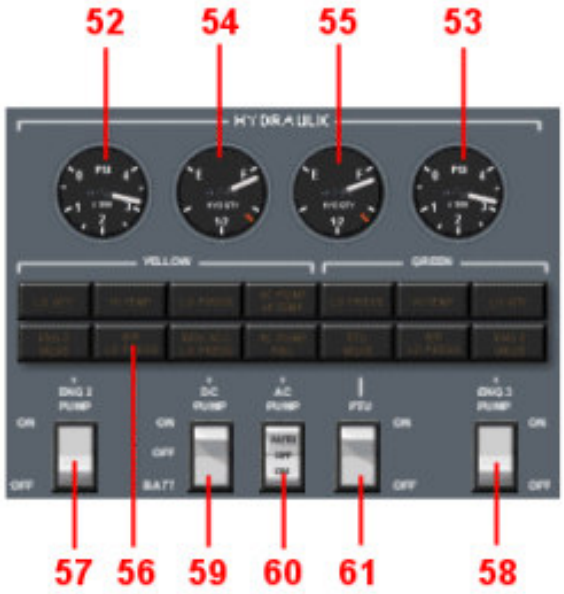
Before you can restart the engine again or moving the throttle, it's necessary to open the high pressure fuel valve again. This will be done on the same way. Just click below the corresponding throttle to bring it back to the "On" position. If you are using any hardware throttle you have to move the throttle completely back before the cut-off valve could be opened or closed.

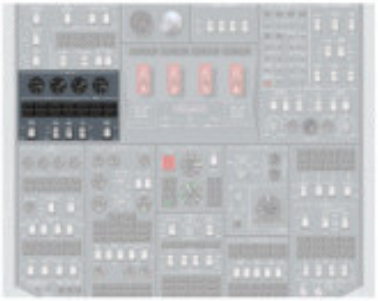
3.4 The Hydraulic System



The above picture (based on the real BAe 146) gives an overview of the complete BAe 146 hydraulic system and shows which aircraft systems are fed from which hydraulic source. Version 4.0 of the BAe 146 panel contents now all of the above pictured systems very close to the real hydraulically system.

3.4.1 The Hydraulic Unit





52	Yellow System Hydraulic Pressure (x 1000 psi).
53	Green System Hydraulic Pressure (x 1000 psi.).
54	Yellow system hydraulic contents
55	Green system hydraulic contents
56	Hydraulic Annunciator. Please see below for a detailed description.
57	Yellow System Engine 2 Hydraulic Pump switch.
58	Green System Engine 3 Hydraulic Pump switch.
59	DC Pump switch. Please see below for a detailed description of the backup systems.
60	AC Pump switch. Please see below for a detailed description of the backup systems.
61	PTU Valve switch. This switch opens the PTU valve to supply a fault systems with hydraulic pressure of the running system. Please see also below for a detailed description of the backup systems.

The Hydraulic Annunciator (pos. 56)

The Eng 2 and Eng 3 Valve lights are just “not in position” lights. They illuminate for a short time after the pumps of engine 2 or engine 3 are switched on or off.

The Air Lo Press lights (one for engine 2 – left and one for engine 3 – right) came up if the corresponding engine gives not enough pressure for the corresponding hydraulic pump. That’s why the light is on if the corresponding engine is off.

The “BRK ACC LO PRESS” light illuminates if you have not enough hydraulic pressure for the brakes and parking brakes. Please see also the description of the backup systems below.

The left “Lo Press” light came up if the yellow hydraulic system is below a pressure of 1500 psi. The right “Lo Press” light came up if the green hydraulic pressure is below 1500 psi. or if the standby generator is active. Please see also the descriptions of the backup systems below.

The PTU Valve light is a “not in position” light which illuminates for a short time after the PTU valve is switched on or off.

All other lights of the hydraulic annunciator have no functions.

3.4.2 The Hydraulic Backup Systems

As written in the electric, fuel and hydraulic chapter, the BAe 146 contents a lot of backup systems for all functions. It was my goal to realize all of them as real as possible. In this chapter you will find a description of the hydraulic based backup systems and the backup systems to keep the hydraulic systems alive.

Backup's for the hydraulic system

Power Transfer Unit PTU

Normally the hydraulics run off the inboard engines, so the engine driven pump of engine 2 supports the yellow system and the engine driven pump of engine 3 supports the green hydraulic system. The services of each system are shown in the graphic overview of the hydraulic. A power transfer unit (PTU) enables the yellow system to run green system if the engine 3 pump fails. The PTU will be opened with the switch pos. 61.

AC Pump

As well as the PTU, there are two further backups which are driven by the electrical system of the BAe 146. An electrical pump running of the AC busbar could feed the yellow system if the electrical AC bus provides electrical power (generators or APU running). This electrical pump will be activated with the AC pump switch (pos. 60). If the switch is in the off position (center position) the pump is switched off. In Auto mode (upper position) the AC pump will be activated when the system itself recognize a fault of the engine 2 pump. In the on position (lower position) the AC pump is always on. If the PTU is opened (switch pos. 61) the AC pump could also provide hydraulic pressure for the green system if both inboard engines failed. In this case the green hydraulic system could just provide a pressure of 2600 psi. and not 3100 psi. as with a running engine 3 and engine 3 pump on. Nevertheless all green services could be used except the standby generator which needs at least a pressure of 2800 psi. You will find more information about the standby generator below.

DC Pump

A DC electrical pump provides further backup by providing a dedicated hydraulic supply only to the landing gear and to the brakes (in the real aircraft the DC pump only provides hydraulic pressure to the emergency landing gear lowering and to the anti-skid brakes – so here is a difference to the real BAe 146). In this panel the DC pump could be set to off or to the "Batt" position (lower position of the switch pos. 59). In the "Batt" position the DC pump is running with electrical power from the battery and so the DC pump work as soon as the battery is switched on. In this case the parking brakes could be activated before an engine runs and/or before the APU is running.

Backup's for other systems supported by the hydraulic system

The hydraulic system of the BAe 146 could not only be fed by the electrical system, it could also provide power (pressure and/or electrical power) to other systems.

Hydraulically driven Standby Pumps

Backup for the fuel system in the event of electrical failure is provided by hydraulically driven standby pumps. The hydraulic standby pumps keeps the feed tanks fuel in the event of a failure of an electrical fuel pump. The standby pumps could be switched on in the fuel unit with the two switches pos. 45 and 46. You will find some further information about this backup and the corresponding annunciator lights in the chapter "The Fuel System".

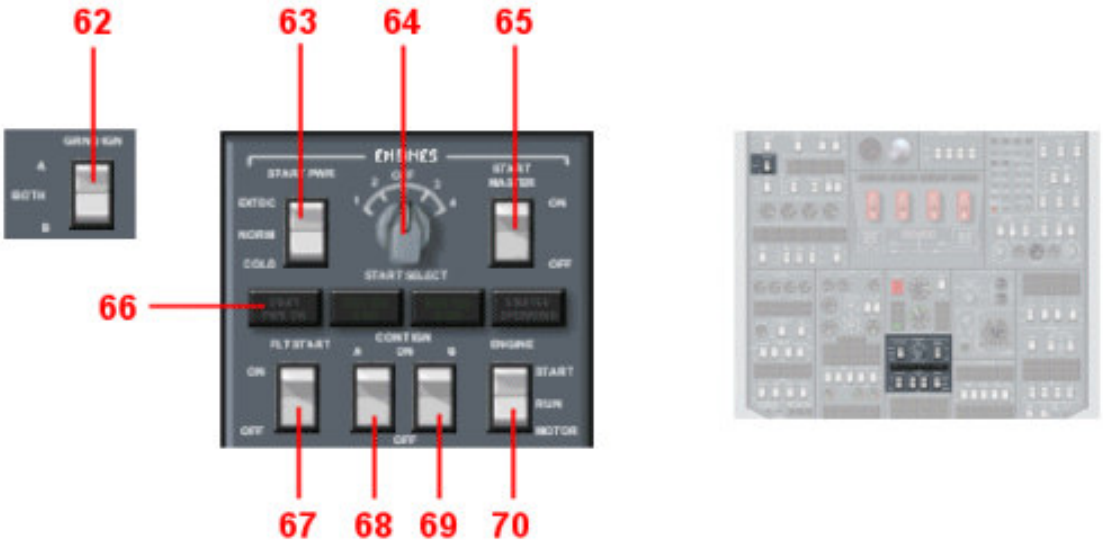
Standby Generator

A hydraulically driven AC/DC standby generator provides backup for the electrical system using the green hydraulic system in the event of a failure of both engine driven generators and APU generator. As the standby generator at least needs a pressure of 2800 psi. it's not possible to activate it just with the yellow system and an opened PTU. You need to have a fully working green system for it.

The standby generator could be armed with the switch pos. 16 in the electric unit of the overhead panel. If the generator is armed it will be activated automatically when the engine driven generators and APU generator fault or all of them are switched off. An activated working standby generator is also indicated with a white annunciator light in the electric main annunciator. If the standby generator is active, the batteries are isolated. In this case the batteries will not be charged. Also a result of this is that you could not activate a stopped APU as the APU needs the battery for starting.

When the standby generator runs hydraulic power for this is high and the remainder of green system services are inoperative. Unfortunately it was not possible to realize all limitations when the standby generator is active with this panel (I'm currently working on them).

3.5 The Engine Starter and Ignition



62	Ground Ignition selector switch. With this switch you choose which of the two ignitions (A or B) is used for starting the engines on ground. Normally both ignitions are used (switch in the center position).
63	Start power switch. This switch has three positions. The upper position “EXT DC” is used to provide the starter with external DC from a GPU. A GPU must be available and the external DC has to be connected for this function. The “Norm” position is used for normal starting. The “Cold” position (lower position) is used at high altitudes or low outside air temperatures. In normal position all DC busses remain powered. When starting with this switch set to “Cold” the other DC busses are disconnected. This because the TRU output voltage is higher (36 volts) and may damage the DC servitudes. For normal and cold starting you need AC power either from the APU or GPU.
64	Engine selector for the starting.
65	Start master switch. The engines are started with DC electrical starter motors which are powered from the start bus. This start bus is connected directly to the TR1 and TR2 outputs by switching the start master switch to on.
66	Engine starter annunciator. Please see below for detailed descriptions.

67	Flight start switch to start an engine in flight. This switch did not base exactly on the real BAe 146. In the real aircraft you have to activate this switch (position on), move the throttle forward and then move the switch back to the off position to start the engine. In this panel you have to activate the start master switch (pos. 65) and then to switch on the flight start switch. The selected engine will then start automatically (just if you are airborne of course).
68	Continuous Ignition switch for Ignition A. The continuous ignition is normally switched on while take off and a short time before landing to prevent an engine failure.
69	Continuous Ignition switch for Ignition B. The continuous ignition is normally switched on while take off and a short time before landing to prevent an engine failure.
70	Engine starter switch. Press this switch to start the engine. The switch goes back to the center position automatically after the engine is running. Do not select another engine as long as the switch is in the start (upper) position.

The Engine Starter Annunciator

The “Start PWR ON” light came up when the start master switch (pos. 65) is on or while the APU is starting.

The green engine ignition lights came up while the engine is starting and the ignition is active (whichever ignition is selected with the switch pos. 62) and N2 is below 40%. In Flightstart just engine ignition A lights up.

The starter operating light illuminates whenever the starter motor is energized. Do not select another engine while the light is on.

Additional Notes

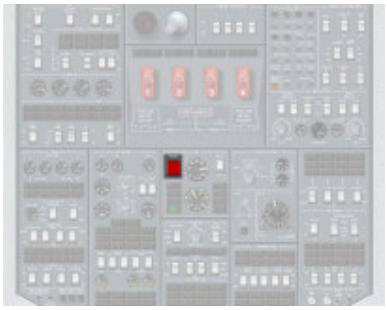
If the start master switch (pos. 65) and the APU generator is on, both engine generators are disconnected. If the APU generator is off and both generators are on, one of the engine generators is disconnected when the start master is on.

Take care that the electrical fuel pump is running when preparing an engine flight start above 20000 feet. Otherwise the engine could not be started.

Please see the checklists for a detailed description of the engine start-up sequence.

3.5.1 The Automatic Starter

The new BAe 146 Panel contains an invisible switch for an automatic start. This switch is set for the user who doesn't want to go through the cold start-up procedure. I prefer you to go through the cold start-up procedure rather than using this switch. Nevertheless some Flightsim pilots do prefer to have such an automatic starter. For them I've implemented it.



Invisible click area for the automatic starter

When using the automatic starter, the next points will be executed and activated:

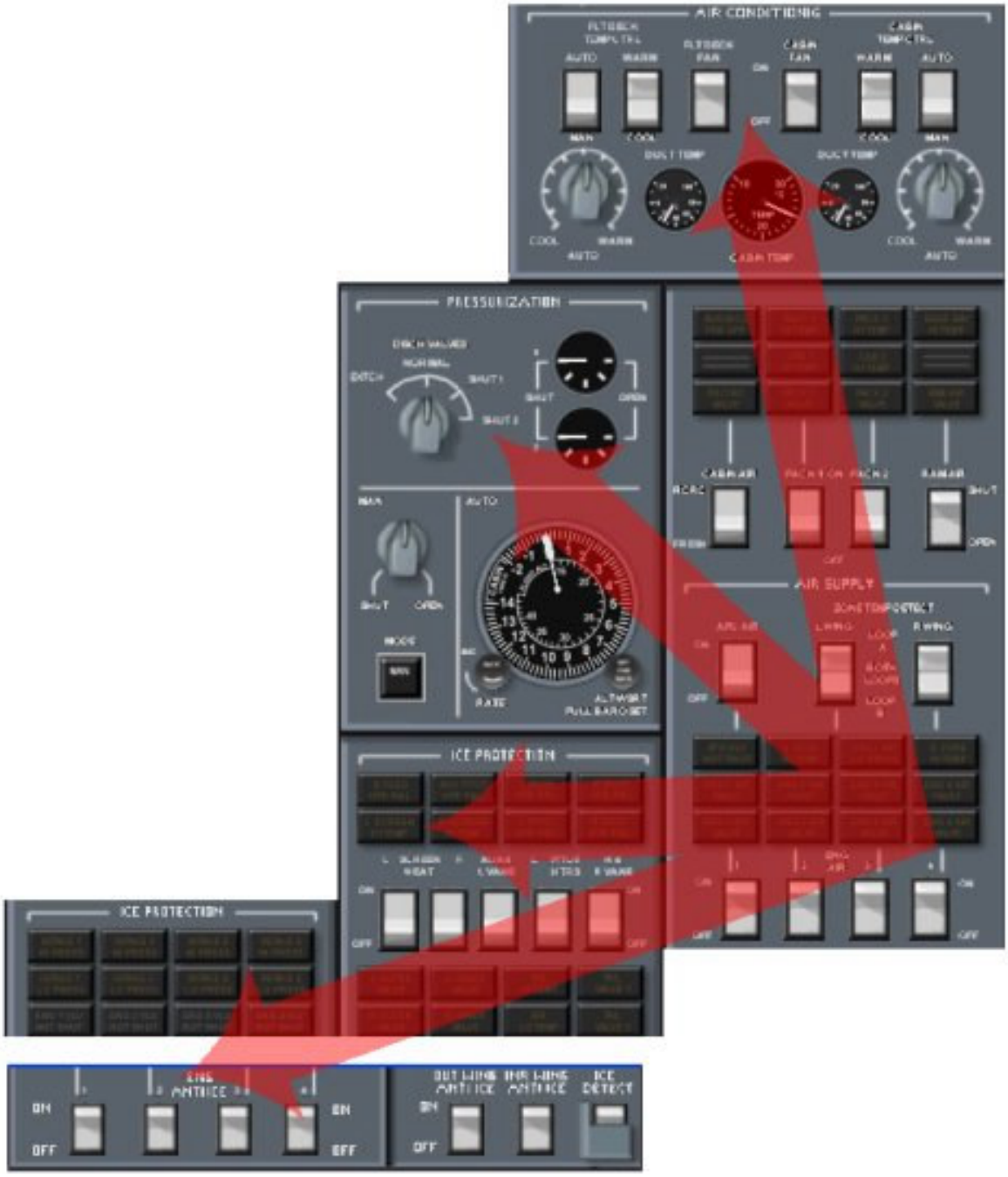
- All electrical busses are activated
- Hydraulic DC pump is connected with the battery
- APU is started
- Fuel valves are opened and fuel pumps are switched on
- Engines are started
- Hydraulic pumps are activated
- Flight Deck Emergency Lights are armed
- Avionics A and B are switched on

Next points are not executed by automatic start:

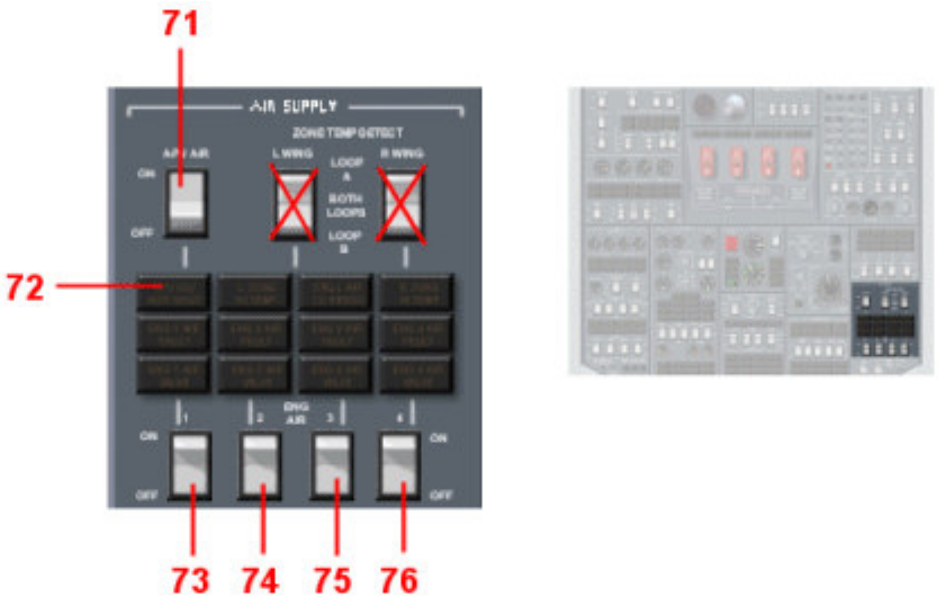
- Autopilot Master Switch and Yaw Damper are not activated
- Anti Skid is not switched on
- All anti-ice and de-ice switches are not set to on
- There is no Cabin Altitude chosen and the discharge valves stay closed
- All extern and intern lights are out
- TMS settings are not resolved

All these points which will not be executed by the automatic start, must be done manually after the autostart is activated.

3.6 The Air Supply and provided Units



3.6.1 The Air Supply Unit



71	APU air switch. If the APU is running you could provide the pressure for the required air supply (the packs or pressurization for example) from the APU. Air from the APU is normally used on ground while engine air used in flight.
72	Air supply annunciator. Please see below for further descriptions.
73	Engine 1 air switch. If engine 1 is running this switch opens the valve for the air supply from engine 1.
74	Engine 2 air switch. If engine 2 is running this switch opens the valve for the air supply from engine 2.
75	Engine 3 air switch. If engine 3 is running this switch opens the valve for the air supply from engine 3.
76	Engine 4 air switch. If engine 4 is running this switch opens the valve for the air supply from engine 4.

Additional Notes

The red crossed switches have no function yet.

The Air Supply Annunciator (pos. 72)

Like the temperature and packs annunciator it's not possible to realize some functions of the air supply annunciator with a Flight simulator panel. That's why a lot of the annunciator lights have no function.

The realized functions are:

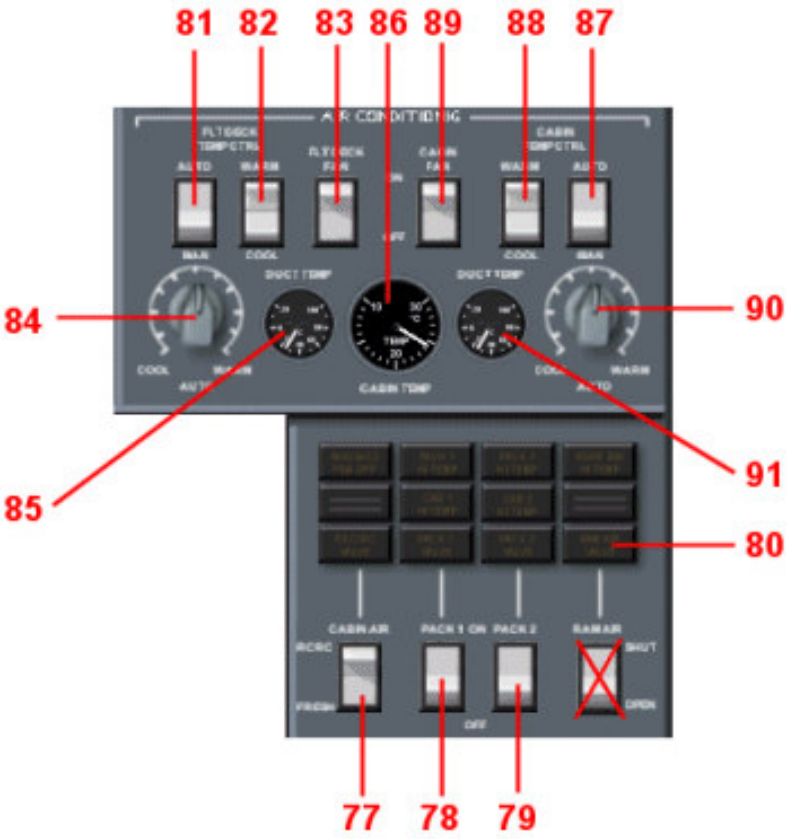
The "APU VLV NOT SHUT" is just a "not in position" light for the APU air switch pos. 78 (or better for the APU air valve). It illuminates a short time after the APU air is switched on or off.

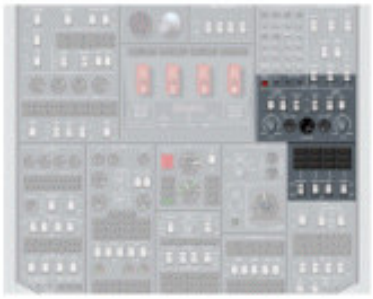
The engine air valve annunciators illuminates whenever the corresponding engine air is switched on and the engine itself is off. The lights came also up if the necessary electrical power supply is not given. Engine air 1 needs DC 1, engine air 2 and 3 needs MDC and engine air 4 needs DC 2 to operate. The annunciator itself needs essential DC (SDC) to work.

Additional Notes for the air supply unit

Normally on ground just APU air is used for the air supply. The reason is that more thrust is lost with the engine air on. That's why you should also use APU air if performance will not allow engine air. You must never take off with engine anti-ice and engine air selected together (too much thrust will be bleed through the engines and so not enough power is given for a safe take-off). If the APU air is fault you could use engine air 4 for pressurization on ground. But this just without switching on the packs.

3.6.2 The Air Conditioning Unit





77	Cabin air circulation switch. With this switch you decide if you want to have an air recirculation or fresh air. Air recirculation (switch position RECIRC) is only available with both Packs or APU air on. Loss of one pack or cabin high altitude warning will automatically revert the system to the fresh mode. Below 10000 ft the cabin air should be in RECIRC (more performance on engines) and above 10000 ft. it should be FRESH (passenger comfort).
78	Air conditioning pack 1 switch. The switches operate isolation/flow control valves that allow engine air or APU air through to each of the packs. Without APU or engine air the packs are not working.
79	Air conditioning pack 2 switch (see also description above).

80	Temperature and Packs annunciator. Please see below for further descriptions.
81	Flight Deck temperature control Auto/Man mode switch
82	Flight Deck Warm/Cold switch for manual flight deck temperature control. When pressings and holding the switch (spring-loaded-to-centre-switch) you will increase or decrease the Flight Deck duct temperature and so regulate the temperature of the cockpit. The switch has no function when the Auto/Man switch (pos. 81) is set to Auto. For more information about controlling the Flight Deck temperature please read the chapter below.
83	Flight Deck fan switch. This switch is used to control an air supply boost valve in the outlet duct from no. 1 pack. When this is used, this valve closes the no. 1 pack air supply to the cabin increasing the air supply to the flight deck. This additional cooling is to be used on the ground only.
84	Flight Deck temperature controller for Auto mode. With this knob you could increase or decrease the Flight Deck temperature. For more information about controlling the Flight Deck temperature please read the chapter below..
85	Flight Deck duct temperature indicator.
86	Passenger cabin temperature indicator.
87	Passenger cabin temperature control Auto/Man mode switch
88	Passenger Cabin Warm/Cold switch for manual cabin temperature control. When pressings and holding the switch (spring-loaded-to-centre-switch) you will increase or decrease the cabin duct temperature and so regulate the temperature of the passenger cabin. The switch has no function when the Auto/Man switch (pos. 87) is set to Auto. For more information about controlling the cabin temperature please read the chapter below.
89	Passenger Cabin fan switch.
90	Passenger cabin temperature controller for Auto mode. With this knob you could increase or decrease the Flight Deck temperature. For more information about controlling the cabin temperature please read the chapter below..
91	Passenger cabin duct temperature indicator.

Additional Notes

The red crossed switches have no function yet.

The Temperature and Packs Annunciator (pos. 80)

The “AVIONIC FAN OFF”, “REAR BAY HI TEMP”, “CAB 1 HI TEMP”, “CAB 2 HI TEMP” and “RAM AIR VALVE” lamps have no function yet.

The “PACK 1 HI TEMP” and “PACK 2 HI TEMP” lamps illuminate when the corresponding pack (duct temp) gets higher than 65 °C. In this case the pack (1 or 2) will be automatically switched off and so the “PACK 1 VALVE” or “PACK 2 VALVE” will illuminate. In the case of a high pack temperature you have to reduce the temperature in manual mode and then switch off and on the corresponding pack again. If the temperature is still too high, you have to wait until the temperature is below 65°C and then repeat the procedure again.

“Recirc Valve” This is a “not in position” light which illuminates a short time after the cabin air circulation switch pos. 77 is moved. It also lights up in the event of a pack failure, high temperature or cabin high altitude indication In this case the valve will revert automatically to fresh. The light goes out after the cabin air circulation switch is set to fresh.

The pack 1 and pack 2 annunciator lights are also “not in position” lights for the two pack switches (or better for the valves of the two packs). The annunciator lights also came up when you switch on the packs without having air from the APU or engines.

Additional Notes for the air conditioning unit

The complete air conditioning system uses power from the AC 1 and AC 2 bus. AC 1 supports electrical power for the flight deck auto and manual temperature control and the cabin manual temperature control. AC 2 supports electrical power to the flight deck and cabin fan and the cabin auto temperature control. If both electrical busses are off line, no temperature control is possible and the flight deck and cabin temperature will increase or decrease to the outside temperature.

The both packs supply different systems. No 1 pack supplies air conditioning to the flight deck and augments the passenger cabin supply. No. 2 pack supplies air conditioning the passenger cabin. The pressurization system works with either pack 1 or pack 2. No. 1 pack is supplied from engines 1 and 2 and no. 2 pack from engines 3 and 4. There is no crossfeed possible, so take care that you have air for the corresponding conditioning system from the named engine. The APU can provide pack 1 and pack 2 when the APU is running and the APU Air switch (pos. 71) is on.

3.6.2.1 Controlling the Cabin Temperature in Auto Mode

After starting the panel, the cabin temperature controlling is automatically set to auto. The auto mode of the cabin control is available as soon as you have air from the APU or engine 3 or 4 and electrical power from the AC 2 bus. As long as there is no air or AC 2 not available, the passenger cabin has the same temperature as the surrounding air (OAT).

Decisive for the auto temperature controlling is, that the Auto/Man switch (pos. 87) is set to “Auto”. If this is done and you have air and electrical power, the system scans the position of the temperature controlling knob pos. 90. The center position (standard) of this knob determines a cabin temperature of 25°C. You can see the actual passenger cabin temperature with the indicator pos. 86. You can also move the mouse over this indicator to see the actual temperature with the yellow tool tip text.

The passenger cabin could be increased or decreased by moving the warm/cold knob pos. 90 to the left (cold) or to the right side (warm). Each mouse click increases or decreases the temperature of 1°C. So the fully left side of the knob results in a cabin temperature of 20°C and the fully right side results in a temperature of 30°C. A colder or warmer cabin temperature is not possible with the auto mode.

The temperature for the passenger cabin will be regulated automatically from the system with the duct temp. The actual duct temp for controlling the passenger cabin is shown in the indicator pos. 91 (move the mouse over the indicator to see the actual duct temp in the yellow tool tip text). When increasing the cabin temp, the system augments the duct temp to about 40°C - 50°C until the cabin temperature catches the selected temperature of the warm/cold knob. After that, the system reduces the duct temp to the desired cabin temperature to hold it. A manual duct temperature control is not necessary in the automatic mode. The same when reducing the cabin temperature. In this case, the system reduces the duct temp to about 3°C until the desired temperature is reached and then increase the duct temp to the desired cabin temperature.

3.6.2.2 Controlling the cabin temperature in manual mode

The manual temperature control is activated when the Auto/Man switch pos. 87 is set to “Man”, air from the APU or engine 3 or 4 is available and the electrical AC 1 bus is powered. Contrary to the auto temperature control you have no temperature limits in the manual mode. The advantage of this is that you could select every cabin temperature you want but this has also the disadvantage that you could overheat the pack (duct temp more than 65°C).

In the manual mode you could not select a cabin temperature directly. The temperature will be set by increasing or decreasing the duct temp with the spring-load switch pos. 88. A single click on the switch increases or decreases the duct temp of 0,1°C. The longer you press the switch to warm or cold, the faster you change the duct temp. The higher the difference between the duct temp and the actual cabin temp is, the faster the cabin temperature will increase or decrease. As soon as the cabin temperature reaches the desired value you have to reduce or raise the duct temp to the desired cabin temperature manually with the duct temp.

Here’s an example of setting the cabin temperature to about 28°C in manual mode:

First set the temperature control to “Man” with the switch pos. 87. After that press the warm/cold switch pos. 88 as long as you have a high enough duct temp for the temperature change. In our example we have an actual cabin temperature of 25°C and want to have a cabin temperature of 28°C. That’s why we decide to increase the duct temp to about 40°C. This is a high enough value for a fast enough changing of the cabin temperature. If you want to reach the desired temperature faster, you could also set a higher duct temp (45°C for example). The warm/cold switch of the manual duct temperature control is programmed on this way, that you could see the selected duct temp with the yellow tool tip text (see picture). You can also see the selected duct temperature in the indicator pos. 91, which also have a yellow tool tip text. As soon as the duct temp is higher than the cabin temperature, the cabin temperature will increase. You could see the actual cabin temperature in the indicator pos. 86. This indicator has also a yellow tool tip text which gives you a close readout of the value (see picture). When the cabin temperature has reached the desired temperature (28°C in our example), you have to set the duct temp back to the desired cabin temperature (with the switch pos. 88) to stop the cabin temperature increasing. Reducing the cabin temperature works on the same way with the difference that you have to set a lower duct temp value than the cabin temperature.

3.6.2.3 Controlling the flight deck temperature

Controlling the flight deck temperature is almost the same as controlling the passenger cabin temperature. There is no temperature indicator for the flight deck included, so the controlling has to be done only with the duct temperature. Both modes (auto and manual) of the FD temperature control needs air from the APU or from engine 1 or 2 and electrical power from AC 1.

In auto mode, the warm/cold controlling knob pos. 84 has the same function as with the cabin temperature control. This means, that in the center position you have a flight deck temperature of 25°C, in the fully left position a temperature of 20°C and in the fully right position a temperature of 30°C.

In manual mode the flight deck duct temperature controls the FD temperature. As written above, there's no indicator to see the actual flight deck temperature. Because of this I have simplified the controlling. When you set the duct temp to 30°C a flight deck temperature of 30°C is simulated. Like with the cabin temperature control it's also possible to overheat the pack with the manual control of the flight deck temperature controlling, when setting the duct temp higher than 65°C.

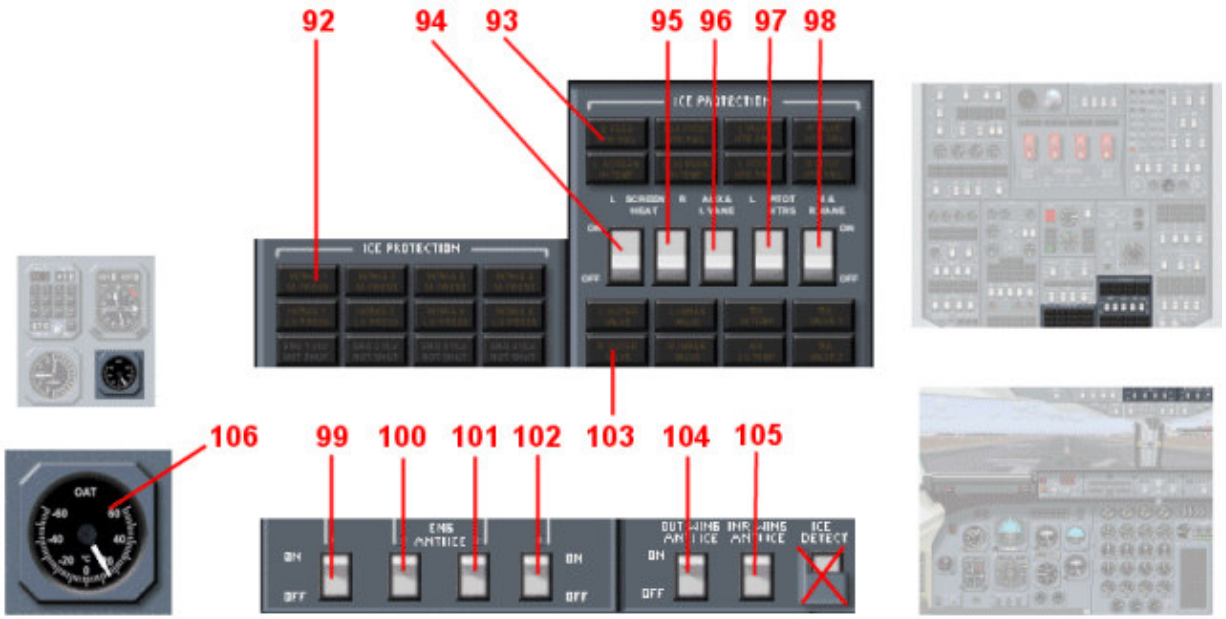
3.6.2.4 Overheating the Packs

In manual mode it's possible to overheat one of the two packs or both packs when setting a higher duct temp than 65°C. If this happens, the amber high temp warning light illuminates (please see also "The Temperature and Packs Annunciator") and the dedicated pack will be automatically switched off. Because of the missing (switched off) pack, there's no temperature control for the flight deck or cabin possible and the temperature reduces to the outside air temperature after some delay. In the case of the lost of both packs, there's also no cabin pressurization possible (very dangerous situation)!

If a pack overheat happens, it's necessary to switch off the dedicated pack and change to the manual temperature control. Than reduce the duct temp by pressing cold for a couple of seconds (temperature must be lower than 65 °C but higher than 3°C). Now switch on the dedicated pack again and watch if the temperature rises to the selected value. If the pack still overheats, repeat the procedure.

In case both packs are lost (and not recovered) you will have pressurisation problems and the cabin altitude will start rising. In this case you need to perform an emergency descent (if the problem occurs at high altitude).

3.6.3 The Ice Protection System



92	Engine anti-ice annunciator. Please see below for detailed descriptions.
93	Screen, vane and pitot annunciator. Please see below for detailed descriptions.
94	Left screen heat switch.
95	Right screen heat switch.
96	Aux and left vane heating.
97	Left pitot heat
98	Right pitot and right vane heat switch.
99	Engine anti-ice for engine 1
100	Engine anti-ice for engine 2
101	Engine anti-ice for engine 3
102	Engine anti-ice for engine 4
103	Wing and tail anti-ice annunciator. Please see below for further descriptions.

104	Outer wing anti-ice switch
105	Inner wing anti-ice switch
106	Outside air temperature indicator OAT (°C) (gauge is placed in the TMS, Pressurization sub window).

The Engine Anti-ice Annunciator (Pos. 92)

The complete engine anti-ice annunciator is supplied with electrical power from the essential DC bus (SDC).

The white engine 1 to engine 4 valve not shut annunciators came up when the corresponding engine anti-ice valve is open. The lights illuminates also when the engine anti-ice switch is off but the electrical supply (DC 1 for engine 1 and 3 and DC 2 for engine 2 and 4) is not given. In this case the valves opens automatically.

The intake lo pressure lights came up when the air intake anti-icing duct indicates low pressure. This happens when the engine anti-ice switch is on but the corresponding engine is not running. The light is also on when the engine anti-ice switch is on and the corresponding engine is below flight idle.

The intake high pressure lights have no function yet.

The Screen, Vane and Pitot Annunciator (Pos. 93)

The screen, vane and pitot heater annunciator is fed from two different electrical busses. The Aux and left valve heater fail lamps are supplied with power from the emergency DC bus (MDC) while all other lamps are supplied with power from the essential DC bus (SDC).

The “Q FEED HTR FAIL” light comes up when left or right pitot heat is on, the standby generator is active and the left landing or taxi light is on. This is one of the limitations when the standby generator is active which is also called: “power reduced to essential level”.

The aux pitot heater fail light and the left valve light came always up when the aux pitot heater and left vane heating is switched off (switch pos. 96),

The right valve heater fail and the right pitot heater fail lights illuminates when the right pitot heat is switched off (switch pos. 98) or if the right pitot heat is on and the necessary electrical power (AC 2 bus) is not given.

The left pitot heater fail light comes up when the left pitot heat is switched off (switch pos. 97) or if the left pitot heat is on and the necessary electrical power (essential AC bus) is not given.

The screen hi temp lights have no function yet.

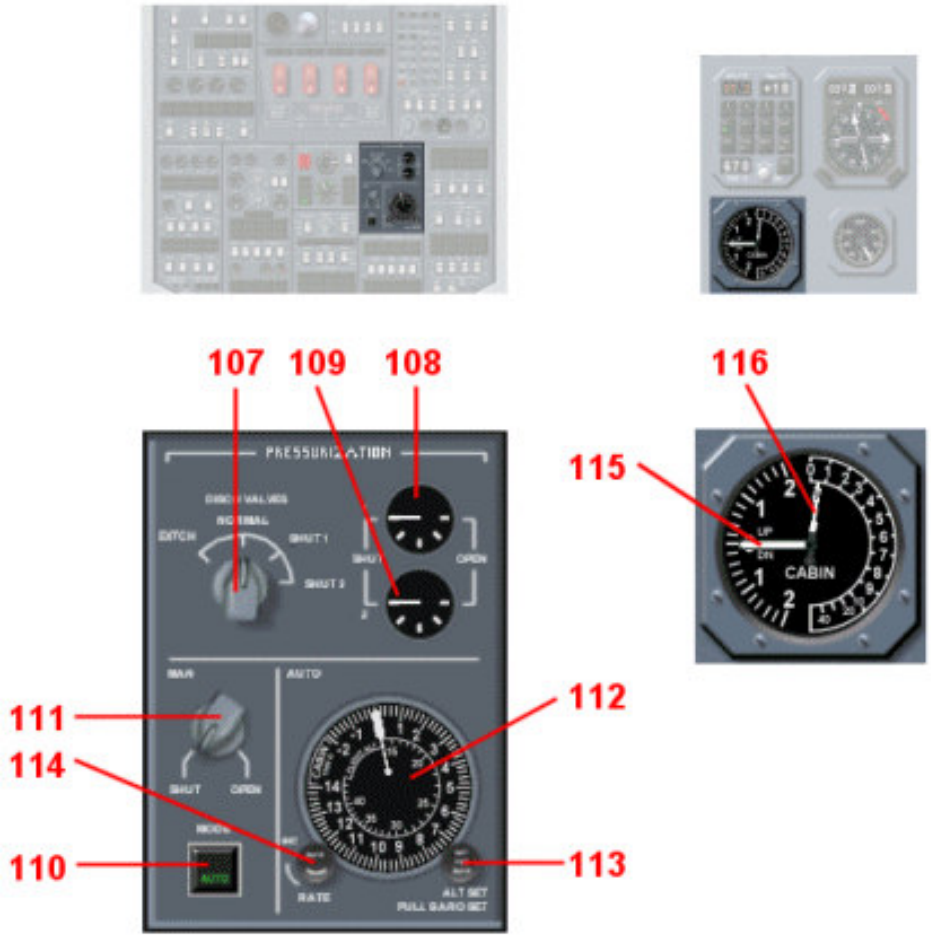
The Wing and Tail Anti-ice Annunciator (Pos. 103)

The left and right outer valve annunciator lights illuminates when the outer wing anti-ice is switched on (switch pos. 104) while the aircraft is on ground. The inner valve lights goes on when the inner valve is switched on (switch pos. 105) while the aircraft is on ground.

The “Air Lo Temp” light illuminates when the aircraft is airborne and one engine is off (lo air pressure from the engine) or one of the engine air switches (pos. 73 – 76) is off.

The tail anti-ice is not realized so all of the tail anti-ice annunciators have no function yet.

3.6.4 The Pressurization Unit



107	Discharge Valve switch. This switch has four positions. Position “Ditch” will be selected below 2000 ft. for an emergency landing on water. “Shut 1” closes discharge valve 1 and “Shut 2” closes discharge valve 2. The position “Normal” is the standard setting and both valves opens and closes as selected (manually in “Man” mode or automatically in “Auto” mode).
108	Indicator for the opening angle of valve 1.
109	Indicator for the opening angle of valve 2.
110	Man / Auto button. If “AUTO” mode is available you could change to manual mode “MAN” with this button.

111	Knob for controlling the opening angle of the discharge valve in manual mode.
112	Altitude selector for automatic mode.
113	Knob for setting the target altitude for automatic mode.
114	Knob for controlling the opening angle of the discharge valve in auto mode.
115	Cabin VSI indicator (gauge is placed in the TMS, Pressurization sub window).
116	Cabin altitude indicator (gauge is placed in the TMS, Pressurization sub window).

Additional Notes

Unfortunately it was not possible to realize a fully realistic working pressurization control with this panel as the Flight simulator did not support any part of a cabin pressurization. However it was my goal to realize one very close to the real one with some tricks. Nevertheless there are minor differences to the real pressurization control.

The complete cabin pressurization just works if the system is supplied with air from the engines or from the APU (for more details please see the chapter The Air Supply Unit).

The illuminated letters “MAN” or “AUTO” on the button pos. 110 is just visible when the electric supply is given. If no electrical supply is given (The manual mode works with emergency DC, MDC and the automatic mode requires essential AC, SAC), the aircraft climbs or descend with the same vertical speed as the aircraft and the cabin alt is the same as the aircraft altitude.

To compress the cabin it’s necessary that you have air from the APU or from the engines. If no air is given, the aircraft climbs or descend with the same vertical speed as the aircraft and the cabin alt is the same as the aircraft altitude.

The triple gauge (pos. 115 and 116) has normally a third needle (that’s why it called triple gauge) which shows the cabin pressure. This third needle is not realized as there is no possibility to show an inexistent value. Well, I could realize a dummy needle but with an eye on the frame rates I decide not to make it.

When you are on the ground, and you select -2000 ft, the system will not pressurize immediately. It first needs to sense that the aircraft has taken off. What happens actually is that when you have started number 2 engine, the press system when in auto will start pre-pressurization to a pressure altitude not more than 400 ft below actual pressure altitude, this to avoid surges during take-off.

In case both packs are lost (and not recovered) you will have pressurisation problems and the cabin altitude will start rising. In this case you need to perform an emergency descent (if the problem occurs at high altitude). For more information please see also chapter Overheating the Packs.

IMPORTANT	Do not change the mode (Auto to Man or Man to Auto) in flight. As in the real aircraft only one mode is annunciated at a time!

3.6.4.1 Controlling the cabin pressure in manual mode

Controlling the cabin pressure in manual mode is very simple. First take care that the pressurization system is fed with air from the APU on ground and emergency DC is given. The pressurization could be controlled as soon as you have electricity (you will see “MAN” on the Man/Auto button pos. 110) and air from the APU (or engines in flight). If essential AC (SAC) is given the mode changes automatically to “AUTO” as soon as SAC is available. If you prefer to fly in manual mode you must press the button pos. 110. After this you will see “MAN” on the button. The pressurization is now controlled manually.

Compared to the auto mode, the rate of climb or rate of descend could not be controlled directly but you could control the opening angle of the discharge valves with the knob Pos. 111. If the knob is in the left position (as in the picture above), the valves are fully closed. The more you open them, the more air flows through the valves. The valve indicators pos. 108 and 109 shows you how much the valves are opened.

When you open the discharge valve and you have bleed air from the APU or engines the cabin altitude rises accordingly the opening angle of the valves. The rate of change (climb or descent) is shown in the cabin VSI indicator (pos. 115). The more you open the valve the higher the rate is.

One of the differences to the automatic mode is, that the manual mode did not close the valves when the desired altitude is reached. After reaching the desired cabin altitude you have to move the knob pos. 111 back to the center position to close the discharge valves.

Typical cabin altitudes for cruise are:

FL240 = 4000 ft.
FL270 = 5000 ft.
FL280 = 6000 ft.

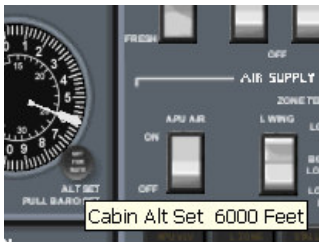
Those are the altitudes the automatic pressurization mode will adjust.

3.6.4.2 Controlling the cabin pressure in automatic mode

Climb

First take care that the pressurization system is fed with air from the APU on ground (or air from the engines in flight) and essential AC (SAC) is given. As soon as SAC is available the text on the button pos. 110 changes to “Auto”. Now the complete pressurization is controlled automatically if also air is available.

Now you have to set a target altitude with the altitude selector pos. 112 by pressing on the knob pos. 113 as long as the needle reaches the desired cabin altitude. The cabin altitude selector has a smaller inner ring where you could find a reference to the flight altitude. The outer ring shows the cabin altitude. The pressure calibration using QNH is not realized with this panel. If you would like to cruise at FL240 for example, you should bring the needle to “4” on the outer ring. As it is not easy to recognize the selected altitude because of the small gauge, you have a yellow tooltip on the altitude selector which helps you adjusting the correct cabin altitude (see picture)



After the preferred altitude is selected you should select the cabin rate of climb (ROC) or cabin rate of descent (ROD). In AUTO mode, you can command the ROC/ROD of the cabin by turning the "rate" button pos. 114. Unfortunately it’s not easy to recognize the selected ROC or ROD with the knob on the gauge because it has no check mark on it. To make it easier to select ROC and ROD, I’ve programmed a yellow tooltip text on the knob (see picture). Each mouse click on the knob increases or decreases the rate in 200 steps.

A standard ROC or ROD is 400 ft./min., this means you have to open the rate with two mouse clicks. After take off you can see the selected ROC or ROD in the cabin VSI pos. 106. Of course you could also select a higher ROC or ROD in case of quicker than normal descent for example to avoid the aircraft catching up the cabin, in which case the cabin would then descent at the same rate as the aircraft since negative pressure is not allowed.

After the aircraft is taking off the system starts to go to the target altitude. The cabin VSI and cabin altitude will now be controlled automatically so you have nothing more to do here. It’s not necessary to move back the rate knob pos. 114 to zero when the target altitude is reached.

If you select a lower target altitude as you really fly, the cabin altitude and cabin VSI stops at the target altitude. For example: If you select a target altitude of 24000 ft. and the aircraft passes 24000 ft. and continues the climb the cabin VSI goes back to zero at 24000 ft. and the cabin altitude didn’t continue the climb because the discharge valves are closed.

Descent

Before you descent it's necessary to set the new desired altitude with the altitude selector pos. 112. This new altitude is normally the altitude of the destination airport. If this altitude is selected and the aircraft starts to descent, the automatic pressure control starts to go to this target when the rate (pos. 114) is not set back to zero. The ROD is controlled with the selected rate pos. 114. The standard ROD is normally also 400 Ft./min, but could be increased or decreased with the rate button.

As soon as the cabin altitude reaches the selected altitude, the discharge valves will be closed automatically. Take care that this did not happen before the aircraft is close the selected altitude. If the cabin altitude reaches the target altitude too soon, the cabin would then descent at the same rate as the aircraft since negative pressure is not allowed. If that happens at 6000 ft descending at 2000 ft/ min for example you will hurt your ears.

3.6.4.3 Protection Built-In for the Pressurization

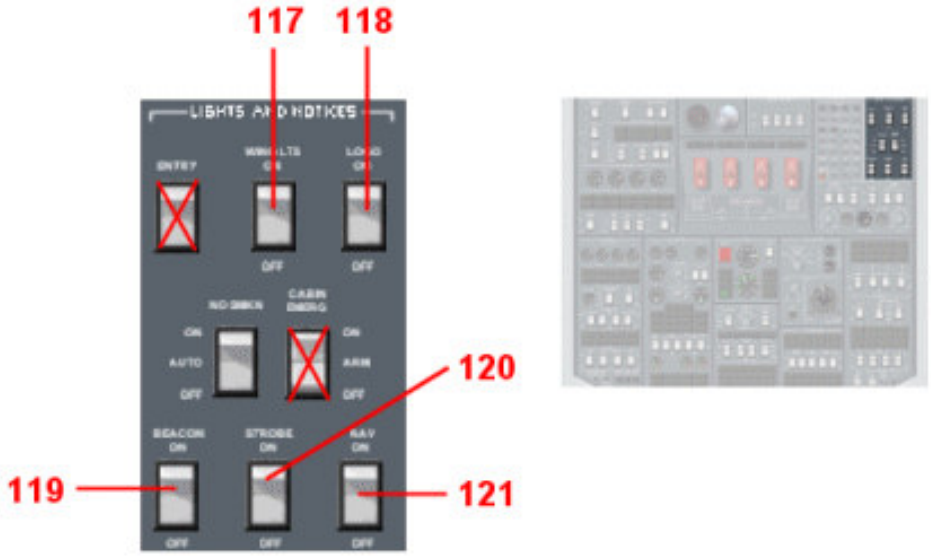
The real BAe 146 discharge valves have some protection built in for the pressurization. Some of them are also realized in this panel.

- When there is no bleed to the discharge valves, they close.
- If the cabin altitude rises above 15.000 feet, they close.
- If the cabin altitude exceeds 9300 feet, the MWS CABIN HI ALT red warning is triggered, and the airco goes to fresh if recirc was selected.
- Upon landing, with thrust levers retarded below 80% N1 and gear touched the ground, the outflow valves are commanded to fully open to equilibrate residual pressure difference. This can only work with engine n°4 ENG AIR switch on. The outflow valves operate with air taken from the ENG AIR valves or APU AIR valve directly, not from the packs. However, they do control air flowing through the cabin which is coming from the packs

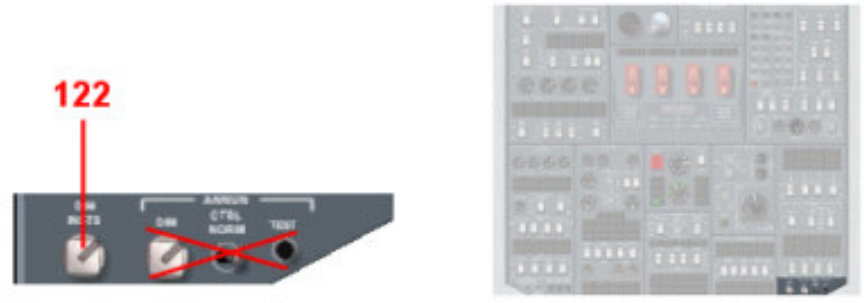
Not realized is the real world function that, if the delta p = pressure difference between inside and outside exceeds 7.4 PSI, the discharge valves will open to maintain that maximum. If the delta p is less than -0.5 PSI, they open inwards (negative pressure differential).

3.7 External and Internal Lights

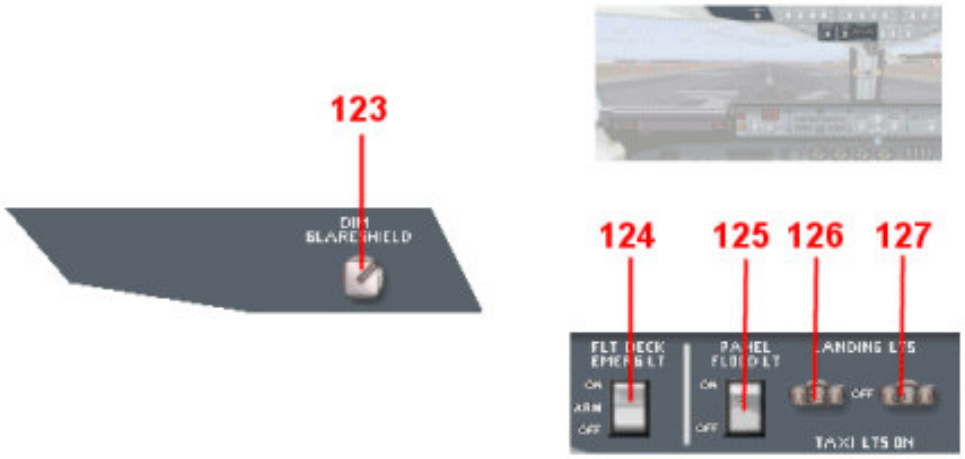
3.7.1 The Light switches



117	Wing lights switch.
118	Logo lights switch.
119	Beacon light switch.
120	Strobes light switch.
121	Navigation lights switch (please see also additional notes).



122	Instrument light switch.



123	Glareshield and overhead letter light switch.
124	Flight deck emergency light switch. This switch has three positions. In the lower position the emergency lights are off. In the center position the emergency lights are armed and will be switched on automatically in emergency electrical level. In the upper position the emergency lights are always on. Please see below for more information about the emergency light switch.
125	Panel flood light switch (in the real aircraft here is normally the rwy exit light switch). Please see also additional notes.
126	Left landing and taxi light switch. The switch has three positions. In the center position the left landing and taxi lights are off. In the upper position the left landing lights are on and in the lower position the left taxi lights are on.
127	Right landing and taxi light switch. The switch has three positions. In the center position the right landing and taxi lights are off. In the upper position the right landing lights are on and in the lower position the right taxi lights are on.

Additional Notes

The red crossed switches in the lights unit have no function yet.

Normally the navigation lights are powered with electricity from the essential DC bus (SDC). But the navigation lights are also fed with an AC-sub-busbar powered from the ground power unit (GPU). This sub-busbar is connected to the main AC 2 bus when external power is given and switched on. That's why the navigation lights are also always on if the GPU is activated. No matter if the navigation light switch (pos. 121) is on or off.

The cockpit flood lights are normally fed with power from the essential DC bus. If the emergency light switch (pos. 124) is armed or on, the cockpit lights are additionally fed with power from the emergency DC (MDC) and in case of a failure of MDC with power from the battery busbars.

If the standby generator is active and the left landing or taxi light (pos. 126) is on, the Q-Feel-Pitot heat is off and the “Q FEED HTR FAIL” light comes up in the screen, vane and pitot annunciator. This is one of the limitations when the standby generator is active which is also called: “power reduced to essential level”. You will find some more information in the chapter “The Ice Protection System”.

3.7.2 The different cockpit lights

Switch pos. 122 activates the instrument lights in all panel windows.

Switch pos. 125 activates the panel flood light (please see also additional notes below).

Switch pos. 123 activates the illuminated letter lights in the glareshield and overhead panel

Additional Notes

Sometimes it could happen that the instruments are not visible (dark) or show strange values and dark frames after switching on or off the panel flood lights. This could be solved when switching on and off the instrument lights again with the switch pos. 122.

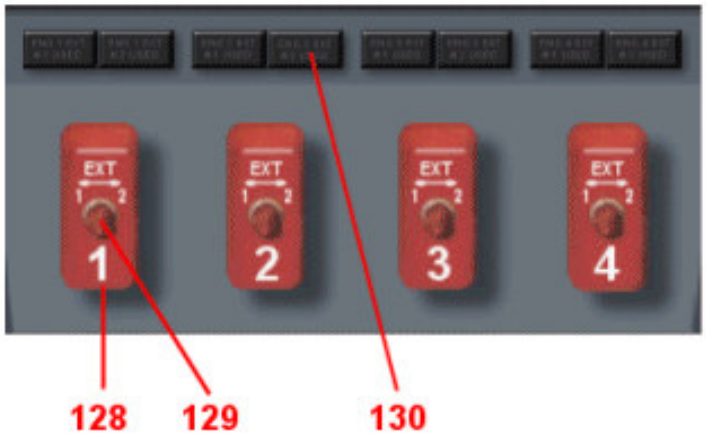
3.8 Fire Warning and Extinguishing

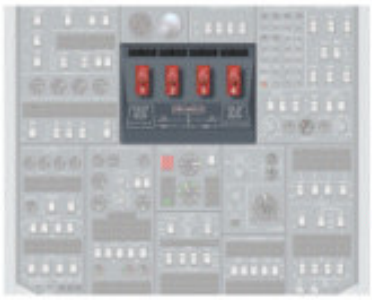
An engine fire warning is given with red warning lights in the MWS and a red warning light on the fire handle. Each engine has it's separate light to see for which engine the system detects a fire. Those lights could be tested on ground using the associated buttons of the ground test unit.

A further red fire warning light belongs to the APU and is placed in the left APU annunciator (pos. 28). A further APU fire warning is given with a red warning light in the MWS.

Engine Fire Warning light in the MWS

Fire Warning light on the Fire Handle grip (pos. 129)



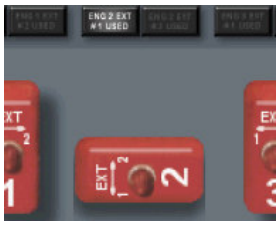


128	Fire grip for engine 1 (left) to 4 (right).
129	Fire warning light for engine 1 (left) to 4 (right).
130	Fire extinguishing annunciators.

Once the system detects a fire in an engine, it could be extinguished using the fire handles in the overhead panel (pos. 128). Beside it's off position, each fire handle has three positions.

In the first pulled out position (without turning the grip) the MWS shows the associated white Engine Fire Handle light and now three additional microswitches are actuated to:

- Close the engine bleed air isolation valve. When the associated engine air is switched on, the amber engine air valve light of the air annunciator (pos. 72) illuminates.
- Trip the engine-driven generator (handle 1 and 4). The associated amber generator light of the generator annunciator (pos. 20) illuminates.
- Close the engine hydraulic pump isolation valve (handle 2 and 3). The associated amber Lo Press and Air Lo Press warning lights of the hydraulic annunciators came on.
- Engine lo pressure fuel valve will be closed to shut down the burning engine.



When the fire still persists, the handle has to be turned 90° to the left or right to operate a microswitch to discharge bottle one (left extinguisher) or bottle 2 (right extinguisher). The picture shows fire extinguishes 1 of engine 2 in use, shown also with the white annunciator light above the fire handle.

To operate the fire handles, there are three mouseclick areas in the panel. The mouseclick position directly on the grip pulls our or pushes in the fire handle. Left and right beside the fire handle are the mouseclick areas to activate extinguisher 1 (left) or 2 (right). This only when the fire handle is already pulled. A click again in the middle of the grip brings the handle back to it's center position from where it could be pushed in back to it's standard off position.

<u>The fire extinguisher annunciators (pos. 130)</u>

Each engine contents a set of two white fire extinguisher lights in the overhead panel. They illuminate when fire extinguisher 1 (left white lamp) or 2 (right white lamp) of an engine is in use moving the fire handle 90° to the left or right. Those lights illuminate also when pushing the fire extinguisher test button of the ground test unit.

Additional Notes

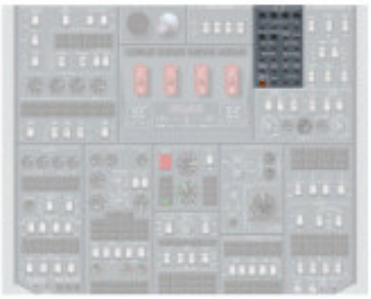
The real BAe 146 contents also a third set of engine fire warning lights on each throttle. Those lights are not realized in the current panel.

The first initial baulk position of the fire handle is not realized with this panel.

The engine fire extinguisher 1 and 2 have no function in the Flight simulator (just dummies), because the FS didn't support any type of fire extinguishing. If a fire is detected with your FS model, it will already be extinguished with moving the fire handle to it's first pulled position.

The fire extinguishing system for the APU is also not realized because of the same reason as for the engine fire extinguishing. Nevertheless it could be tested with the ground test unit. It is normally placed left beside the APU RPM indicator. In this panel you will find the invisible automatic starter here (please see chapter The Automatic Starter).

3.9 The Ground Test Unit



The ground test unit is designed for checking some very important functions and safety functions of the aircraft already on ground before take off. The unit contents no own warning light for the tests but triggers the lights of each system annunciator and the MWS. The ground test unit also triggers some of the relevant sounds, like acoustic stall and overspeed warning sounds for example. As the name suggests the unit is only for ground tests and did not work once airborne.

Each failure and warning simulation is active as long as the button for it is pressed and will be released when the button is released.

The buttons of the ground test unit triggers the following functions (button description from top left to bottom right):

Line 1:

The four large buttons of the first line are for simulating engine overspeed (left button for engine 1 to right button for engine 4). Pressing the button effects the amber MWS engine overspeed warning to illuminate.

Line 2:

The second line of the ground test unit is for simulating an engine fire. Each engine has it's own button (engine 1 left – engine 4 right). Pressing the button effects the red MWS engine fire warning and the red fire warning lamp of the fire handle to illuminate. The engine fire warning test contents also an acoustic warning. Additionally to the warning lamps, you will hear the fire warning bell as long as you press the button.

Line 3:

The first button on the left side of the third line is for simulating an APU fire. When the button is pressed the red APU fire warning in the MWS, the red APU fire warning and the amber Loop Fault caution in the left APU annunciator (pos. 28) illuminate. Additionally to the visual warning and caution lamps, you will hear the fire warning bell. When the APU was running while the button is pressed it will be shut down. To restart the APU after the APU fire test you must switch on the APU again.

The second button of the third line is for simulating an APU overspeed. When pressing this button while the APU is running, the APU will shut down. To restart the APU after the APU overspeed test you must switch on the APU again.

The third button of the third line is for simulating the APU and engine fire extinguishers. When pressing this button, the white annunciator lights of the engine fire extinguishers (pos. 130) and the white APU EXT USED light of the left APU annunciator (pos. 28) illuminate.

The right button of the third line is for simulating detected smoke. When this button is pressed, the red ELEC SMOKE light of the MWS illuminate.

Line 4:

The first and second button of line 4 are for simulating a stall. When a button is pressed, the red stall ident lamps left beside the airspeed indicator and the amber stall ident lamp of the MWS illuminate. Additionally to the visual warning and caution lamps, you will hear an acoustic stall warning.

The zone loops A and B buttons have no function in this panel

Line 5:

The first and second button of line 5 are for simulating an overspeed. The overspeed test has no visual warning. When the buttons are pressed, you will hear the overspeed warning sound.

The next two buttons are for the yellow and green Anti Skid fault testing. When the buttons are pressed, the amber annunciator lights Anti Skid Fault and Anti Skid Inop of the Anti Skid annunciator illuminate and the Anti Skid system will be switched off. Because of this, the caution lights stays on even when the test buttons were released. To reactivate the Anti Skid system and to extinguish the amber caution lights, the Anti Skid has to be switched on again.

Line 6:

In line 6 no button is realized.

Line 7:

The amber ground test in button is just a dummy yet. It could be switched on (the button illuminates then) or off.

The second button is just for testing the warning horn. When pressing the button, you hear the horn sound.

The L and R Squat SW button on the right side of line 7 have no functions yet.

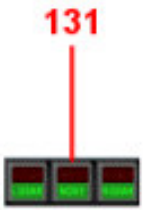
Additional Notes

The real BAe 146 has separate buttons for stall warning and stall ident. Because of the available free place, both functions are combined in the stall warn buttons in this panel.

3.10 Gear, Brakes and Anti Skid

3.10.1 The Landing Gears

In the real BAe 146 panel, the grip for operating the landing gears is placed on the left side of the first officers panel. The FO panel is currently not realized with my panel, why you just have the landing gear lights to see if the gears are up or down.



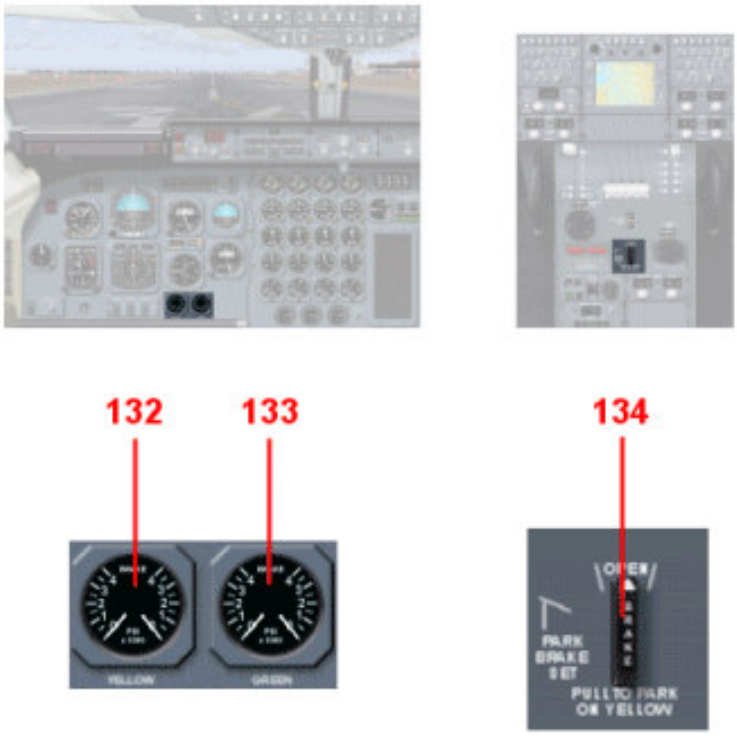
131	Landing gear lights for left main gear (left), center gear (center) and right main gear (right).

When electrical power is available and the lights are off, the gears are up and locked. Green lights shows that the gear is fully down and locked. Red lights shows gear in movement (not locked).

The gear indicators use electrical power from the DC2 bus. Without DC2, the lights have no function.

The landing gears are connected to the green hydraulic system, but could also be operated in emergency mode with the yellow hydraulic system. Another backup system for the landing gear (emergency) is the DC pump.

3.10.2 The Wheel Brakes



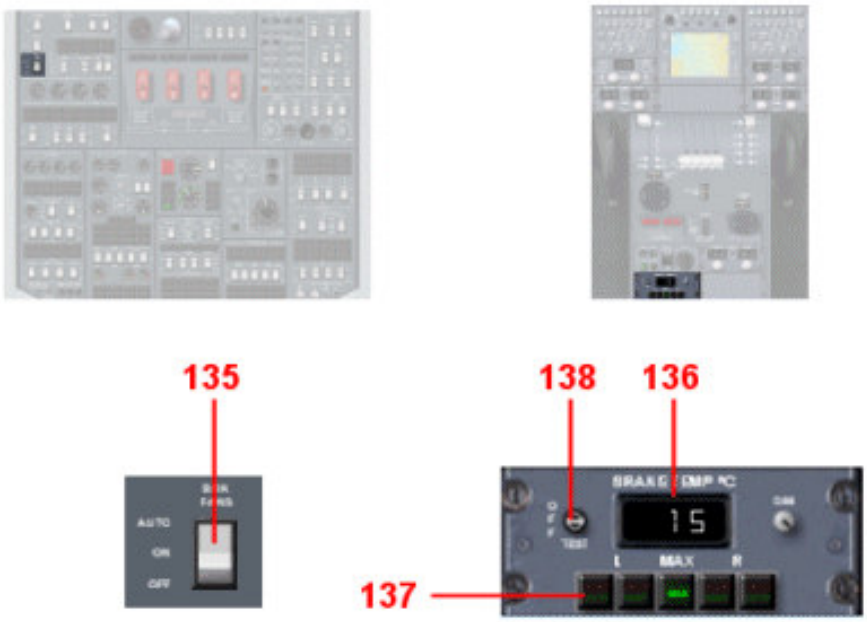
132	Yellow brake pressure indicator
133	Green brake pressure indicator (without function yet)
134	Parking brake handle (gauge is placed in the pedestal sub window)

The wheel brakes are supplied with hydraulic pressure from the yellow hydraulic system. The yellow hydraulic system is driven from the hydraulic pump of engine 2. When no engine is running, the parking brakes could be supplied with pressure from the electrical DC pump. The DC pump is also supplied with DC from the batteries. For this, the DC pump switch (pos. 59) must be set to position “BATT”. The chapter “The Hydraulic System” contents more information about the hydraulic supply and the backup systems.

In the real aircraft, the parking brakes could also be supplied with pressure from the green hydraulic system when the parking brake lever is pulled. This is not realized yet, so the brake indicator pos. 133 has no function at the moment.

The brake indicator need electrical power from the emergency AC bus (MAC).

3.10.2.1 Brake Temperature and Brake Fans



135	Brake fans switch
136	Wheel Brake temperature
137	Buttons for indicated brake temperature

The brake fans switch in the overhead panel has three positions. With “Auto” selected (switch in the upper position) the fans will be automatically switched on with the nose gear locked down and switched off as soon as the nose gear is unlocked. The brake fans could be manually switched on with the switch in “On” position. When the switch is “Off” (lower switch position), the brake fans have no function.

The brake fan switch is supported from the electrical DC1 bus and the brake fans are supported from AC1 or AC2 (crossed).

The function of the brake fans is to decrease the brake temperature faster than with only using the outside air temperature. Especially after a landing where a strong braking is used and so the brake temperature increase to high temperatures, the brake fans cools the brakes and reduce the temperature much faster. Because of this, the brake fans switch is normally always set to “Auto”.

The display of the brake temperature indicator (pos. 136) in the pedestal panel shows the selected wheel brake temperature. The buttons (pos. 137) below the temperature indicator have several functions.

When the center button “MAX” is pressed, the green text “MAX” illuminates on the button and the highest of the four brake temperature will be displayed. Pushing any of the four other buttons (L or R) will cause the MAX light to go out and the selected button to light up (green text). The individual temperature for the corresponding brake will be displayed. This could be the left outer, the left inner, the right inner or the right outer temperature.

If a brake temperature is in excess of a nominal 650°C this will be displayed in conjunction with an illuminated red OVHT text on the button for the associated brake. This light stays on as long as the temperature is more than 650°C.

Pressing the test button (pos. 138) will cause the display to indicate approximately 750°C and all four OVHT button lights will illuminate for a couple of seconds (test phase).

The brake temperature indicator is supplied from the DC1 busbar.

Additional Notes

All in all the brake temperature indicator is just a working dummy yet, because the Flight simulator didn’t support this function. Also a too high brake temperature has no effect on the flightdynamics at the moment. If the next FS version will also support no effect on the brake temperature, I could realize a function to have a real effect, because of a too high brake temperature.

3.10.3 Anti Skid

139	Anti Skid switch
140	Anti Skid and Spoiler annunciator

The Anti Skid switch in the overhead panel has three positions. In position “Off” the Anti Skid control is de-energized direct braking. When selected “On” the Anti Skid is active when the electrical DC2 bus is available. In position “BATT” (lower switch position) the Anti Skid is energized from the electrical MDC bus.

When the Anti Skid switch is selected on or Batt and the system is not available, the amber Anti Skid light of the MWS goes on and the amber Anti Skid lights of the Anti Skid and Spoiler annunciator illuminate.

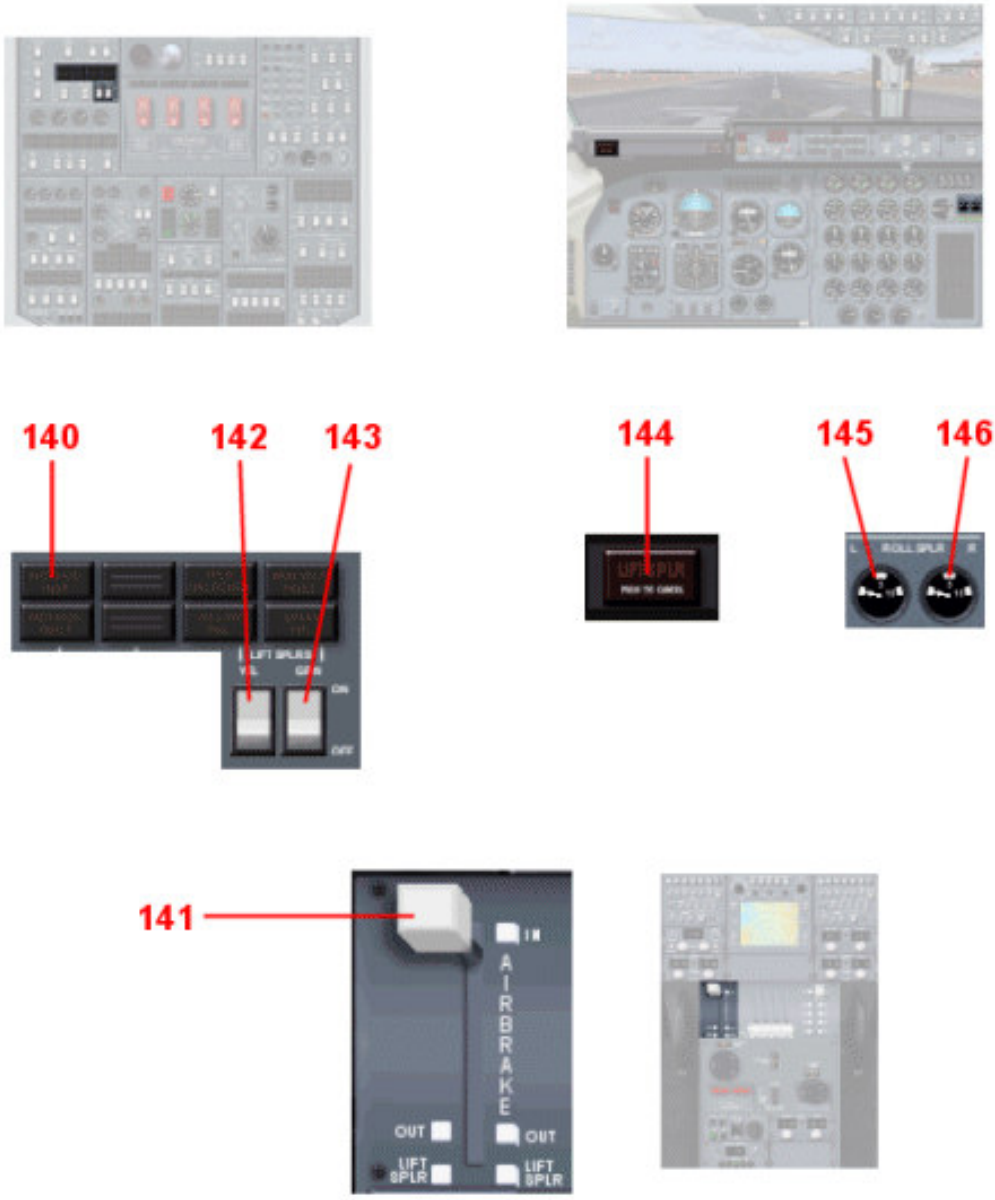
The Anti Skid and Spoiler Annunciator (pos. 140)

The two amber Anti Skid caution lights came up when the antiskid system is fault or the electrical supply for the antiskid system is not given. They will also illuminate after testing an Anti Skid fault with the ground test unit. To reset the lights and Anti Skid function after a ground test, the Anti Skid has to be switched on and off again.

Additional Notes

Unfortunately the current Flight simulator did not support any Anti Skid function and also did not support any effect because of an iced or wet runway. Because of this, the Anti Skid function of this panel is just a working dummy.

3.11 Airbrake and Spoilers

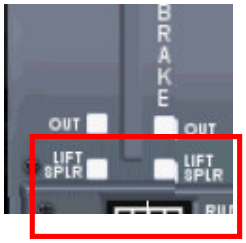


140	Anti Skid and Spoiler annunciator
141	Airbrake and Lift spoiler lever
142	Lift spoiler yellow control switch
143	Lift spoiler green control switch

144	Lift spoiler caution light
145	Left roll spoiler indicator
146	Right roll spoiler indicator

The airbrake is operated by an hydraulic jack, powered by green hydraulic system. The combined airbrake lift spoiler lever (pos. 141) in the pedestal panel enables the airbrake to be selected to any position between in and out.

Additionally to the airbrake which is at the back of the aircraft, the BAe 146 contents three lift spoilers and one roll spoiler on each wind, all hydraulically powered. The lift- and roll spoilers are for ground use only and will be selected by the combined airbrake lift spoiler lever (pos. 141) in the pedestal panel. To activate the lift- and roll spoilers, the airbrake has first to be selected out. It's not possible to select the lift spoilers without a selected airbrake. The airbrake lever contents an invisible mouseclick area at the bottom of the gauge. When the air-brake is selected out, the lift spoilers could be selected by clicking on this area (see picture).



Mouseclick area for selecting the lift spoiler

For lift spoiler deployment three conditions must be satisfied:

- The lift spoiler yellow and lift spoiler green control switches (pos. 142 and 143) must be set to on.
- Three of the four thrust levers must be retarded to idle.
- The aircraft must be on ground (weight on wheels)

Failures of the lift spoilers to deploy is indicated by an amber caution light (pos. 144) in the glareshield panel. This warning will be activated when the airbrake lever has not been selected to lift spoiler within six seconds of touchdown. Selecting lift spoiler will cancel the warning provide the spoilers then deploy.

The warning could also be cancelled by pressing the warning light. Otherwise it will cancel automatically 14 seconds after touchdown.

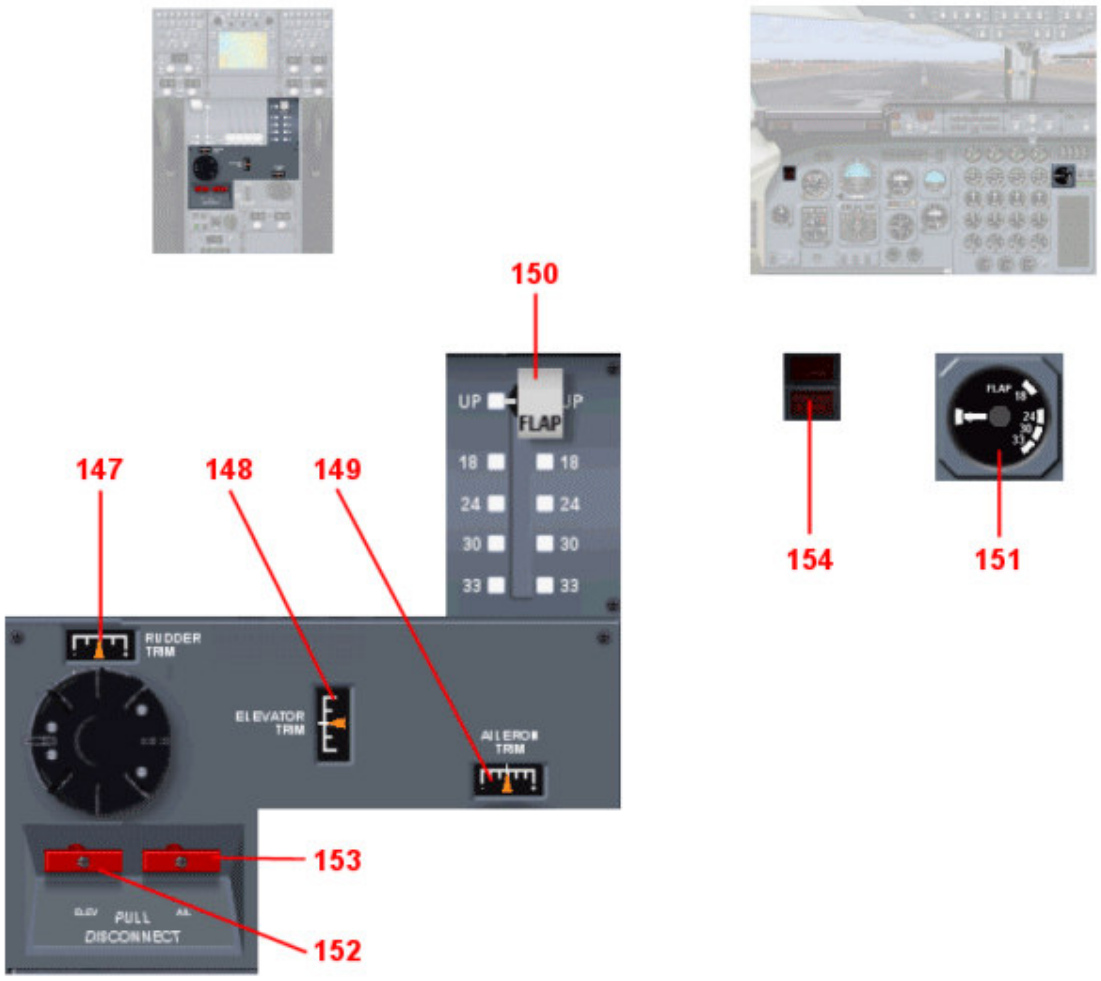
To retract the lift spoiler the mouseclick area below the lever must be pressed. After this, the airbrake lever could be selected back to the in position.

The BAe 146 panel currently has no lift spoiler warning or caution light realized in the annunciator pos. 140.

Additional Notes

The airbrake could be deployed with the # key or with the mouse. Unfortunately it's not possible at the moment to retract the spoiler also with a key function. The only way to retract a deployed airbrake is by using the mouse. I'm currently working on a solution.

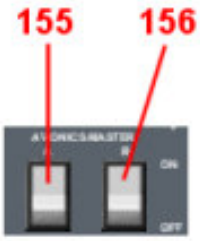
3.12 Further Flight Controls and Indicators

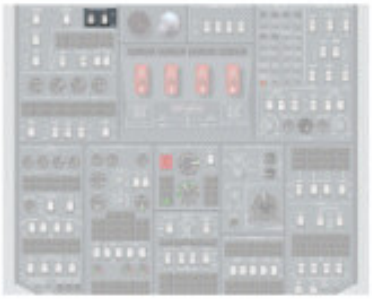


147	Rudder trim indicator
148	Elevator trim indicator
149	Aileron trim indicator
150	Flap lever
151	Flap position indicator
152	Elevator disconnect switch
153	Aileron disconnect switch
154	Stall ident warning lights

3.13 Communication and Radios

3.13.1 The Avionic A and Avionic B Busses





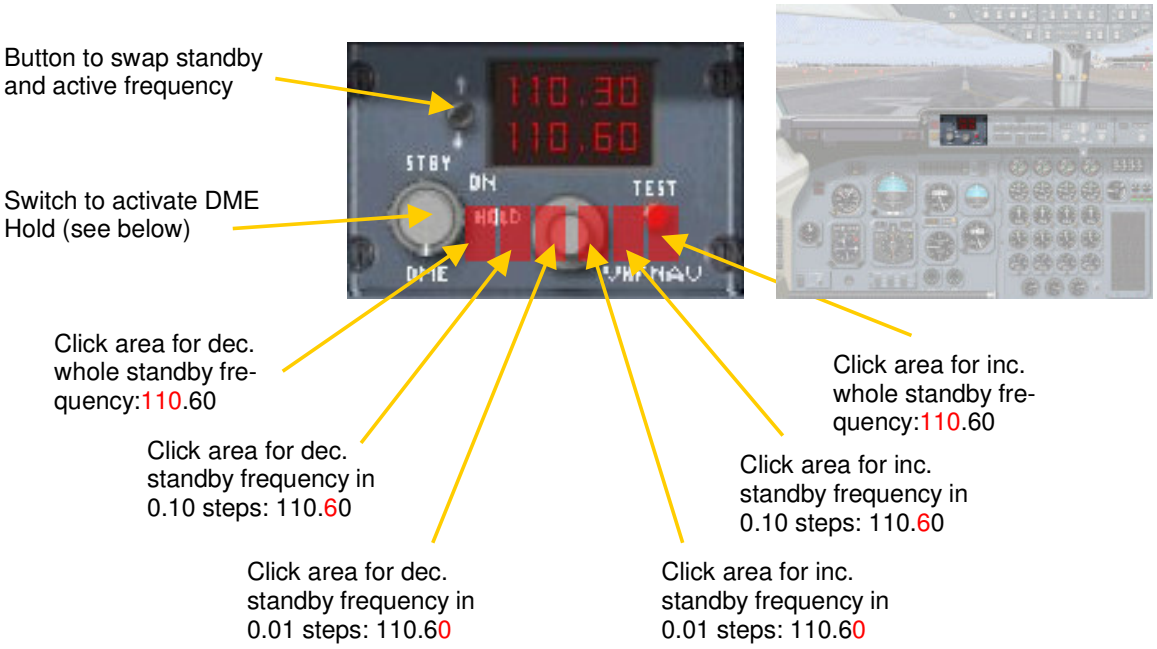
155	Avionic A bus master switch
156	Avionic B bus master switch

The BAe 146 has two avionic busses used for the radios and navigation instruments. The allocation of each instrument is:

Avionic Bus A	Avionic Bus B
• Attitude navigation needles • Comm 1 • Nav 1 • ADF • Transponder • HSI when AP Nav 1 • HSI DME when AP Nav 1 • HSI groundspeed when AP Nav 1 • DBI (RMI) DME 1 • DBI (RMI) ADF needles • DBI (RMI) VOR 1 needle	• Comm 2 • Nav 2 • HSI when AP Nav 2 • HSI DME when AP Nav2 • HSI groundspeed when AP Nav 2 • DBI (RMI) DME 2 • DBI (RMI) VOR 2 needle

3.13.2 The Nav 1 Radio

The digital display of the NAV 1 radio contents the active frequency (upper area) and the standby frequency (lower area). Both frequencies are only visible, if the essential AC bus is available (battery bus is used for backup) and the avionic A bus in the overhead panel (pos. 155) is switched on.

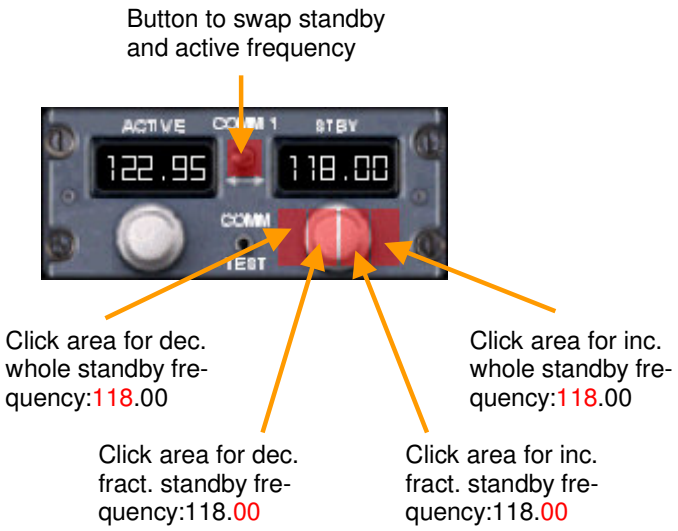


With the BAe 146 Nav 1 radio, it is only possible to set the standby frequency. The swap button changes the standby and active frequency. This function works independent from the setting in the aircraft.cfg. It's not necessary to make any changes in this file.

The DME hold function of this panel isn't equal to the real DNE hold. While the real DME hold continuously indicates the distance of the last frequency (corresponds a third Nav) during a further Nav 1 station could be adjusted, the DME hold of this panel freezes the distance of the active Nav 1. This can be used e.g. to determine a certain distance between two freely selectable points or to determine a covered distance. The hold function and switch can only be adjusted when Nav 1 receives a DME signal.

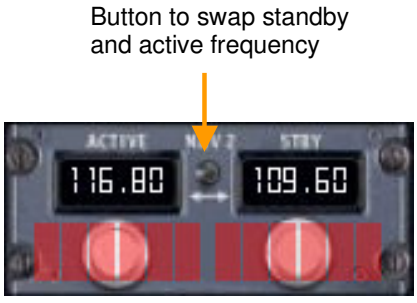
3.13.3 The Comm 1 and Comm 2 Receiver

The two Comm receivers are developed identically. The digital displays of Comm 1 are only visible if the emergency DC bus (MDC) and the avionic A bus is available. Comm 2 needs electrical power from the essential AC bus (SAC) and a switched on avionic B bus.



In both Comm receivers, only the standby frequency could be adjusted (dependent on the settings of the aircraft.cfg). The standby and active frequency could be changed with the swap switch between the digital displays.

3.13.4 The Nav 2 Radio



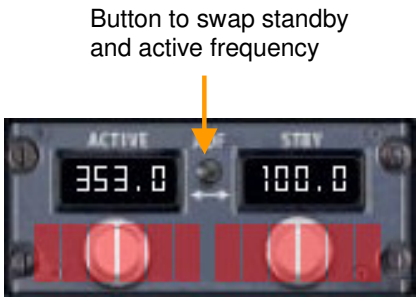
The Nav 2 radio has also a digital display for the active frequency (left) and for the standby frequency (right). Both displays are only visible if the essential DC bus (SDC) is available and the avionics B bus is connected. In contrast to the Nav 1 radio and the two to Comm receivers, you can adjust the active and standby frequency at the same time, independently the entries of the aircraft.cfg.

Below each frequency are left and right from the white adjusting wheels three mouse click areas. The outer areas adjust the frequency in whole steps (116.80), the middle areas set the frequency in tenth steps (116.80) and the inner areas adjust the frequency in hundredth steps (116.80).

Changes of the active frequency are transferred directly to the flight simulator, while changes of the standby frequency are only activated with operation of the swap switch between the digital frequency displays. However you could preselect a standby frequency or change an active frequency at each time.

3.13.5 The ADF Receiver

The ADF receiver has a digital display for the active frequency (left) and for the standby frequency (right). Both displays are only visible if the emergency AC bus (MAC) is available and the avionic A bus is connected. In contrast to the Nav 1 radio and the two to Comm receivers, you can adjust the active and standby frequency at the same time, independently the entries of the aircraft.cfg.



Below each frequency are left and right from the white adjusting wheels three mouse click areas. The outer areas adjust the frequency in thousands and hundreds steps (353.0), the middle areas set the frequency in tens (353.0) and the inner areas adjust the frequency in single and tenth steps (353.0).

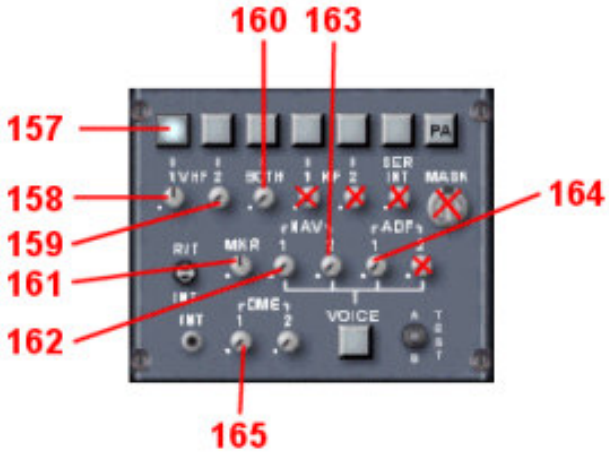
Changes of the active frequency are transferred directly to the flight simulator, while changes of the standby frequency are only activated with operation of the swap switch between the digital frequency displays. However you could preselect a standby frequency or change an active frequency at each time.

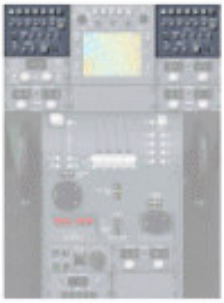
3.13.6 The Transponder

The transponder of the BAe 146 panel is almost equal to the functions of the standard transponder of the flight simulator. The digital display is only visible if the essential AC bus (SAC) is available and the avionics A bus is connected.

Underneath the digital display are four mouse click areas, which are assigned to the four numbers of the transponder. As with the standard FS transponder, you can only increase each number. If a number reaches "9", it begins again with "0".

3.13.7 The Audio Selector Unit





157	Audio transmit buttons
158	VHF 1 receive switch
159	VHF 2 receive switch
160	“Both” receive switch for VHF 1 and VHF 2
161	Marker receive switch
162	Nav 1 receive switch
163	Nav 2 receive switch
164	ADF 1 receive switch
165	DME 1 receive switch (coupled with DME 2)

Additional Notes

The right audio unit is just a second audio unit gauge which is coupled directly with the left one. You could not select separate modes there.

The transmit buttons and the voice transmit button have no function yet. Those are just dummies.

The red crossed switches have no function yet.

3.14 The Sperry Primus 90 Weather Radar

271	Off switch
272	Switch to activate WX (weather radar) view.
273	Switch to activate map view
274	Range selector

The weather radar is placed in the pedestal sub window.

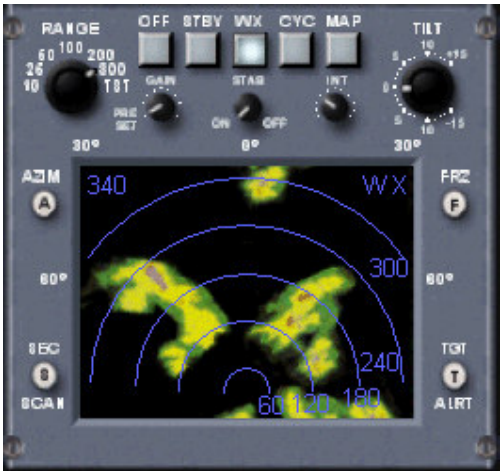
The weather radar will be switched on with the switch pos. 272 (weather radar will be displayed) or 273 (moving map will be displayed). Button pos. 271 switches off the complete weather radar. It is not possible to select the weather radar mode together with the moving map mode.

The range for the weather radar or the moving map is selected with the knob pos. 274. Here you select a distance of 10, 25, 50, 100 and 200 miles. The 300 NM range is not realized with this panel.

The top left corner of the display shows the actual aircraft heading. On the top right side, the current weather radar mode is shown.

Weather Radar in Map View Mode

Weather Radar in WX (Weather Radar) Mode



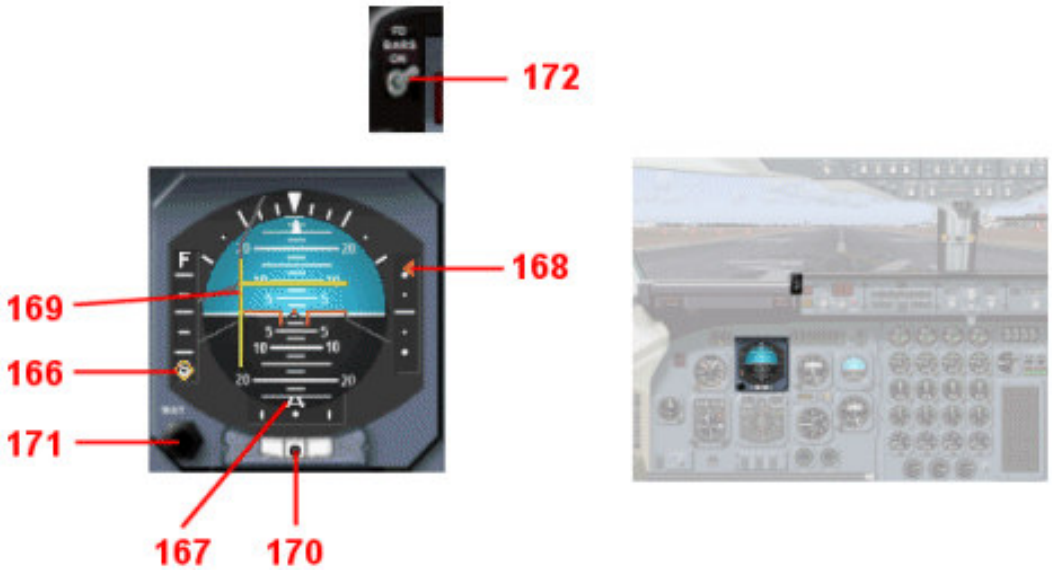
Additional Notes

Both realized modes of the weather radar did not base on the real Primus 90 weather radar. The map mode based on the FS2004 GPS map view and the weather radar is just a working dummy. It doesn't display the real weather conditions.

The red crossed switches have no function yet.

3.15 The Primary and Standby Instruments

3.15.1 The Sperry AD310 ADI



166	Fast / Slow indicator for the selected speed of the airspeed indicator (pos. 145).
167	Localizer indicator.
168	Glide sloop indicator.
169	Flightdirector bars
170	Ball
171	ADI Test knob.
172	Flightdirector bars switch (switch is in the left side of the glareshield panel).

Additional Notes

With the split selector of the BAe 146 autopilot you have the possibility to select Nav 2 for the HSI. This is not possible with the ADI. The real ADI just could be changed to Nav 2 with one of the covered switches below the HSI but this is not realized with this panel so the localizer and glide sloop indicator shows always the corresponding signal of Nav 1.

The Fast/Slow indicator belongs to the selected speed bug of the airspeed indicator This is not an indicator for the autopilot. The IAS and Mach hold of the BAe 146 autopilot works now as in the real aircraft. You do not have any target airspeed indicator or airspeed selector for the speed hold there. You will find more information about this in the chapter about the autopilot.

The localizer of the ADI works much more precise than the GDI needle of the HSI. The GDI needle of the HSI has a full range over the display while the range of the localizer needle is just 1/5 of the HSI range. This is helpful for a precise alignment.

The ADI could be enlarged by clicking on the horizon of the ADI gauge. Enlarged instruments could be switched off with a further click on the horizon.

The ADI Off Flags

The BAe 146 has Off flags for the Fast/Slow indicator, the flightdirector, the glide slope indicator, the localizer and for the attitude itself.

The flags for the fast/slow indicator, the attitude and the flightdirector are visible if the ADI and/or corresponding function is without electrical power. The same to the glide slope and localizer indicators but here the off flags are also visible when Nav 1 has no glide slope or localizer signal.

3.15.2 The Flightdirector Modes

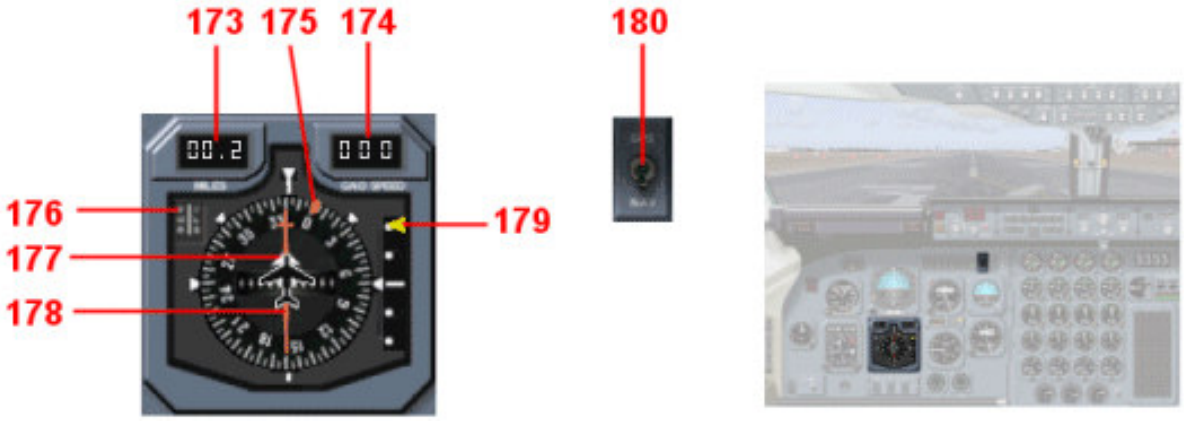
When the flight director bars are switched on (switch pos. 172), the autopilot is active, and the TURB mode of the AFGS is not selected, the flight director bars show directly the autopilot commands. When the autopilot is switched off and the bars are on, they show the modes which are selected with the AFGS mode selector (please see also chapter The Automatic Flight Guidance System (AFGS)). Some functions of the mode selector just uses the lateral FD bar, some just the vertical bar and some modes uses both. Combinations are possible. Which FD bar is active and what value is shown when the corresponding mode is pressed is shown below.

GSL	When GSL is pressed the vertical bar show the path of the glide sloop and the lateral bar show the localizer signal. The functions of this mode could be compared with an old style VOR/ILS indicator.
ALT	The ALT mode just uses the vertical FD bar. It belongs to the altitude when the mode is pressed. A preselected altitude is not possible for the FD without using the autopilot.
VS	The VS mode just uses the vertical FD bar. It belongs to the rate of climb or descend when the mode was pressed.
Mach	The MACH mode just uses the vertical FD bar. It belongs to the actual Mach speed while the mode was pressed and could be compared with the F/S indicator.
IAS	The IAS mode just uses the vertical FD bar. It belongs to the actual airspeed while the mode was pressed and could be compared with the F/S indicator.
V/L	The V/L mode just uses the lateral FD bar. It belongs to the received VOR or LOC signal of Nav1. This mode could be compared with an old style VOR/LOC indicator.
BLOC	When BLOC is pressed the vertical bar show the path of the glide sloop and the lateral bar show the localizer signal of the back course.
HDG	The HDG mode just uses the lateral FD bar. It belongs to the selected heading of the HSI and shows the direction the aircraft has to turn to reach this selected heading.

When the FD bars are switched on but non of the above listed modes are selected, the FD bars are not visible.

All of the above listed FD modes will be disengaged as soon as the autopilot is activated with the AP main switch.

3.15.3 The Collins 331A-8K HSI



173	Digital DME 1 or DME 2 readout (whichever is selected with the split selector of the autopilot)
174	Digital ground speed contingent on the selected DME.
175	Heading bug. The heading bug will be selected in the glare shield panel. Please see the autopilot chapter for more information.
176	Mechanical signal display. Reads VOR if Nav 1 or Nav 2 (whichever is selected with the split selector of the autopilot) receives a VOR signal, reads VOR/ILS if Nav 1 or Nav 2 receives an ILS signal and GPS if GPS mode is selected with the switch pos. 180.
177	To / From flag
178	HSI localizer needle.
179	HSI glide sloop needle.
180	Nav / GPS switch.

Additional Notes

The HSI contents also two digital readouts for the selected heading of the autopilot and the current aircraft heading. Just click in the center of the HSI to activate them or click again to deactivate them. Those digital readouts are useful as the HSI is a little bit small for a precise readout of the heading and HSI select.

The two digital readouts are just visible if they are supplied with electrical power and the corresponding avionic switch is on. Please find more information in the chapters “Electrical allocation of the gauges” and “The Avionic A and Avionic B Busses”.

The HSI could be enlarged by clicking on the horizon of the ADI gauge. Enlarged instruments could be switched off with a further click on the horizon.

<u>The HSI Off Flags</u>

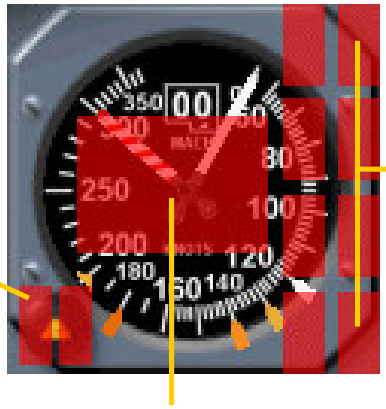
The HSI contents three different off flags. The upper HDG off flag and the red/white Loc/Nav flag in the center of the HSI is visible if the HSI is without electrical power (emergency AC bus / MAC), no horizontal gyro signal is present or if the avionic A or avionic B switch is off (switch pos. 155 and 156) in a way which Nav signal for the HSI is selected with the split selector of the autopilot.

The glide sloop off flag is visible when the HSI is without electrical power (MAC), the selected radio is off line (with the avionics A or B switch), or if the received signal has no glide sloop.

3.15.4 The Airspeed Indicator

181	Airspeed needle
182	Mechanical Mach display
183	Limit speed pointer
184	Command speed pointer. This bug is a help for the pilot and is not coupled with any function of the BAe 146 autopilot. The Fast/Slow indicator of the ADI (pos. 166) gets the information from this speed pointer setting.
185	Setting knob for the command speed pointer.
186	V1 reference bug
187	VR reference bug
188	V2 reference bug
189	VFTO reference bug

Mouseclick Areas in the Airspeed Indicator



The Airspeed Indicator Off Flag

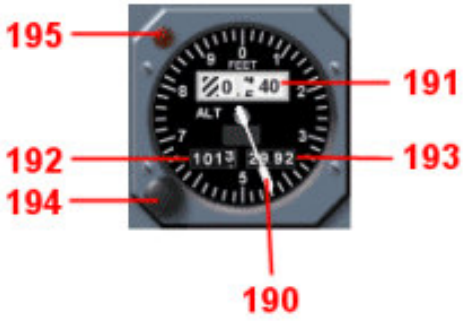
The airspeed indicator off flag of the Mach readout is visible when the emergency AC bus (MAC) is not available.

Additional Notes

The airspeed indicator could be enlarged by clicking on the horizon of the ADI gauge. Enlarged instruments could be switched off with a further click on the horizon.

3.15.5 The Altimeters

3.15.5.1 The Servo Altimeter



190	Altimeter needle
191	Mechanical altitude readout
192	Barometric pressure in millibars (MB)
193	Barometric pressure in inches of mercury (in Hg)
194	Setting knob for barometric pressure
195	Altitude alerter (see chapter “Altitude Alerting” fore detailed information)

The Servo Altimeter Off Flags

The off flags of the servo altimeter are visible when the emergency AC bus (MAC) is not available. In this case the airspeed needle also jumps back to zero.

Additional Notes

The servo altimeter could be enlarged by clicking on the horizon of the ADI gauge. Enlarged instruments could be switched off with a further click on the horizon.

3.15.5.2 The Non Servo Altimeter

The non servo altimeter or standby altimeter is a pure mechanical instrument and is connected to the aircraft static system. Because of this, the non servo altimeter has no off flags as no electrical power is necessary.

Beside the mechanical altitude readout, the non servo altimeter contents also the mechanical readouts for the barometric pressure in millibars and in inches of mercury. The pressure could be adjusted with the knob on the lower left side of the altimeter.

3.15.5.3 The Radio Altimeter and Decision Height Selector

205	Digital radio altimeter (up to 2500 feet AGL).
206	Mechanical decision height selector.
207	Decision height warning lamp
208	Click area for the radio altimeter (please see below for detailed descriptions)
209	Click area for setting the decision height (please see below for detailed descriptions).

The Radio Altimeter and Decision Height Off Flags

Both, the radio altimeter and decision height selector, use electrical power from the essential AC bus (SAC). If SAC is not available, the digital radio altitude is not displayed and the decision height selector is covered with a red off flag as shown in the picture.

Additional Notes

Below the radio altimeter are three click areas. If you click on the left side you decrease the displayed radioalt and if you click on the right side you increase the displayed radioalt. This could be useful for correcting the value to the used aircraft or making any fine adjustment. If you directly click in the center area below the radioalt you will reset the value.

The decision height selector has four click areas below the displayed value. If you click close to the center you will increase or decrease the decision height in 1 steps. If you click left or right from this position you increase or decrease the value in 10th steps.

3.15.6 The Vertical Speed Indicator

The vertical speed indicator (VSI) provides indication of the aircraft's rate of ascent or descent. The indication of the vertical speed is shown by the needle moving over the calibrated dial. The instrument gives instantaneous response to vertical accelerations to overcome lag in the aircraft static system. Because of this, the VSI indicator did not content any off flag and no electrical power is necessary for it.

Additional Notes

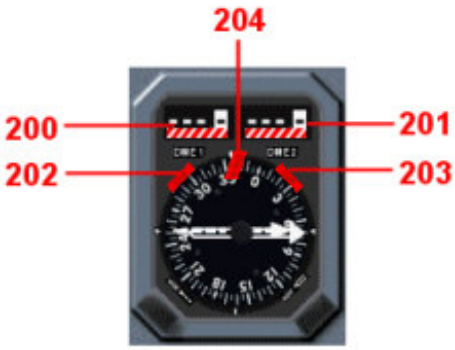
The vertical speed indicator could be enlarged by clicking on the horizon of the ADI gauge. Enlarged instruments could be switched off with a further click on the horizon.

3.15.7 The Standby Attitude

The Standby Attitude Off Flag

The standby attitude indicator is connected to the emergency DC bus (MDC). Should the MDC bus fail or is not available, the standby attitude did not work and the off flag in upper right side of the instrument is visible.

3.15.8 The Distance Bearing Indicator (DBI)



196	Mechanical DME 1 readout
197	Mechanical DME 2 readout
198	VOR 1 or ADF needle
199	VOR 2 or ADF needle
200	DME 1 (DME of Nav 1) off flag (see further description below)
201	DME 2 (DME of Nav 2) off flag (see further description below)
202	Nav 1 or ADF off flag (see further description below)
203	Nav 2 or ADF off flag (see further description below)
204	Gyro off flag

The two needles of the DBI could be set to Nav 1, Nav 2 or ADF 1 (a second ADF is not realized yet). In the lower area of the DBI are two mouseclick areas to change each receiver unit. The left picture shows those areas with a red rectangle.

The needle position 198 could be set to Nav 1 or ADF and the needle position 199 could be set to Nav 2 or ADF by a click on the mouseclick areas of the gauge.

There are just buttons to change from Nav 1 to ADF or Nav 2 to ADF, so it's not possible to see what receiver unit is selected with the button. The arrows and description above those buttons change when changing the receiver. Nevertheless it's also too small to see what is selected. Because of this you will find a yellow tooltip text on the buttons. Here you could see if you've selected Nav 1, Nav 2 or ADF.

The DBI Off Flags (pos. 200 – 204)

The off flags of the DBI have different functions. The main off flag pos. 204 comes up without electrical power or without gyro signal. The off flags of the DME (pos. 200 and pos. 201) came up without electrical power, without DME signal of the corresponding Nav or with a switched off avionic bus. The left red off flag (pos. 202) is visible when either Nav 1 or ADF (depending the selected receiver) has no signal, no electrical power is given or the avionic A switch is off. The right red ADF off flag (pos. 203) is visible when Nav 2 or ADF receives no signal, no electrical power is given or the avionic A or B switch is off.

Additional Notes

The DBI in the main panel window could be enlarged by clicking on the horizon of the ADI gauge. Enlarged instruments could be switched off with a further click on the horizon.

The BAe 146 panel contents a second DBI which is placed in the TMS Pressurization sub window. This DBI has the same functions as the DBI in the main window. Nevertheless it's needles could be set differently to DBI 1.

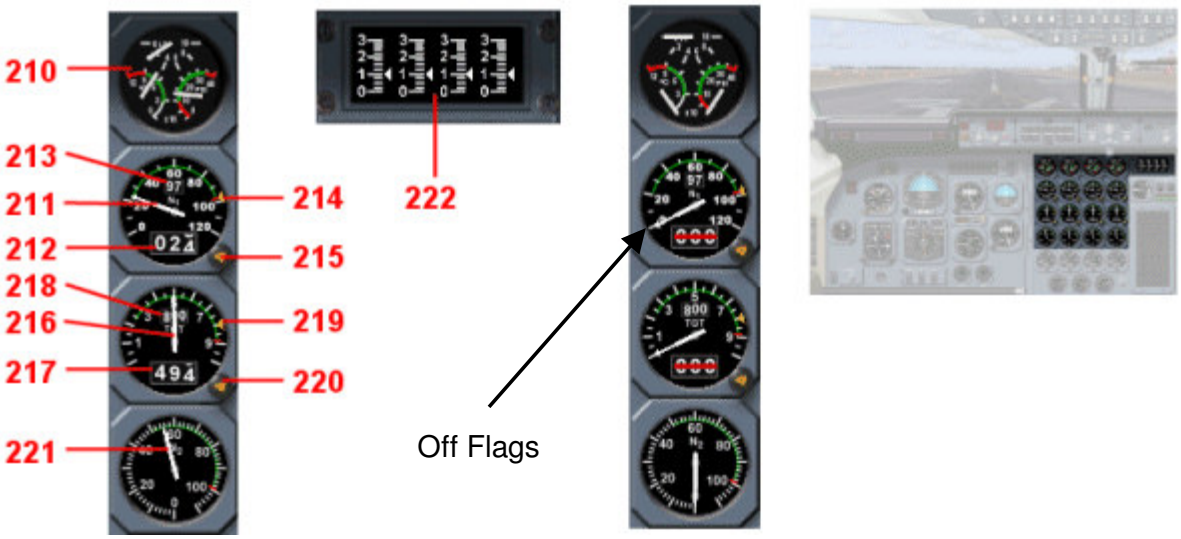
3.15.9 The Analogue Clock

The BAe 146 clock is supported from the hot battery bus. When this bus fail, the clock has an own internal battery which supports the clock with electrical power.

The clock could be set with the black knob on the lower right side of the gauge. It's also possible to set the simulation rate with the clock. The gauge has no display for the simulation rate, but it is shown when moving the mouse to the center of the clock. Here are also the moseclick areas for setting the simulation rate (see picture).

3.16 The Engine Instruments

3.16.1 The Main Engine Instruments



210	Oil pressure, temperature and quantity.
211	Engine N1 % rpm fan speed indicator.
212	Mechanical N1 pointer readout.
213	N1 Command bug mechanical readout.
214	N1 Command bug indicator.
215	N1 Command bug setting knob.
216	TGT – turbine gas temperature indicator (°C)
217	Mechanical TGT pointer readout.
218	TGT Command bug mechanical readout.

219	TGT Command bug indicator.
220	TGT Command bug setting knob.
221	Engine N2 % rpm compressor speed indicator.
222	Engine vibration for engine 1 – 4.

Additional Notes

Except the engine vibration all above shown engine gauges are identically for all four engines.

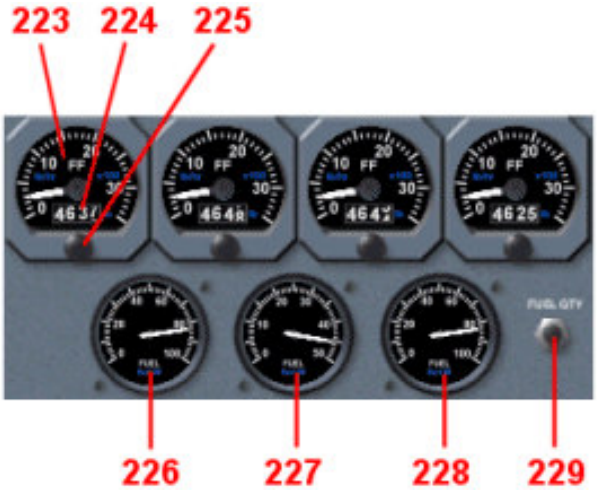
The oil quantity indicator is just a fake as the Flight simulator did not support any oil quantity.

The N1 and TGT command bug readouts are not easy to recognize when using a small monitor. However you can see the selected value better when taking care about the orange command bug position.

The off flags of N1 and TGT are visible when the electrical supply is not given. In the case of a missing electrical supply all needles go back to the zero position.

With the N1 command bugs (pos. 214) and the TGT command bugs (pos. 219) the pilot sets the TMS calculated values. Before take off for example, the N1 bug will be set with the N1 value of the TMS indicator. The TGT bug could be set for the adjusted TGT value in the TMS. Both bugs were not set automatically from the TMS. For more information about the TMS value, see chapter “The Thrust Modulation System (TMS)”.

3.16.2 The Fuel Flow and Fuel Quantity gauges



223	Fuel Flow indicator lbx100/hr.
224	Fuel used counter (lbs per engine)
225	Fuel used reset button.
226	Left wing tank fuel contents (lbs)
227	Center tank fuel contents (lbs)
228	Right wing tank fuel contents (lbs)
229	Button for changing the electrical supply of the fuel content gauges. If the button is not presses the gauges requires essential DC (SDC), if the button is pressed the gauges work with emergency DC (MDC).

Additional Notes

The fuel used gauges works very precise. However if you change the daytime with the menu you will get wrong values as the gauge calculates the fuel used with the Flight simulator time. If you do this and you see strange or wrong values, please press the reset button (pos. 225) to set the value back to zero.

3.16.3 The Thrust Modulation System (TMS)

The Thrust Modulation System (TMS) is no full autothrottle. It is designed to reduce pilot workload by synchronising the engines to a selectable master engine or to a pre-computed TGT, N1 or N2. So all in all it's a simple type of autothrottle with authority limited to a maximum of +/- 1/2" on the throttle rods. It trims the engines to a pre-computed N1, N2 or TGT according to the phase of flight selected, e.g. take-off, de-rated take-off, maximum climb, normal climb, cruise or descent.

The TMS gauge is placed in the TMS, Pressurization sub window.

230	TMS main switch
231	Digital TMS target indicator
232	Mechanical Reference temperature T_{REF}
233	Mechanical TGT selector
234	Throttle actuator lights

235	TMS Mode selectors
236	N1 or N2 control mode
237	Master engine selector
238	TMS test button

On the TMS mode selector, the pilot select the required mode of operation, which is interfaced with a microprocessor based computer (TMC) driving an actuator on each engine fuel control unit to provide limited trim authority about thrust lever settings. Each trim actuator is motored to a center position when the TMS is in a non-controlling mode or selected off.

The throttle actuator lights pos. 234 have the following meaning:

The blue arrows illuminate when one of the TMS modes is activated and the throttle is beyond it's control limit (actuator has been commanded beyond it's control limit). The blue arrows show that the throttle must be moved forward (increase thrust) to bring it into the TMS control area. Each engine throttle has it's own light. The arrows are just visible if engine N1 is more than 36%.

The white arrows illuminate when one of the TMS modes is activated and the throttle is beyond it's control limit (actuator has been commanded beyond it's control limit). The white arrows show that the throttle must be moved back (decrease thrust) to bring it into the TMS control area. Each engine throttle has it's own light. The arrows are just visible if engine N1 is more than 36%.

3.16.3.1 The TMS Modes

TO

The TO/GA button activates either TO or GA. When the aircraft is on ground the TO (take off) mode will be activated, the button shows the white text TO and the green arrow below the TO text illuminates. When another mode was selected before, it will be cancelled automatically when the TO button is pressed.

When in take off mode, the digital TMS target indicator (pos. 231) shows the calculated N1 thrust, depending on the airfield altitude, ambient temperature, bleed state and selected reference temperature T_{REF}. An illegal bleed state occurs when any engine air is used on ground together with an activated pack. This is shown with a blinking N1 thrust in the TMS target indicator (pos. 231).

After selecting the take off mode on ground and increasing thrust to more than 36% N1, the blue arrows of the actuator lights (pos. 234) illuminate. As each engine attains target speed its associated blue arrow goes out. Should a thrust lever be advanced so far that its actuator has reached the limit of its trim down authority when controlling to a target, a white arrow in the associated engine lights advising the pilot to retard that thrust lever. When no arrow illuminates and N1 is more than 36%, the TMS controls the throttle to seek the calculated thrust shown in the TMS target indicator. The throttles are not controlled from the system as long as the white or blue arrows are on and N1 is more than 36% N1.

The take off mode of the TMS is just active as long as the airspeed is below 75 knots. At 75 knots IAS all actuators freeze and the throttles are no longer controlled from the TMS.

GA

The GA (go around) mode of the TMS disconnects all thrust controlling of the TMS. On ground it will be activated when pressing the TO/GA button twice (the first pressing activates the TO mode). When airborne the take off mode (TO) could not be activated. Because of this the GA mode is active with the first pressing of the button. In GA mode, the TMS button shows the white text GA and the green arrow below illuminate. Activating the GA mode, disengages all other TMS modes.

Because of the fact that the actuators and so no thrust control is active, the white and blue arrows of the throttle actuator lights are off.

The GA mode will also be activated when pressing another TMS mode than TO or GA on ground. To activate the desired other TMS mode, it's button has to be pressed again.

MCT

Pressing the MCT pushbutton causes the TMS to enter the MCT mode. In MCT mode, the MCT button shows the white text “MCT” and a green arrow illuminates below it. When the MCT mode is engaged the digital TMS target indicator shows 770 (°C) as long as the N1 limit is not passed. When the maximum continues N1 limit of 94.1% exceeds, the display changes to 94.1 (% N1). This N1 schedule prevents over-thrusting.

In the MCT mode the blue and white arrows of the throttle actuator lights have the same function as with the TO mode. When the throttles are below the target area but N1 is more than 36% N1, the blue arrows illuminates. When the throttles are above the target area, the white arrows illuminate and the throttles have to be moved back to bring them into the target area of the TMS system. When no arrow illuminates and N1 is more than 36%, the TMS controls the throttle to seek 770°C TGT or 94.1% N1 depending on each limit (shown in the TMS target indicator). The throttles are not controlled from the system as long as the white or blue arrows are on and N1 is more than 36% N1.

The MCT mode could be cancelled by pressing the MCT button again or when another TMS mode is selected.

TGT

When selecting the TGT mode, all other TMS modes disengage and the white text "TGT" is visible on it's button and a green arrow below the text starts illuminating. The TGT mode scans the selected TGT value in the target indicator (pos. 233). This value is shown in the digital target indicator when it is below 770°C. 770°C is the highest value the system allows. When a higher TGT is set, the system use 770°C as target and shows this in the indicator.

The TGT value could be set with invisible click spots below (decrease) and above (increase) the TGT value. There are three different click areas for it. On the left side you could set 100's, in the center 10's and on the right side you could adjust single values. Like in the real aircraft, the TGT mode will be disengaged when changing the 100's value. After setting a new 100's value, the TGT mode must be switched on again to engage it.

When engine RPM is above 36% N1 the blue and white arrows of the throttle actuator lights are visible when the throttles are outside the TMS target area. The blue arrows come up when thrust has be increased and the white arrows come up when thrust has to be decreased to come into the target area. The system controls the throttles only when they are in the target area of the actuators (TGT is on, engine RPM is more than 36% N1 and no arrow is illuminating).

DESC

The DESC mode is used for descent. When selecting the DESC mode, all other TMS modes disengage and the white text "DESC" is visible on it's button and a green arrow below the text starts illuminating. The DESC mode always works with N2 RPM. When DESC is selected, the digital target indicator shows the calculated N2 target, depending on the altitude and selected engine anti-ice. Engine 1 and 4 have different N2 targets compared to engine 2 and 3 depending on the selected engine anti-ice.

With engine anti-ice off the target for engine 1 and 4 is flight idle. The target for engine 2 and 3 is calculated from the system and shown in the target indicator. With engine anti-ice on, the system calculates the target N2 RPM for all four engines. This target RPM is shown in the target indicator. An activated Wing anti-ice requires a higher target value, no matter if inner, outer or both wing anti-ice is switched on.

When engine RPM is above 36% N1 the blue and white arrows of the throttle actuator lights are visible when the throttles are outside the TMS controlling area. The blue arrows come up when thrust has be increased and the white arrows come up when thrust has to be decreased to bring the throttles into the target area. The system controls the throttles only when they are in the target area of the actuators (DESC is on and no arrow is illuminating). With engine anti-ice off, there's no controlling of the engine 1 and 4 throttles. Those throttles must be brought to the Idle position manually from the pilot. The throttles of engine 2 and 3 are controlled from the system when they are in the target area. With engine anti-ice on all four throttles are controlled from the system when they are in the target area. Nevertheless there is a different target area for the inner and outer engines.

SYNC

When selecting the SYNC mode, all other TMS modes disengage and the white text "SYNC" is visible on it's button and a green arrow below the text starts illuminating. When flying in SYNC mode engine 1 or 2, whichever is selected with the master engine selector (pos. 237), is the master engine and the three other engines will be synchronized to this engine. N1 or N2 RPM (whichever is selected with N1 / N2 control mode button pos. 236) of the master engine is the target for the remaining engines. That's why the target indicator shows no value and the display is blank.

The blue and white arrows of the throttle actuator lights did not come up for the master engine in SYNC mode, because the RPM of this engine is always the target. The blue arrows for the remaining engines illuminate, when their N1 or N2 value is below the target area of the master engine.

When the master engine runs with 88% N1 and engine 2 shows 80% N1 for example, the blue arrow of engine 2 come up because it's not automatically synchronized to the master engine. The white arrows illuminate when the thrust of the remaining engines is above the target area of the master engine. The remaining engines were automatically synchronized to the master engine when RPM is more than 36% N1 and no arrow illuminates.

TGT SYNC

The TGT SYNC is a special form of the SYNC mode. It will be selected by pressing SYNC (all other modes disengage) and then TGT. When pressing TGT first, it will be cancelled by pressing SYNC. That's why SYNC has always be selected first. Like in SYNC mode, engine 1 or 2 (whichever is selected with the master engine selector pos. 237) is the master engine and the remaining engines will be synchronized to it. The target for the master engine is the selected TGT of the mechanical TGT selector pos. 233. This value is shown in the digital target indicator. When a higher TGT than 770°C is dialled, the target is 770°C which is shown in the target indicator. The synchronization of the remaining engines occurs with the engine temperature of the master engines. Because of this, the N1 / N2 control mode button pos. 236 of the TMS is not in use.

The blue and white arrows of the target indicator lights for the master engine come up when it's TGT is outside the selected target temperature. The blue arrow illuminates when the TGT of the master engine must be increased and the white arrow shows that the TGT must be decreased to bring the throttle into the controlling area of the TMS. The throttle of the master engine will only be controlled automatically when it's N1 RPM is more than 36% N1 and no arrow is illuminating. The blue arrows for the remaining engines illuminate, when their engine temperature is below the target area (TGT) of the master engine. When the master engine runs with 690°C TGT and engine 2 shows 650°C TGT for example, the blue arrow of engine 2 come up because it's not automatically synchronized to the master engine. The white arrows illuminate when the temperature of the remaining engines is above the target area of the master engine. The remaining engines were automatically synchronized to the master engine when RPM is more than 36% N1 and no arrow illuminates.

Regardless of which TMS mode is selected (N1 RPM, N2 RPM or TGT control), the thrust will not increase 97% N1 or 770°C TGT as long as the throttles are in the controlling range of the TMS. When the throttles are controlled from the system, they are not adherent from the actuators. All throttles could be moved manually from the pilot, no matter which mode is active or if the throttles are in the controlling area or not. When engine 1 TGT is 680°C, TGT mode is active and 680°C is selected and so throttle 1 is in the controlling range (blue and white arrow dies not illuminate) for example, throttle 1 could be moved forward manually.

Additional Notes

The GA mode could also be activated by pressing one of the disconnect buttons on the thrust levers 1 or 4. Those disconnect buttons are not realized yet, why it's just possible to activate the GA mode with the TO/GA mode button.

In the real BAe 146 the maximum continuous thrust with the MCT mode is 857°C TGT. I had to reduce this value to 770°C to allow the TMS system to work with the available aircraft models.

3.16.3.2 TMS Selftest

A manual TMS selftest is initiated by pressing the test button (pos. 238) with the system in the standby state (switched on but without an activated TMS mode). The digital target readout shows 88.8 and all indicators on the CDU come on in sequence. On completion of the test if the green annunciator on the test button remains lit the test is successful completed and the TMS is in the standby state ready for a mode selection. As soon as a TMS mode is selected, the green annunciator light of the test button goes off.

If the amber annunciator remains lit the test has failed and the amber MWS annunciator "TMS FAULT" also lights.

3.16.3.3 Flexible Take Off

When available runway length is greater than the minimum needed for normal take off, engine life could be enhanced by carrying out a reduced thrust or flexible take off. In this case a temperature T_{REF} higher than ambient is set on reference temperature selector (pos. 232) causes the TMS computer to demand the reduced N1 which would have been produced by the engine at the higher ambient temperature.

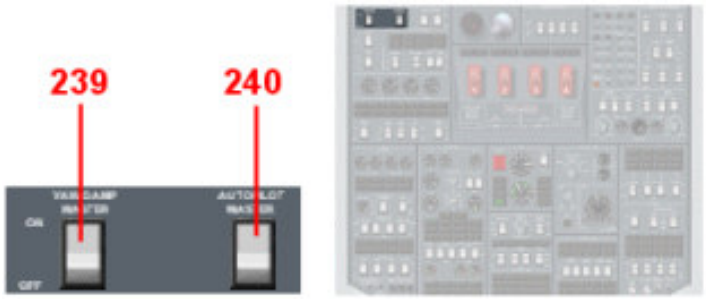
Special notes for the usage of flexible ratings:

- Do not use $N1_{FLEX}$ greater than $N1_{REF}$
- Do not use $N1_{FLEX}$ less than 78,0% N1
- Do not use $N1_{FLEX}$ less than $N1_{REF}$ – 8,0%

3.17 The Automatic Flight Guidance System (AFGS)

The BAe 146 is equipped with a comprehensive automatic flight guidance system (AFGS) centred on the Smiths SEP 10 autopilot and driving dual flight director displays on the ADI. This AFGS can control the aircraft through every phase of flight from climb-out to decision height, annunciating mode selection in the push buttons.

The complete system is only available when the electrical AC1 and AC2 bus is available and the aircraft is airborne. Additionally the AP and the Yaw Damper contents two main switches in the overhead panel which must be on before the AP or the Yaw Damper could be activated.



239	Yaw Damper master switch
240	Autopilot master switch

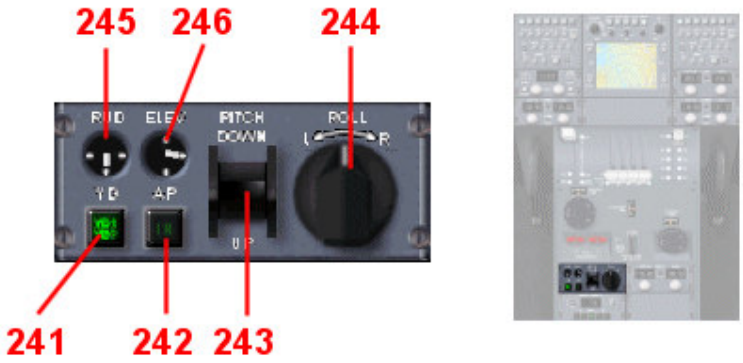
The autopilot and yaw damper master switches do not activate the autopilot or yaw damper itself. This will be done in the autopilot control unit. However it's necessary to activate the master switches before activating the autopilot or yaw damper. Otherwise both systems will not work and you will see a red warning light for the autopilot or amber warning light for the yaw damper in the AFGS annunciator.

The BAe 146 AFGS system consists of the autopilot control unit, the mode selector unit, the navigation selector unit and the altitude selector unit. Additionally to this units, the yoke contents an autopilot disconnect button and the SYNC button. All selected AFGS modes were shown in the flight annunciator panel.

Except the basic pitch and roll modes, the autopilot requires an activated flight director (switch pos. 172). Switching off the flight director causes all modes of the mode selector unit to disengage.

3.17.1 The AFGS Control Units

The Autopilot Control Unit



241	Yaw Damper switch
242	Autopilot main switch
243	Pitch rate switch
244	Turn control knob
245	AP forced rudder control indicator
246	AP forced elevator control indicator

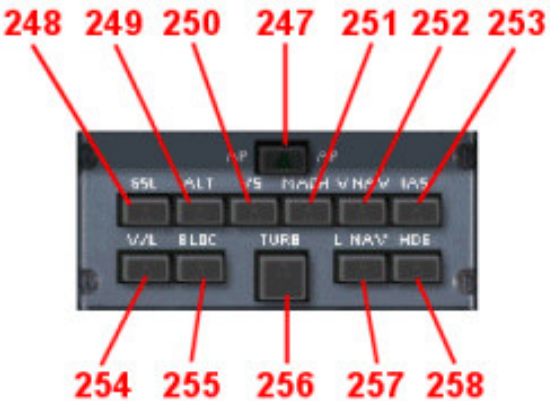
The autopilot control unit contents the autopilot main switch (pos. 242) and yaw damper main switch (pos. 241). When the autopilot and yaw damper master switches in the overhead panel (pos. 239 and 240) are on, those main switches activates the yaw damper and autopilot. The buttons show the green text YD1 / YD2 and AP illuminating on it.

After engaging the autopilot with the main switch in the control unit, the AFGS system activates the roll and pitch mode. When the pitch mode gets active it stores the current aircraft pitch and holds it until another vertical mode is selected or the pitch is increased or decreased with the pitch rate switch (pos. 243). The roll mode forces the aircraft to stay on the heading when the autopilot was switched on until another lateral mode is selected or the roll rate will be changed with the turn control knob (pos. 244).

The Mode Selector Unit

The mode selector unit is mounted on the glareshield and contains the push button switches for the selected mode. Hidden legends are used so that the button appears blank, until a mode is selected when a white triangle is illuminated. Engagement of the autopilot is indicated by a green triangle on the AP button (pos. 247) at the top of the panel.

In essence the bottom row selects lateral modes and the middle row selects vertical modes.



247	AP main switch indicator light
248	Glideslope coupling mode button (GSL)
249	Altitude mode button (ALT)
250	Vertical speed button (VS)
251	Mach mode button (MACH)
252	VNAV button (without function in the real BAe 146 and in this panel)
253	Airspeed mode button (IAS)
254	VOR / LOC mode button (V / L)
255	Back localizer coupling button (B LOC)
256	Turbulence button (TURB)
257	Lateral navigation mode button (L NAV)
258	Heading mode button (HDG)

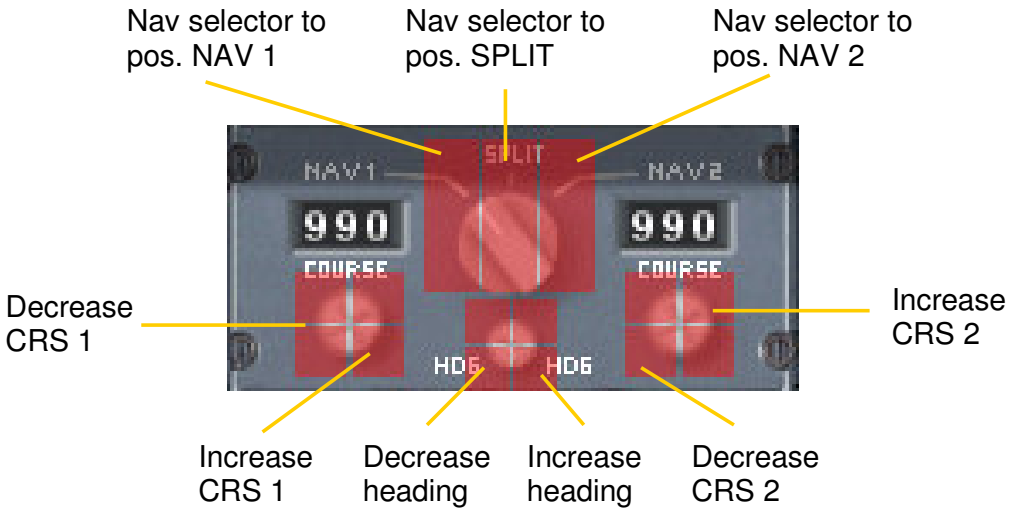
The Navigation Selector Unit

The navigation selector unit is placed on the glareshield and contains a large rotary switch (pos. 263) which selects the distribution of the radio navigation information to the autopilot and to the pilots instruments.

The autopilot and flight director use the information that is displayed on the captain's HSI. With SPLIT selected NAV 1 supplies HSI 1 and NAV 2 supplies HSI 2. If NAV 1 is selected, then both HSI's are supplied from NAV 1 and a NAV 2 selection supplies both HSI's from NAV 2.

259	Mechanical NAV 1 course readout.
260	Knob for setting NAV 1 course
261	Mechanical NAV 2 course readout
262	Knob for setting NAV 2 course
263	Split selector (description see above)
264	Heading selector knob

Mouseclick areas in the Navigation Selector Unit



The CRS 1, HDG and CRS 2 knobs have two separate mouseclick areas for decreasing and increasing their values. The upper mouseclick area increases or decreases the value in single steps and the lower mouseclick area increases or decreases the value in 10th steps.

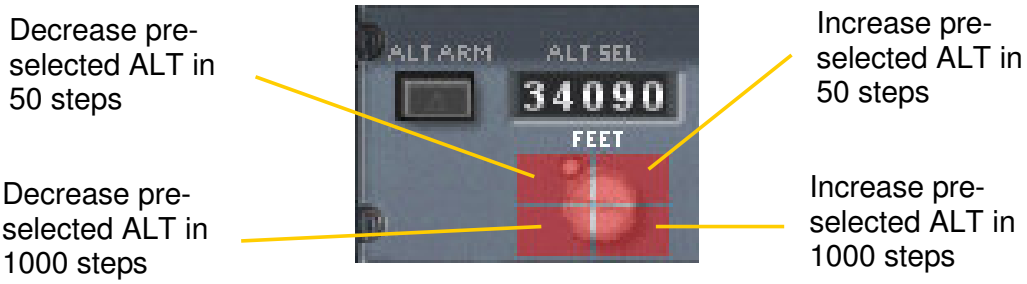
The Altitude Selector Unit

265	Pre-select ALT button
266	Mechanical altitude pre-select readout
267	Knob for setting pre-selected altitude

With the altitude selector unit it's possible to set an altitude for the PITCH, IAS Mach and VS autopilot modes. When on of those modes is active and the pre-selected alt button (pos. 265) is on, the autopilot changes to ALT when the selected altitude is attained. For more information about the pre-selected ALT mode see chapter "The Vertical AFGS Modes" of this manual.

Changing the selected altitude with the selector knob (pos. 267) disengages the pre-selected altitude mode automatically. When the pre-selected altitude have to be changed, the pre-selected ALT button must be pressed again to engage the mode.

Mouseclick areas in the Altitude Selector Unit



The OFF flags in the Altitude Selector Unit

The altitude selector unit of the BAe 146 AFGS system contents a red bar as an off flag which is visible when the electrical busses AC 1 or AC 2 (both busses are necessary for the AFGS system) is not available. In this case the mechanical readout shows five zeros.

3.17.2 AFGS Control Functions of the Yoke

The BAe 146 yoke is placed in a separate sub window. Please see chapter “General Panel Layout” for more information.

268	Autopilot disconnect button
269	SYNC mode button (mouseclick area)

The BAe 146 Yoke has two separate functions for the AFGS system on the left side of it. The yellow area contents a smaller red button (pos. 268) which disconnects the autopilot. It could not be used to engage the autopilot. A disconnected autopilot must be engaged again with the AP main switch (pos. 242) when needed.

The SYNC button (pos. 269) switches on off the autopilot SYNC mode. In the real aircraft the button is in front of the yoke. Because of this, the yoke in the BAe 146 panel just contents an invisible mouseclick area for it.

An engaged SYNC mode is shown with the white text “SYNC” in the AFGS annunciator unit (see chapter “The AFGS Annunciators”)

Additional Notes

In the real aircraft the SYNC mode is only active while the SYNC button is pressed. This was not possible with this BAe 146 panel. With this panel the SYNC mode is not a button but a switch. The SYNC mode has to be pressed to activate it and has to be pressed again to disengage it.

3.17.3 The Basic AFGS Modes

PITCH

The pitch mode of the AFGS system is a basic mode which didn't require the flight director. Pitch is active when the autopilot is engaged but no vertical mode is selected on the mode selector unit. When engaging the autopilot, the system stores the actual pitch and holds this pitch until another vertical mode is selected. An engaged pitch mode is shown in the AFGS annunciator with the green illuminating text "PITCH".

The stored pitch could be changed by pressing the SYNC button on the yoke. When the SYNC button is pressed, the aircraft has no vertical control of the autopilot and the pilot could change the pitch manually. Pressing the SYNC button again, the AFGS stores the new pitch and holds it. While SYNC is active, the AFGS annunciator shows the white illuminating text "SYNC" together with the green illuminating text "PITCH". The SYNC annunciator goes off as soon as SYNC is pressed again.

The pitch rate switch (pos. 243) of the autopilot control unit is another way to change the current pitch rate. With this switch the pitch could be increased or decreased without disengaging the actual mode and without loosing the vertical controlling of the aircraft by the autopilot. Pressing the pitch rate switch while another vertical mode is active, disengages this mode and engages the pitch mode. Each click on the upper pitch down or lower pitch up position decreases or increases the pitch.

When pre-select ALT is engaged (button pos. 265), the pitch mode disengages and ALT will be engaged automatically when the selected altitude is attained. A negative pitch changes not automatically to a positive pitch when the pre-selected altitude is higher than the current altitude. When the selected altitude is higher than the current altitude, pitch must be brought to positive climb manually (using SYNC or the pitch rate switch). The same with positive pitch and a lower selected altitude.

As long as the autopilot is on, pitch could only be disengaged by selecting another vertical mode. There is no way to disengage pitch when no other vertical mode is engaged and the autopilot main switch is on.

ROLL

The roll mode of the AFGS system is a basic mode which didn't require the flight director. Roll is active when the autopilot is engaged but no lateral mode is selected on the mode selector unit. When engaging the autopilot, the system stores the actual heading and holds this heading until another lateral mode is selected. An engaged roll mode is shown in the AFGS annunciator with the green illuminating text "ROLL".

The stored heading could be changed by pressing the SYNC button on the yoke (pos. 269). When the SYNC button is pressed, the aircraft has no lateral control of the autopilot and the pilot could change the heading manually. Pressing the SYNC button again, the AFGS stores the new heading and holds it. While SYNC is active, the AFGS annunciator shows the white illuminating text "SYNC" together with the green illuminating text "ROLL". The SYNC annunciator goes off as soon as SYNC is pressed again.

With the turn control knob (pos. 244) of the autopilot control unit the current roll rate could be changed (roll left or roll right). The more the knob is turned to the left or right the more the roll rate increase. Turning the roll rate knob while another lateral mode is active, disengages this mode and engages the roll mode. When another lateral mode in the control unit is selected while the roll mode is active, the knob turns back to center and the roll mode will be disengaged.

As long as the autopilot is on, roll could only be disengaged by selecting another lateral mode. There is no way to disengage roll when no other lateral mode is engaged and the autopilot main switch is on.

TURB

Pressing the TURB button on the mode selector unit engages the TURB mode and disengages all other AFGS modes. An engaged TURB mode is shown with the illuminating white triangle on the TURB button and the green illuminating text TURB in the AFGS annunciator. The TURB mode is an autopilot mode only. When the flight director is on the FD bars are not visible in the ADI.

In TURB mode the main autopilot channel gearings are reduced to give a soft ride to allow smoother movements to regain altitude during turbulence.

HDG could be used together with the TURB mode (because of the pitch and roll controlling of the autopilot in TURB mode, HDG is the only further mode which could be selected together with TURB). After TURB has been engaged HDG may be subsequently engaged to give TURB plus HDG.

TURB can be disengaged by re-pressing the TURB button or by disengaging the autopilot. On disengagement of TURB, the AP and FD (if switched on) will revert to pitch and roll or to pitch and HDG if selected.

3.17.4 The Vertical AFGS Modes

The BAe 146 contents the vertical modes ALT, VS, GSL, IAS and Mach. Pre-selecting an altitude is possible together with the VS, IAS and Mach mode of the AFGS. For each mode applies that the autopilot must be available and the AP main switch in the autopilot control unit must be on. When the autopilot main switch is off but the flight director is on, the flight director shows each command but it has to be manually performed.

Altitude Mode (ALT)

Pressing the ALT button on the mode selector unit disengages all vertical modes and engages the ALT mode. A white triangle on the ALT button illuminates and the AFGS annunciator shows the green text "ALT". The aircraft holds the altitude which was shown in the altimeter at the moment of mode engage. ALT could not be engaged when in TURB mode.

When climbing or descending to a pre-selected altitude, ALT hold will be engaged automatically when the selected altitude is attained. ALT hold could be used together with GSL hold. When the glideslope is captured, ALT will be disengaged automatically. Disengaging the ALT hold function causes the pitch mode to come active when no other vertical mode is used. The ALT mode requires the flight director. When the flight director is switched off, altitude hold does not work.

The ALT mode is disengaged by re-pressing the ALT button, selecting IAS, Mach, VS or TURB or disengaging the autopilot. ALT is automatically superseded at ILS glideslope capture.

Vertical Speed Mode (VS)

Pressing the VS button on the mode selector unit disengages all vertical modes and engages the VS (vertical speed) mode. A white triangle on the VS button illuminates and the AFGS annunciator shows the green text "VS". The aircraft holds the vertical speed rate which was shown in the VSI at the moment of mode engage. VS is a climb and descent mode which could be used after take off for example. VS could not be engaged when in TURB mode

The vertical speed rate (climb or descent rate) could be changed by pressing the SYNC button on the yoke. When the SYNC button (pos. 269) is pressed, the aircraft has no vertical control from the autopilot and the pilot could change the climb or descent rate manually. Pressing the SYNC button again, the AFGS stores the new vertical speed rate and holds it. While SYNC is active, the AFGS annunciator shows the white illuminating text "SYNC" together with the green illuminating text "VS". The SYNC annunciator goes off as soon as SYNC is pressed again.

When pre-select ALT is engaged, the VS mode disengages and ALT will be engaged automatically when the selected altitude is attained. A negative vertical speed rate will not automatically change to climb when the pre-selected altitude is higher than the current altitude. When the selected altitude is higher than the current altitude, the vertical speed rate must be brought to positive climb manually (using SYNC). The same with positive vertical speed rate and a lower selected altitude.

Disengaging the VS hold function causes the pitch mode to come active when no other vertical mode is used. The VS mode requires the flight director. When the flight director is switched off, VS does not work.

The VS mode is disengaged by re-pressing the VS button, selecting IAS, Mach, ALT or TURB or disengaging the autopilot. ALT is automatically superseded at ILS glideslope capture or ALT arm flare.

Glideslope coupling mode (GSL)

The GSL mode is the only vertical mode which could be selected while another mode, except TURB, is active without disengaging the other mode as long as the glide slope is not captured. When GSL is active, the white triangle on the GSL button illuminates and the AFGS annunciator shows the white text “GSL” when glideslope is armed or the green text “GSL” when glideslope is captured. When the navigation radio did not receive a glideslope signal, the mode will not be activated and the white triangle on the button stays off. When the mode was once armed and the aircraft moves out of the glideslope range, the mode will be disengaged (triangle goes off). When GSL was already armed but the aircraft could not hold the glideslope, the AFGS activates the pitch mode automatically and GSL changes to armed as long as the signal is received. GSL could not be engaged when in TURB mode

When another vertical mode is used together with the GSL mode, the other vertical mode disengages automatically when the glideslope is captured. The aircraft starts descending then with the glide slope of the received ILS signal.

IMPORTANT

For a standard ILS approach (glideslope and localizer), the GSL and the VOR/LOC (button V / L pos. 254) buttons must both be pressed in the mode selector unit.

Disengaging the GSL mode causes the pitch mode to come active when no other vertical mode is used. The GSL mode requires the flight director. When the flight director is switched off, GSL does not work.

The Airspeed Mode (IAS)

Pressing the IAS button on the mode selector unit disengages all vertical modes and engages the airspeed mode when TURB is not selected. At the same time the indicated airspeed of the airspeed indicator will be stored from the AFGS system. A white triangle on the IAS button illuminates and the AFGS annunciator shows the green text "IAS". The autopilot varies pitch now in both cases to maintain the stored airspeed. This is not the airspeed which is selected with the speed bug of the airspeed indicator. Pre-selecting a speed for the airspeed mode of the AFGS system is not possible.

When the indicated speed is higher than the stored airspeed the pitch will increase. A lower indicated airspeed reduces the pitch. The system uses positive and negative pitch for maintaining the stored airspeed. The larger the difference between the indicated airspeed and the stored airspeed, the more positive or negative pitch is necessary. Increasing thrust after selecting the IAS mode, effects in increasing pitch. On this way it's possible to adjust the pitch rate for climb or descent with the thrust.

The stored airspeed of the airspeed mode could be changed by pressing the SYNC button on the yoke. When the SYNC button is pressed, the aircraft has no vertical control of the autopilot and the pilot could change the airspeed with changing the pitch manually. Pressing the SYNC button again, the AFGS stores the new airspeed and varies pitch in both cases again to maintain the stored airspeed. While SYNC is active, the AFGS annunciator shows the white illuminating text "SYNC" together with the green illuminating text "IAS". The SYNC annunciator goes off as soon as SYNC is pressed again.

When pre-select ALT is engaged, the IAS mode disengages and ALT will be engaged automatically when the selected altitude is attained. A negative pitch will not automatically change to a positive pitch when the pre-selected altitude is higher than the current altitude. When the selected altitude is higher than the current altitude, the pitch must be brought to a positive value manually by increasing thrust. The same with positive pitch and a lower selected altitude.

The IAS mode could not be used together with ALT, VS, TURB or Mach. A combination with GSL is possible as long as the glide slope is not captured. When the glideslope is captured, IAS will automatically disengage.

The airspeed mode is disengaged by re-pressing the IAS button, selecting VS, Mach, ALT or TURB or disengaging the autopilot. IAS is automatically superseded at ILS glideslope capture or ALT arm flare.

Disengaging the IAS hold function causes the pitch mode to come active when no other vertical mode is used. The airspeed mode requires the flight director. When the flight director is switched off, IAS does not work.

The Mach Mode

Pressing the Mach button on the mode selector unit disengages all vertical modes and engages the Mach mode when TURB is not selected. At the same time the datum mach number will be stored from the AFGS system. A white triangle on the MACH button illuminates and the AFGS annunciator shows the green text "MACH". The autopilot varies pitch now in both cases to maintain the stored mach datum. Pre-selecting a mach number for the Mach mode of the AFGS system is not possible.

When the actual mach number is higher than the stored datum mach number the pitch will increase. A lower mach number reduces the pitch to negative values. The system uses positive and negative pitch for maintaining the stored mach datum. The larger the difference between the actual mach number and the datum mach number, the more positive or negative pitch is necessary. Increasing thrust after selecting the Mach mode, effects in increasing pitch. On this way it's possible to adjust the pitch rate for climb or descent with the thrust.

The stored datum mach number of the Mach mode could be changed by pressing the SYNC button on the yoke. When the SYNC button is pressed, the aircraft has no vertical control of the autopilot and the pilot could change the airspeed with changing the pitch manually. Pressing the SYNC button again, the AFGS stores the new mach number and varies pitch in both cases again to maintain the datum mach number. While SYNC is active, the AFGS annunciator shows the white illuminating text "SYNC" together with the green illuminating text "MACH". The SYNC annunciator goes off as soon as SYNC is pressed again.

When pre-select ALT is engaged, the Mach mode disengages and ALT will be engaged automatically when the selected altitude is attained. A negative pitch will not automatically change to a positive pitch when the pre-selected altitude is higher than the current altitude. When the selected altitude is higher than the current altitude, the pitch must be brought to a positive value manually by increasing thrust. The same with positive pitch and a lower selected altitude.

The Mach mode could not be used together with ALT, VS, TURB or IAS. A combination with GSL is possible as long as the glideslope is not captured. When the glideslope is captured, Mach will automatically disengage.

The Mach mode is disengaged by re-pressing the Mach button, selecting VS, IAS, ALT or TURB or disengaging the autopilot. Mach mode is automatically superseded at ILS glideslope capture or ALT arm flare.

Disengaging the Mach hold function causes the pitch mode to come active when no other vertical mode is used.

3.17.5 The Lateral AFGS Modes

The BAe 146 contents the lateral modes VOR / LOC, back localizer coupling, heading and lateral navigation. For each mode applies that the autopilot must be available and the AP main switch in the autopilot control unit must be on. When the autopilot main switch is off but the flight director is on, the flight director shows each command but it has to be manually performed.

VOR / LOC Mode

The V / L button is used for VOR navigation (V - VOR) and localizer holding (L - LOC). The mode could be used together with another lateral mode as long as the CDI or localizer is just armed and not captured. In this case the other lateral mode will automatically be disengaged as soon as the CDI or LOC is captured. The aircraft turns to the adjusted course to follow the CDI or localizer. When the CDI or localizer is already in the tolerance area where its been captured, all other lateral modes will be switched off and VOR or LOC will engage when the V / L button is pressed. When the button is pressed without receiving a VOR or localizer signal, the white triangle on the button does not illuminate and the mode will not be engaged. It's also not possible to engage the VOR / LOC mode as long as TURB is used.

The VOR/LOC mode activates either the white "VOR" or "LOC" text on the AFGS annunciator when the CDI or localizer is armed or activates the green "VOR" or "LOC" text when the CDI or localizer is captured.

The centre rotary switch on the navigation selector unit (pos. 263) will determine which navigation receiver supplies the AFGS and the frequency selected will decide between VOR and ILS coupling.

IMPORTANT

For a standard ILS approach (glideslope and localizer), the GSL (pos. 248) and the VOR / LOC (button V / L pos. 254) buttons must both be pressed in the mode selector unit.

Disengaging the VOR / LOC mode causes the roll mode to come active when no other lateral mode is used.

The Back Localizer Coupling Mode (BLOC)

The BLOC button activates the back localizer coupling (backcourse) mode of the AFGS system. The mode could be used together with HDG as long as the localizer is just armed and not captured. When HDG is enabled together with BLOC, HDG will disengage automatically when the localizer is captured. The aircraft turns to the adjusted backcourse to follow it. When the backcourse is already in the tolerance area where its been captured, all other lateral modes will be switched off and BLOC will engage when the BLOC button is pressed. When the button is pressed without receiving a localizer signal, the white triangle on the button does not illuminate and the mode will not be engaged. It's also not possible to engage the back localizer coupling mode as long as TURB is used.

An armed BLOC mode is shown in the AFGS annunciator with the white illuminating text "BLOC". An enabled BLOC with an captured localizer is shown with the green text "BLOC".

BLOC could not be used together with VOR / LOC or GSL. Disengaging the BLOC mode causes the ROLL mode to come active when no other lateral mode is used.

The Heading Mode (HDG)

Pressing the HDG button on the mode selector unit disengages all lateral modes and engages the HDG mode. A white triangle on the HDG button illuminates and the AFGS annunciator shows the green text "HDG". The aircraft turns now to the selected heading of the HSI and holds this heading until it will be changed from the pilot or another lateral mode is selected.

HDG could be used together with VOR / LOC and BLOC as long as the CDI or localizer of those modes is just armed and not captured.

HDG could also be used together with the TURB mode (because of the pitch and roll controlling of the autopilot in TURB mode, HDG is the only further mode which could be selected together with TURB). After TURB has been engaged HDG may be subsequently engaged to give TURB plus HDG.

Disengaging the HDG mode causes the roll mode to come active when no other lateral mode is used. The HDG mode requires the flight director. When the flight director is switched off, HDG does not work.

The Lateral Navigation Mode (LNAV)

Pressing the LNAV button on the mode selector unit disengages all lateral modes and engages the lateral navigation mode LNAV. A white triangle on the LNAV button illuminates and the AFGS annunciator shows the green text "LNAV". It's not possible to engage the lateral navigation mode when TURB is used.

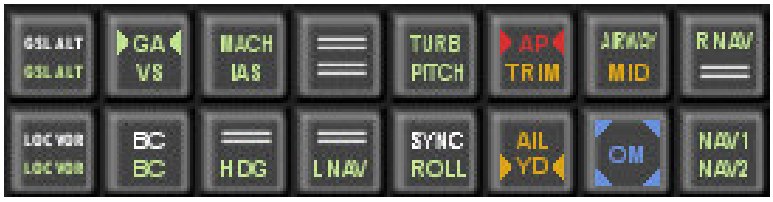
The LNAV mode of the AFGS system is used to combine the BAe 146 autopilot with an external navigation tool (like FSNav), separate GPS gauge or INS gauge. When the LNAV mode is selected, the AFGS opens the standard heading control (HDG) for external use. Separate gauge which uses other functions than the heading could not be coupled with the LNAV function. Using the LNAV did not overwrite the selected HDG.

LNAV could be used together with VOR / LOC and BLOC as long as the CDI or localizer of those modes is just armed and not captured.

Disengaging the LNAV mode causes the ROLL mode to come active when no other lateral mode is used. The LNAV mode requires the flight director. When the flight director is switched off, LNAV does not work

3.17.6 The AFGS Annunciators

AFGS annunciator left beside the ADI



AFGS annunciator right beside the ADI

The left AFGS annunciator lights have the following functions:

SPLY	The green SPLY annunciator illuminate when the Lift Spoilers are out. Please see chapter “Airbrake and Spoilers” for more information. This light is not coupled with the AFGS system!
SPLG	The green SPLG annunciator illuminate when the Lift Spoilers are out. Please see chapter “Airbrake and Spoilers” for more information. This light is not coupled with the AFGS system!
AIRB	The white AIRB annunciator light illuminate when the Airbrake is out. This light is not coupled with the AFGS system!
DH	The amber DH light illuminates when the radio altitude is smaller than the selected decision height. This light is not coupled with the AFGS system!
CAT2	Please see chapter “Category 2 Approach Monitoring System” for any information about the green CAT2 annunciator light.
CAT2	Please see chapter “Category 2 Approach Monitoring System” for any information about the amber CAT2 annunciator light.
GSL	The amber GSL light flashes when the AMS is armed bur the glideslope beam deviation is excessive. Please see chapter “Category 2 Approach Monitoring System” for more information about the AMS and AMS warning lights.

LOC	The amber LOC light flashes when the AMS is armed bur the localizer beam deviation is excessive. Please see chapter “Category 2 Approach Monitoring System” for more information about the AMS and AMS warning lights.

The right AFGS annunciator lights have the following functions:

GSL	The white GSL annunciator light illuminates when the GSL button is pressed, the corresponding navigation signal receives a glideslope and the GSL mode of the autopilot is armed (glideslope not captured yet). The green GSL annunciator light illuminates when the GSL button is pressed and the corresponding navigation signal receives a glideslope which is captured.
ALT	The white ALT lamp illuminates when a preselected altitude is armed (see chapter “The Vertical AFGS Modes”) but not captured. As soon as the preselected altitude is attained the white lamp goes off and the green ALT lamp comes on. The green ALT lamp illuminates always when the ALT button is pressed.
LOC	The white LOC lamp illuminates when the V / L button is pressed and the corresponding Nav receives a localizer signal which is armed. The LOC light changes to green as soon as the localizer is captured.
VOR	The white VOR lamp illuminates when the V / L button is pressed and the corresponding Nav receives a CDI signal which is armed. The VOR light changes to green as soon as the CDI is captured.
GA	The green GA annunciator light illuminates when GA is selected on the TMS.
VS	The green VS light illuminates when vertical speed hold is selected.
BC	The white BC lamp illuminates when the BLOC (backcourse) button is pressed and the corresponding Nav receives a signal which CDI or localizer is armed. The BC light changes to green when its CDI or localizer is captured.
Mach	The green Mach light came up when Mach hold is activated.
IAS	The green IAS light came up when IAS hold is activated.
HDG	The green HDG light came up when HDG hold is activated.
LNAV	The green LNAV annunciator light illuminates when LNAV (lateral navigation mode) is selected.

TURB	The green TURB light came up when the TURB mode (wing leveller) is selected
PITCH	The green PITCH annunciator light illuminates when the basic pitch mode is engaged from the AFGS system.
SYNC	The white SYNC annunciator light illuminates when SYNC is pressed on the yoke. The aircraft has currently no automatic vertical or lateral control.
ROLL	The green ROLL annunciator light illuminates when the basic roll mode is engaged from the AFGS system.
AP	The red AP light illuminates under two conditions. The light illuminates for ¾ second when the AP is disengaged. The light is on continuously when the AP main mode is on but the autopilot is not available. To cancel the light you have to press the AP main button again.
YD	The amber YD light illuminates when the yaw damper is switched off.
AIRWAY	Inner marker light
MID	Middle marker light
OM	Outer marker light.
NAV1	The green NAV1 light illuminates when the AP is armed for NAV1 with the split selector pos. 263.
NAV2	The green NAV2 light illuminates when the AP is armed for NAV2 with the split selector pos. 263.

All not mentioned annunciator lights have no function yet.

Additional Notes

Except the red AP light all AFGS annunciators requires electrical power from the DC 1 bus. The red AP light gets electrical power from the emergency DC bus (MDC).

The left and right AFGS annunciators could be enlarged by clicking on it with the mouse.

3.17.7 Category 2 Approach Monitoring System (AMS)

The CAT 2 approach monitoring system (AMS) operates in conjunction with the autopilot to provide for a monitored approach down to a decision height of 100 feet.

To arm the AMS and illuminate the CAT 2 annunciator switch green requires the following inputs to be valid:

- Glideslope and localizer valid
- Localizer tuned
- Landing gear down
- Less than 600 feet radio height
- Nav selector (pos. 263) in SPLIT position
- Autopilot engaged
- Autopilot BLOC not selected

If the inputs are incorrect at 600 feet radio alt, the AMS will not arm and no annunciation on the AFGS annunciator unit will be given. If any input fails after the AMS is armed and the CAT 2 annunciator lights green, the annunciator will change to amber (lower CAT 2 annunciator light).

The amber LOC and amber GSL annunciator lights below the CAT 2 annunciator lights flash when the respective ILS beam deviation is excessive. With all conditions for a CAT 2 approach satisfied the system will be armed automatically at 600 feet radio alt and the CAT 2 annunciator switch on the AFGS annunciator will illuminate green. Pressing the CAT 2 annunciator switch will inhibit the AMS and the amber CAT 2 annunciator light illuminate.

3.17.8 Altitude Alerting

An altitude alerting system provides a visual warning of the approach to a pre-selected altitude and once this altitude has been attained the system provides an audio and visual warning should a 300 feet deviation occur. Visual warning is presented by an amber lamp fitted on the top left hand bezel of the servo altimeter (pos. 195).

Audio warning is given by a dedicated altitude alerting “beep” sound which sounds on departure from the selected altitude as the 300 feet point is crossed.

When the aircraft approaches to within 900 feet of the selected altitude a steady visual warning will come on (lamp pos. 195) and remain on until 300 feet and then be extinguished. If after passing 900 feet before the selected altitude and before reaching 300 feet the aircraft deviates by more than 900 feet from the selected altitude the lamp pos. 195 starts flashing. This warning will continue to flash until height is reduced to less than 900 feet or a new altitude is selected on the Alt selector (pos. 266).

Whilst the aircraft remains within +/- 300 feet of the selected altitude, the altitude alerting system will be quiescent. Should the aircraft deviate more than +/- 300 feet a flashing visual warning and the altitude alerter audio warning will be given as the 300 feet point is crossed. The flashing visual warning remains on until the error is reduced below 300 feet or a new altitude is selected on the Alt selector (pos. 266).

3.17.9 Automatic Safety Functions of the AFGS System

The AFGS system disconnects the autopilot automatically when:

- Stall is identified
- Bank angle greater +/- 19° below 350 feet radio altitude
- Bank angle greater +/- 42° above 350 feet radio altitude

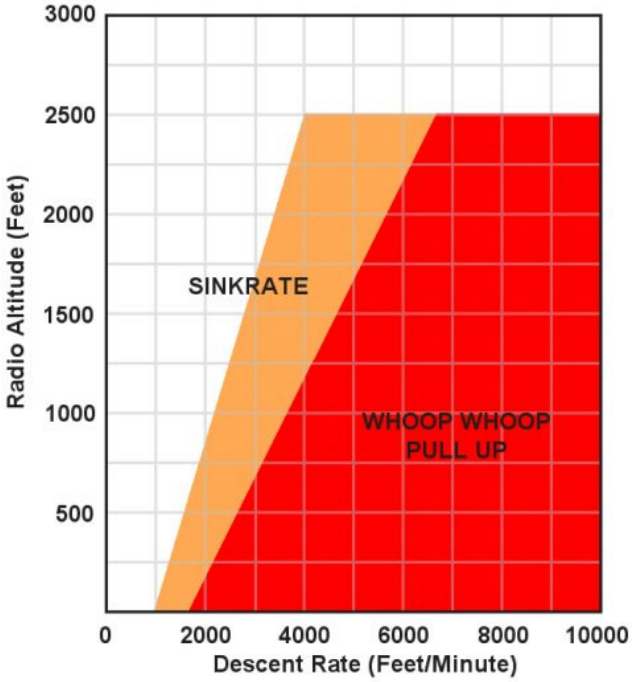
To re-engage the autopilot, the aircraft must first be brought to a safety flight condition and then the autopilot could be switched on again with the with the main switch (pos. 242) in the autopilot control unit.

3.18 The AlliedSignal MK VII EGPWS

The enhanced ground proximity warning system (EGPWS) of the BAe 146 generates visual and acoustic warnings when the aircraft approaches the ground in a dangerous manner. It also generates acoustic altitude information in order to inform the pilots that they are approaching the ground.

The ground proximity warning computer (GPWC) monitors and processes specific signals from the aircraft and triggers warning if one of the seven included warning modes is violated. For each mode acoustic warnings (synthetic voice) are defined. In the event that a multiple acoustic warnings trigger at the same time, they have different degrees of urgency. Some of the acoustic warnings ("Pull up" warnings) also triggers a visual warning in the GPWS annunciator pos. 270. The warning envelopes are described in detail in the following chapters of this manual.

3.18.1 GPWS Mode 1 Excessive Descent Rate

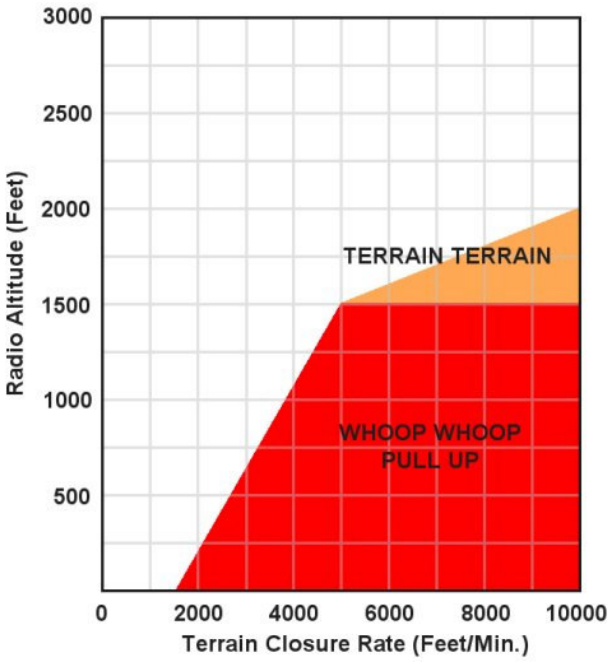


Mode 1 provides alerts for excessive descent rates with respect to altitude above ground level (AGL) and is active for all phases of flight. The outer boundary of this mode activates the acoustic “Sinkrate” alert without triggering a visual warning of the lamp pos. 242. The conditions for the acoustic “Sinkrate” warning could be seen in the picture above (amber area). The sinkrate warning is active and repeats continuously until the outer boundary is exited.

The inner boundary of mode 1 activates an acoustic “whoop whoop” which is followed by a synthetic voice callout “Pull Up”. It triggers also the red warning lamp pos. 270 in the glareshield panel. The acoustic warning repeats continuously and the visual warning illuminates until the inner boundary is exited.

3.18.2 GPWS Mode 2 Excessive Closure Rate

Mode 2 provides alerts to help protect the aircraft from impacting the ground when rapidly rising terrain with respect to the aircraft is detected. This mode based on radio altitude and how fast radio altitude is decreasing (closure rate).



Mode 2 is active during climb out, cruise and initial approach (flaps not in landing configuration and aircraft not in glideslope centreline).

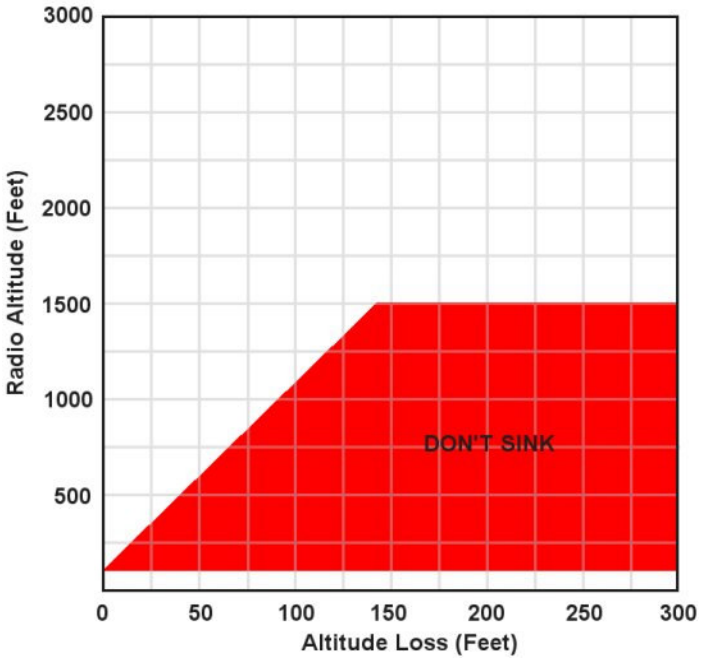
If the aircraft penetrates the caution envelope (amber area in the above picture), the aural message “Terrain Terrain” is generated without a visual warning in the GPWS lamp pos. 270. If the aircraft continuous to penetrate the envelope, the EGPWS warning light pos. 270 illuminates and the acoustic warning “whoop whoop”, followed by the synthetic voice message “Pull Up”, repeats continuously until the warning envelop is exited.

Additional Notes to mode 2

The real AlliedSignal MK VII EGPWS has two sub modes 2A and 2B. In the BAe 146 panel just mode 2A is realized. The description of mode 2 above based on the description of the real mode 2A.

3.18.3 GPWS Mode 3 Altitude Loss after Take Off

Mode 3 provides alerts for significant altitude loss after take off. With gear and flaps not in landing configuration. The amount of altitude loss that is permitted before an alert is given is a function of the height of the BAe 146 above terrain as shown in the picture below.



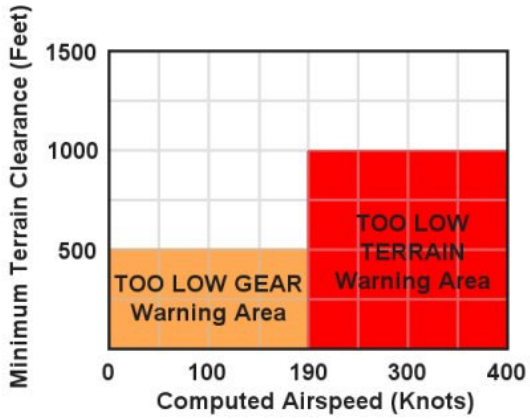
This protection is available until the EGPWS determines that the BAe 146 has gained sufficient altitude that is no longer in the take off phase of flight.

Significant altitude loss after take off activates the EGPWS aural message “Don’t sink, don’t sink” without triggering a visual warning in the EGPWS lamp pos. 270. Upon establishing a positive rate of climb, the aural message of the EGPWS will cease.

3.18.4 GPWS Mode 4 Unsafe Terrain Clearance

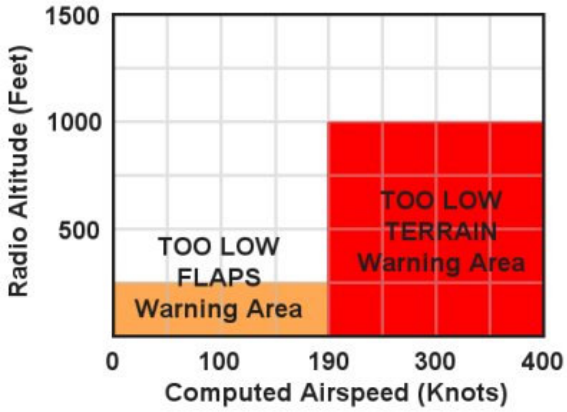
Mode 4 provides alerts for insufficient terrain clearance with respect to phase of flight, configuration and speed. Mode 4 exists in three forms, 4A, 4B and 4c (not realized with this panel).

Mode 4A is active during cruise and approach with gear and flaps up. This provides alerting during cruise for inadvertent flight into terrain where terrain is not rising significantly, or the aircraft is not descending excessively. It also provides alerting for protection against unintentional gear-up landing.



Below 1000 ft. AGL and above 190 knots airspeed, the mode 4A aural alert is “Too Low Terrain” (red area in the above picture). There is no visual warning in the EGPWS warning lamp pos. 270. Below 500 feet AGL and less than 190 knots the aural alert “Too Low Gear” cam up to inform the pilot that the gear is not down. Both aural messages repeated continuously until the aircraft starts climbing or until the gear is down. Between 1000 feet AGL and 245 feet AGL the “Too Low Terrain” warning stays active also with gear down when the flaps are not in landing configuration (see mode 4B).

Mode 4B is active during cruise and approach with gear don and flaps not in landing configuration.



Below 1000 feet and above 190 knots airspeed the mode 4B aural alert is “Too Low Terrain” (red area in the above picture). There is no visual warning in the EGPWS warning lamp pos. 270. Below 245 feet AGL and less than 190 knots airspeed, the mode 4B aural alert is “Too Low Flaps” al without visual warning in the EGPWS warning lamp. There’s no way to disengage the flap warning, as the BAe 146 panel did not content an flap override switch at the moment. Both aural messages repeated continuously until the aircraft starts climbing or until the flaps are in the landing configuration. Between 1000 feet AGL and 500 feet AGL the “Too Low Terrain” warning stays active also with flaps in the landing configuration but gear is up (see mode 4A).

Additional Notes to mode 4

Mode 4C, which is also part of the real BAe 146, is not realized at the moment.

In mode 4A the red area increases the value from 190 knots to 250 knots and in mode 4B from 159 knots to 250 knots. Because of several reasons this is not realized in this panel. The values 190 knots are fix for both modes.

3.18.5 Mode 5 Excessive Deviation below Glideslope

Mode 5 provides an aural alert “Glideslope,” if the aircraft is below 1000 feet AGL, above 150 feet AGL and 1.3 dots or greater below the glideslope beam (no soft alert is realized with this panel). Below glideslope alerts are enabled only if the localizer is within 2 dots, landing gear and flaps are selected and a front course approach is determined.

EGPWS mode 5 alerts are inhibit during backcourse approaches to prevent nuisance alerts due to false fly up lobes from the glideslope.

3.18.6 GPWS Mode 6 Advisory Callouts

3.18.6.1 Altitude Callouts

Mode 6 of the EGPWS contents altitude callouts which consist of predefined Radio Altitude based voice callouts. There is no visual alerting provided with these callouts. The BAe 146 is equipped with the following acoustic altitude messages:

Callout	Occurs at (feet AGL)
Twenty Five Hundred	2500
One Thousand	1000
Five Hundred	500
Four Hundred	400
Three Hundred	300
Two Hundred	200
Approaching Minimums	DH + 80
Minimums	DH
One Hundred	100
Eighty	80
Sixty	60
Fifty	50
Forty	40
Thirty	30
Twenty	20
Ten	10

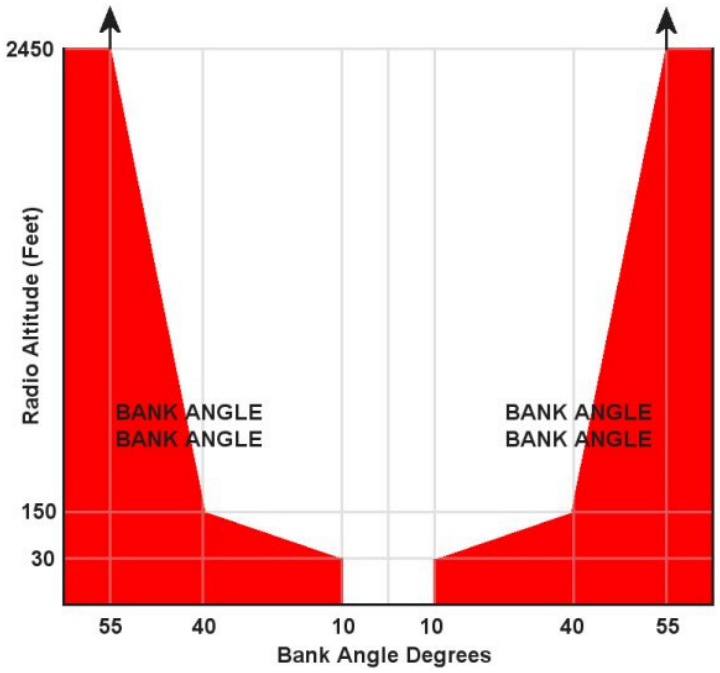
Decision Height based callouts (Approaching Minimums and Minimums) require the landing gear down to be down and occur when descending through the radio altitude corresponding to the selected decision height (pos. 206).

3.18.6.2 Bank Angle Callout

The callout “Bank Angle, Bank Angle”, which is also part of Mode 4, advises of an excessive roll angle. Bank angles in excess of:

- ± 10° between 5 and 60 feet,
- ± 10° to 40° between 30 and 150 feet,
- ± 40° to 55° between 150 and 2450 feet,

produce the bank angle advisory (red area in the picture below). Bank angle advisories are inhibited below 5 feet.



Additional Notes to the Bank Angle callouts

The real EGPWS contents different excessive bank angle envelops depending on passenger aircraft or transport aircraft. This panel contents only the bank angle envelopes for passenger aircraft.

3.18.7 GPWS Message Priority

To prevent that acoustic messages will not operate at the same time, the EGPWS system has a priority for each acoustic warning, which is shown in the table below. This has no validity for the optical warnings.

1	“Pull Up”
2	“Terrain, Terrain”
3	“Minimums”
4	“Too Low Terrain”
5	“Too Low Gear”
6	“Too Low Flaps”
7	“Sinkrate”
8	“Don’t Sink”
9	“Glideslope”
10	“Approaching Minimums”
11	“Bank Angle, Bank Angle”
12	Altitude Callouts

3.18.8 GPWS Short Level Self Test

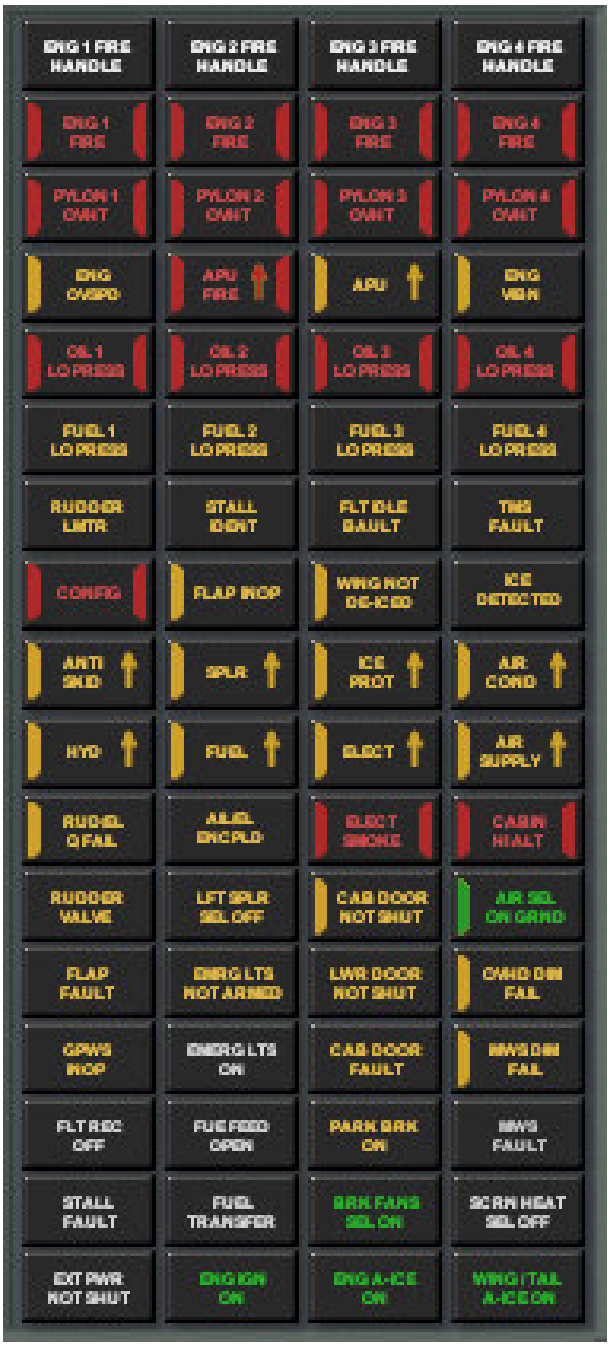
The short level self test is intended to provide a Go/No Go confidence test to indicate EGPWS functionality. A short level self test sequence is as follows:

- Warning light pos. 270 illuminates
- Voice “Glideslope” sounds
- Voice “Pull Up” sounds
- Voice “Glideslope” sounds
- Voice “Pull Up, Pull Up, Pull Up” sounds
- Warning light pos. 270 turns off

If the self test will not work as listed above, the EGPWS system is not working. In this case check if the essential AC bus (SAC) is powered. The complete EGPWS system needs electrical power from the SAC bus. If there is no power no EGPWS warning is active and the self test will not work.

3.19 The Master Warning System (MWS)

3.19.1 The MWS Main Unit



The master warning system (MWS) in association with glareshield-mounted red/amber flashing attention lights and a small number of audio warnings, indicates aircraft system faults or emergencies on the master annunciator panel. Annunciator captions are illuminated in red, amber, green or white according to the categories of alert. Any of the red or amber warnings will cause the appropriate glareshield warning lights to flash and the annunciator panel caption to illuminate until cancelled by pressing either glareshield light.

Some caution and warning lights contents also an acoustic warning. The caution and warning lights which have also a sound are market with an amber beam (ear) on the left side of the caution light and a red beam (ear) on the left and right side of the warning light.


Ears may be singled or doubled and signify degree of importance of warning. These annunciators are accompanied by an audio warning and operation of the flashing red or amber lights on the glareshield panel. One ear causes a single metallic “ding” sound and a double ear cause a triple metallic “din, ding, ding” sound each four seconds.

Red annunciator lights indicates a fault condition requiring immediate crew action. Amber annunciator lights with an ear indicates high category caution which immediate crew attention and amber annunciator lights without an ear indicates low category caution. White annunciator lights (in the lower MWS) support system functioning and green annunciator lights advisory.

Arrows of some MWS annunciator lights indicates a further annunciators illuminated on the overhead (up arrow) or on the main panel (right arrow) which should be observed for more information about the fault.


The attention lights in the glareshield panel left from the Nav1 radio flashes if the main MWS unit recognizes a faulty system, necessary switched off unit or any other warning or caution.

The red MWS attention light blinks when a red MWS warning light is on and the amber MWS attention light blinks when an amber MWS light is on.

3.19.2 Description of the MWS Annunciator Lights

Below are the descriptions of each MWS caution- warning- and reference lamps. It is written in such a way that the description of the lamps goes from above downward (LINE) and from left to the right.

Line 1

The first line contents the white annunciator lights for the fire handles of engine 1 (left) to 4 (right). The lights illuminate as soon as a fire handle is pulled.

Line 2

These four red warning lights serve for the announcement of an engine fire for each engine (engine 1 left to engine 4 right). They also illuminate when a fire test of the ground test unit is proceed. A fire warning of the MWS involves also an acoustic warning.

Line 3

In the real BAe 146 those red lamps shows a Pylon Overheat. In this BAe 146 panel the four red warning lamps shows an overheat (EGT temperature) of each engine (engine 1 left to engine 4 right). The lamps go on at a temperature of more than 880°C. It involves also an acoustic warning.

Line 4

The amber „ENG OVRSPD" lamp illuminates when engine 1 exceeds 100% N1. The red “APU FIRE” annunciator normally lights when the system detects an APU fire. This is not realized with this panel. However the lamp illuminates when a fire test of the ground test unit is proceed. The amber "APU" caution lamp marks an error of the APU system. The up-arrow indicate that more information about the APU fault could be found in a separate lamp of the overhead panel (please see there). The amber caution lamp „ENG VIBN“ lights up, if engine exceeds a vibration of 1,6. All lamps of line 4 involve also an acoustic warning.

Line 5

The red warning lights of line 4 are for the oil pressure of each engine (engine 1 left - engine 4 right). They illuminate when an engine has a low oil pressure or when the corresponding engine is not running. The oil pressure warning lamps involves also an acoustic warning.

Line 6

The four amber caution lamps of line 5 illuminate when the fuel pump of the corresponding engine (engine 1 left - engine 4 right) is not turned on. They are also on, if the fuel pressure of the respective engine drops too far so the engine is no longer supplied with fuel.

Line 7

The “RUDDER LMTR” and the “FLT IDLE BAULK” lamps of line 7 have no function yet. The “STALL IDENT” caution lamp illuminates when the system detects a stall or the stall test of the ground test unit is proceed. The amber “TMS FAULT” lamp illuminates when a fault is detected after a TMS self test or both DC busses for the TMS are not available.

Line 8

The red "CONFIG" warning lamp illuminates when a wrong configuration while takeoff (more than 60% N1) or landing is existent. The system scans the flap, trim and the gear position. The "FLAP INOP" lamp is not realized yet in this panel. The amber "WING NOT DE ICED" lamp goes on, if the flap position amounts to 18° or more, the inner wing deice is on but the outer wing deice is off. The "ICE DETECTED" lamp is not realized yet because it’s not possible at the moment to scan icing conditions with the flight simulator. The “CONFIG” and "WING NOT DE ICED" lamps of line 8 involve also an acoustic warning.

Line 9

The amber "ANTI SKID" caution lamp lights up, if anti skid is not available or not turned on. The light came also on when a ground test is proceed. The "SPLR" caution lamp has no function yet. The "ICE PROT" lamp illuminates, if the ice protection system in the overhead panel locates an error or is not available. Further information about the ice protection fault could be found in the corresponding annunciator lamp of the overhead panel. The amber "AIR COND" caution light illuminates, if e.g. the packs were activated but no air of the APU or the engines is available. It also illuminates if the packs were overheated. Further information about the fault of the air conditioning system could be found in the corresponding annunciator lamp of the overhead panel. All lamps of line 9 involves also an acoustic warning.

Line 10

The amber "HYD" caution lamp lights up when the hydraulic system has a fault or when the system is not available. It illuminates also, if the standby generator is active. Further information about the hydraulic fault could be found in the corresponding annunciator lamp of the overhead panel. The "FUEL" lamp marks an error in the fuel system of the BAe 146 or if the fuel pressure drops too far within the system. Further information could be found in the corresponding lamp of the overhead panel. The "ELECT" annunciator illuminates, if a necessary electrical bus is not available or the system determines an error in a bus. Further information could be found in the corresponding lamp of the overhead panel. The amber "AIR SUPPLY" lamp goes on, if no air is available for the appropriate system, or the system determines an error of the air distribution. Further information could be found in the corresponding lamp of the overhead panel. All caution lamps of line 10 involve also an acoustic warning.

Line 11

The “RUD/EL Q FAIL” lamp has no function yet. The amber “AIL/EL UNCPLD” light illuminates when the aileron or elevator is disconnected in the pedestal panel (switch pos. 152 and 153). The red “ELECT SMOKE” warning light illuminates normally when the system detects smoke. This is not realized with the panel. Nevertheless, like in the real aircraft. the lamp illuminates when the smoke test of the ground test unit is proceed. The red "CABIN HI ALT" warning lamp illuminates when the cabin altitude exceeds 9000 ft. Both red warning lamps involves also an acoustic warning.

Line 12

The “RUDDER VALVE” lamp has no function yet. The amber “LIFT SPLR SEL OFF” light illuminates when the lift spoilers are switched off and so not available (switch pos. 142 and 143). The lamp "CAB DOOR NOT SHUT" illuminates when the doors of the aircraft are opened. The green advisory lamp „AIR SEL ON GROUND“ is on when engine air is used on ground.

Line 13

The “FLAP FAULT” and “OVHD DIM FAIL” lamps of line 13 have no function yet. The amber lamp "EMERG LTS NOT ARMED" illuminate when the cockpit emergency Lights are not armed (switch pos. 124). The lamp "LWR DOOR NOT SHUT" illuminates when the doors of the aircraft are opened.

Line 14

In line 14 is just the white annunciator “EMERG LTS ON” realized. It illuminates when the cockpit emergency light is switched on (pos. 124) or when the system activates the emergency lights automatically when the switch is set to “ARM”.

Line 15

The white “FLT REC OFF” and “MWS FAULT” lamps of line 15 have no function yet. The white annunciator lamp „FUEL FEED OPEN“ illuminates, if one of the fuel feed valves (common or X-feed) is opened. The amber "PARK BRK ON" lamp illuminates as soon as the parking brakes are set.

Line 16

The first white “STALL FAULT” lamp of line 16 has no function yet. The white „FUEL TRANSFER“ annunciator is on, if the center fuel transfer switch in the overhead panel (pos. 41) is set to “Auto” or “On” and the fuel transfer of the center tank is active. The green advisory lamp “BRK FANS SEL ON” illuminate when the brake fans are switched on (pos. 135). The white annunciator Lampe „SCRN HEAT SEL OFF“ illuminates, if one of the screen heats is switched off.

Line 17

The white annunciator „EXT PWR NOT SHUT” illuminates, if the GPU is connected to the aircraft. The green lamp “ENG IGN ON” illuminates, if the ignitions are active or continuous ignition is on. The green advisory lamp „ENG A ICE ON“ illuminates, if engine anti-ice of any engine is switched on. The lamp „WING / TAIL A ICE ON“ illuminates, if wing and tail anti-ice is switched on.

Additional Notes of the MWS system

The MWS could be enlarged by clicking on it with the mouse.

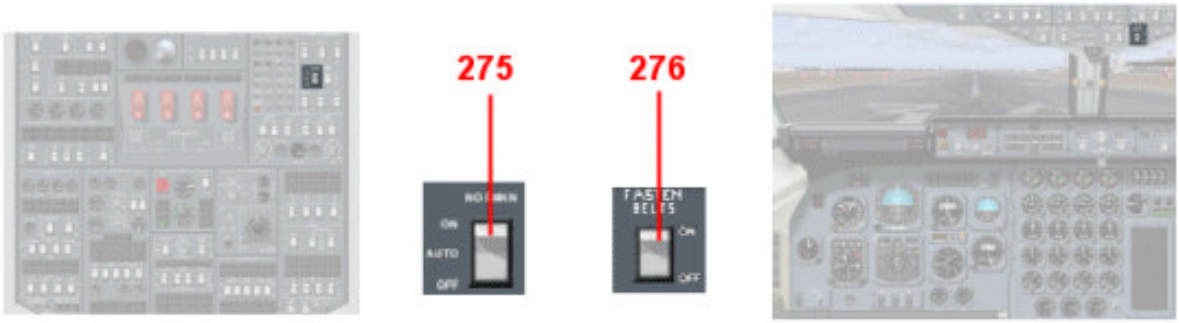
Each warning light of the MWS has a separate tool tip text for the mouse. As soon as you move the mouse pointer over the light you get an information of the light.

The MWS uses electrical power from the emergency DC bus (MDC). However the systems for which the warning lights are for have different electrical sources. That’s why you see some lights already after activating the MDC bus and some lights after the corresponding electrical bus of those systems are activated.

The MWS caution and warning attention lights in the glareshield panel could be disengaged when clicking on the lights. As soon as a new caution or warning light of the MWS came up the lights go on again.

The acoustic MWS caution and warning “ding” sounds could be disengaged when clicking on the MWS attention lights. As soon as a new caution or warning situation occurs, the MWS warning sound and light came up again.

3.20 Cabin Announcements



275	No Smoking Switch
276	Fasten Seat Belts Switch

The no smoking switch is placed in the overhead panel. It has three positions (Off, Auto and On). When electrical power is available, you will hear a ding sound when the switch is clicked.

The fasten seat belts switch is placed in the upper area of the main panel. When electrical power is available, you will hear a ding sound when the switch is clicked.

4 The BAe 146 Checklists

4.1 Overview Start-up Procedures (detailed)

1. Switch on the batteries (Pos. 4 and 5) (see page 15)
2. Set the DC selector (pos. 6) to position BATT1 (see page 15)
3. Check voltmeter (pos. 7) (see page 15)
4. Set the standby inverter to ARM (switch pos. 15) (see page 15)
5. Emergency AC Off light in the electric master annunciator pos. 11 goes off. (see page 15)
6. Parking brakes set
7. Switch on the APU generator (pos. 27) (see page 19)
8. If GPU is available connect external AC (pos. 31) (see page 21)
9. Switch on the external AC master switch (pos. 12) (see page 15)
10. Start APU (switch pos. 24) (see page 19)
11. Green APU available light (pos. 28) comes on at 100% rpm and all other APU warning lights goes off (pos. 29) (see page 19)
12. The START PWR ON light in the starter annunciator (pos. 66) off. (see page 33)
13. Airbrake (Spoilers) in
14. Master switches all on (Yaw Damper, Autopilot, Avionics A and B switches in the upper left side of the OH panel)
15. Anti Skid on (switch pos. 139) (see page 68)
16. External lights set (see page 53)
17. Bus ties both armed (switch pos. 13 and 14) (see page 15)
18. Standby generator armed (switch pos. 16) (see page 15)
19. Generator 1 and 4 off (switch pos. 21 and 22) (see page 15)
20. Gear indicator (pos. 131) checked (three greens) (see page 64)

21. APU air on (switch pos. 71) (see page 37)
22. Pack 2 on (switch pos. 79) (see page 39)
23. Cabin air recirc as required (switch pos. 77) (see page 39)
24. Set DC pump to BATT (switch pos. 59) (see page 29)
25. Switch on AC pump (pos. 60) and PTU (pos. 61) (see page 29)
26. Check yellow and green hydraulic pressurization (pos. 52 and 53) (see page 29)
27. Check Trim positions (pos. 147 - 149) (see page 71)
28. Start Master is off (Pos. 65) (see page 33)
29. Switch off AC pump and PTU (pos. 60 and 61) (see page 29)
30. continuous ignition off (pos. 68 and 69) (see page 33)
31. Engine anti-ice off (pos. 99 – 102) (see page 45)
32. Wing anti-ice off (pos. 104 and 105) (see page 45)
33. Engine air off (pos. 73 – 76) (see page 37)
34. Flight deck emergency lights armed (pos. 124) (see page 53)
35. Thrust levers HP fuel valves off (see page 26)
36. Flight instruments checked
37. Avionics checked
38. No Smoking signs on (pos. 275) (see page 139)
39. Check the parking brake pressure (indicator pos. 132) (see page 65)
40. Hydraulics all off except DC pump set to BATT (see page 29)
41. Fuel panel checked (see page 23)
42. Set pressurization (please see chapter 3.6.4 - 3.6.4.3) (see page48)
43. Switch on the fasten seat belts light and sign (pos. 276) (see page 139)

44. Flowmeters zeroed for all four engines (pos. 225) (see page 96)
45. Fuel contents checked (see page 96)
46. Throttle HP valves opened – Throttle in the “On” position (see page 26)
47. Electrical fuel pumps all on (pos. 48 – 51) (see page 23)
48. Engine Anti-ice on (pos. 99 – 102) (see page 45)
49. If external DC is used for starting connect external DC with pos. 32 (see page 21)
50. Start Power as required (switch pos. 63) (see page 33)
51. Start master on (pos. 65) (see page 33)
52. White START PWR ON light came up (pos. 66) (see page 33)
53. Select engine with selector pos. 64) (see page 33)
54. Engine starter to position start (pos. 70) (see page 33)
55. All four starter annunciator lights came up while starting (pos. 66) (see page 33)
56. When the starter switch goes back to the “RUN” position and the green ignition lights and the white “STARTER OPERATING” light goes off select the next engine for starting.
57. Set start power to Normal (pos. 63) (see page 33)
58. Set start selector and start master to off (pos. 64 and 65) (see page 33)
59. Engine anti-ice as required (pos. 99 – 102) (see page 45)
60. Generator 1 and 4 on (pos. 21 and 22) (see page 15)
61. Check generator Ammeters. Ammeter of Gen 1 and 4 should be indicated while APU ammeter should be on 0 (see page 15)
62. Switch on Hydraulics (pos. 57 and 58) (see page 29)
63. Switch off DC pump (pos. 59) (see page 29)
64. Check hydraulic pressure (pos. 52 and 53) (see page 29)
65. Check parking brake pressure (pos. 132) (see page 65)
66. Switch off external AC (pos. 12) when ext. AC was in use (see page 15)
67. Disconnect GPU (pos. 31 and 32) when GPU was in use (see page 21)

For the complete Checklist please see next chapter!

4.2 Complete Panel Checklist

Based on the real BAe 146 Checklist but with some changes for the use with this Panel in the Flight Simulator.

Safety Check before A/C Power on / Flight Deck Safety Check

- Tech Log — CHECKED
- Library — CHECKED
- Emergency Equipment — CHECKED AND SECURED
- Circuit Brakers — SET
- Flaps — SELECTION NOTED
- WX Radar — OFF
- Battery Selector — BATT / VOLTS CHECKED
- Batteries — ON AND CHECKED
- Standby Inverter — ARM AND CHECKED
- Parking Brake — SET
- Ground Test
  APU Fire / Ext / Smoke — CHECKED
- Packs / APU Air — OFF / OFF
- Brake Fans — OFF
- Fuel Pump 2 — ON
- APU Generator — ON
- Ext. AC (if required) — CHECKED ON
- APU — START
- Emergency Lights — ARMED
- Master Switches — ALL ON
- Anti Skid + Lift Spoilers — ALL ON
- External Lights — SET
- Airbrake — IN
- Fire Handles — ALL IN
- Bus Ties — BOTH AUTO
- Standby Generator — ARMED
- Generator 1 and 4 — BOTH OFF
- Ground Test Eng Fire / Stall /
  Overspeed / Anti Skid / Horn — CHECKED
- APU Air / Pack 2 — ON / ON
- DC Pump — BATT
- AC Pump and PTU — ON / ON CHECKED
- Trims — CHECKED

- Thrust Levers — OFF
- PTU and AC Pump — OFF / OFF
- Continuous Ignition — BOTH OFF
- Galley — ON
- Engine Anti Ice — ALL ON
- Wing Ice Protection — ALL OFF
- Engine Air — ALL OFF
- Glareshield — CHECKED
- TMS — TESTED
- Center Panel — CHECKED
- Control Disconnect — BOTH HANDLES IN
- Autopilot — OFF
- Avionics — CHECKED
- No Smoking Signs — ON
- Flight Instruments — CHECKED

Cockpit Crew Checklist

- Fasten Seat Belts — ON
- Pressurization — SET
- Fuel Panel — SET
- Fuel Quantity — CHECHED
- Flow Meters — ZEROED
- Gear Lights — 3 GREENS
- Rudder / Aileron Trim — 0 / 0
- Speeds — BUGGED
- TMS / N1 / ALT — CHECKED + BUGGED
- Take-Off Trim — SET

Before Start Checklist

- Parking Brakes — SET
- Brake Fans — OFF
- Parking Brake Pressure — CHECKED
- Hydraulic Pump 2 / Hydraulic Pump 3 — OFF / OFF
- Electrical Fuel Pumps — ALL ON
- Packs 2 / APU Air — OFF / OFF
- Wing Lights — ON

Starting

- Start Clearance — OBTAINED
- Rotary Beacon — ON
- Engine Anti Ice — ON
- Start Power — AS REQUIRED
- Start Master — ON
- Start Selector — ENGINE NO…..
- Engine — START

After Start

- Start Power — Norm
- Start Master — OFF
- Start Selector — OFF
- Engine Anti-ice — AS REQUIRED
- Generator 1 and 4 — ON
- Hydraulic Pump 2 / Hydraulic Pump 3 — ON / ON CHECKED
- Brake Fans — AUTO
- APU Air / Packs 2 — ON / ON
- DC Pump — OFF
- Heaters — ALL ON

Taxi

- Taxi Lights — ON
- Flaps — SET
- Airbrakes / Spoilers — IN
- Altimeters — QNH SET AND X-CHECKED
- Take-Off Trim — RE-CHECKED
- Config. Warning — CHECKED
- Brakes — CHECKED
- Strobes — ON
- Nav Aids and Flight Director — SET
- Transponder — SET CODE
- Speed — X-CHECKED

Before Take off

• Transponder	ON
• WX Radar	AS REQUIRED
• Cabin Secure for T/O	RECEIVED
• AC Pump	ON
• Flight Controls	CHECKED
• Ignition	AS REQUIRED
• MWS	CHECKED
• TMS	TAKE-OFF
• RWY Heading	CHECKED
• Lights	TAKE OFF

After Take off

• Gear	UP / LIGHTS OUT
• Flaps	UP AND INDICATED
• Engine Air	ALL ON
• APU Air	OFF
• Packs	BOTH ON
• Recirc/Fresh	FRESH
• AC Pump	OFF^
• TMS	AS REQUIRED
• APU	AS REQUIRED

Climb

• Altimeters	1013 SET AND CHECKED
• APU	STOP
• Continuous Ignition	AS REQUIRED
• Pressurization	CHECKED
• Lights	OFF AT FL100
• Fasten Belts	AS REQUIRED
• No Smoking	AS REQUIRED

Descent

• Fasten Seat Belts	AS REQUIRED
• Pressurization	SET AND CHECKED
• No Smoking	AS REQUIRED
• TMS / N1 / ALTS	CHECKED + BUGGED
• Speeds	BUGGED

10.000 FT

• Fasten Seat Belts	ON
• Lights	ON
• Pressurization	CHECKED

Approach

• Altimeters	QNH SET AND CHECKED
• No Smoking	ON
• APU	STARTED / CHECKED
• Fuel Panel	CHECKED
• Nav Switch	NAV
• Engine Air	AS REQUIRED

Landing

• Altimeters	QNH SET AND CHECKED
• Gear	DOWN 3 GREENS
• Brake Pressure	CHECKED
• Cabin Secure for Landing	RECEIVED
• APU Air	APU RUNNING / ON
• Pack 1	OFF
• Engine Air	OFF
• Lights	AS REQUIRED
• Flaps	SET FOR LANDING

After Landing

• Lights / Strobes	ON
• Taxi Lights	ON
• Airbrakes/Spoilers	IN
• WX Radar	OFF
• TMS	OFF
• Flaps	SELECTED UP
• Brakes	CHECKED
• Engine Anti-ice	AS REQUIRED
• Ignition	OFF
• Heaters	ALL OFF
• Strobes	OFF
• Flaps	INDICATED UP
• Trims	4.5 / 0 / 0 SET

Shutdown Checklist

• Brakes	YELLOW / PARK
• Hydraulics	ALL OFF
• Generator 1 and 4	OFF
• Thrust Levers	FUEL OFF
• Fuel Pumps	1 / 3 / 4 OFF
• Fasten Belts	OFF
• No Smoking	OFF
• Taxi Lights	OFF
• Brake Fans	AS REQUIRED
• Engine Anti Ice	ALL ON
• Beacon	OFF
• Wing Lights	OFF

Leaving Aircraft

• Master Switches	OFF
• Anti Skid / Lift Spoilers	OFF
• Emergency Lights	OFF
• Pack 2 / APU Air	OFF / OFF
• APU	STOP
• APU Generator	OFF
• Fuel Pump 2	OFF
• Galley	OFF
• Lights	OFF
• Batteries	OFF
• Battery Selector	OFF

5 BAe 146 Appendix

5.1 Appendix 1 Flap Limitation Speeds

Flap Setting	IAS
18°	215 knots
24°	180 knots
30°	170 knots
33°	150 knots

5.2 Appendix 2 Speedcharts

27000 kg			
Take Off Flaps	18°	24°	30°
V_R	104	96	90
V_2	115	106	100
V_{FTO}	147		
V_{ER}	157		
Landing Flaps	33°	24°	
V_{REF}	100	114	
Abnormal Flaps	30°	18°	0°
V_{REF}	106	125	155

28000 kg			
Take Off Flaps	18°	24°	30°
V_R	106	98	90
V_2	117	107	100
V_{FTO}	151		
V_{ER}	161		
Landing Flaps	33°	24°	
V_{REF}	102	116	
Abnormal Flaps	30°	18°	0°
V_{REF}	108	127	158

29000 kg			
Take Off Flaps	18°	24°	30°
V_R	108	100	92
V_2	119	109	101
V_{FTO}	154		
V_{ER}	164		
Landing Flaps	33°	24°	
V_{REF}	104	117	
Abnormal Flaps	30°	18°	0°
V_{REF}	109	128	160

30000 kg			
Take Off Flaps	18°	24°	30°
V_R	111	102	94
V_2	120	110	103
V_{FTO}	157		
V_{ER}	167		
Landing Flaps	33°	24°	
V_{REF}	106	119	
Abnormal Flaps	30°	18°	0°
V_{REF}	111	130	163

31000 kg			
Take Off Flaps	18°	24°	30°
V_R	113	104	96
V_2	122	112	105
V_{FTO}	159		
V_{ER}	169		
Landing Flaps	33°	24°	
V_{REF}	108	121	
Abnormal Flaps	30°	18°	0°
V_{REF}	113	132	166

32000 kg			
Take Off Flaps	18°	24°	30°
V_R	115	106	98
V_2	124	114	106
V_{FTO}	162		
V_{ER}	172		
Landing Flaps	33°	24°	
V_{REF}	109	122	
Abnormal Flaps	30°	18°	0°
V_{REF}	115	134	168

33000 kg			
Take Off Flaps	18°	24°	30°
V_R	117	108	100
V_2	125	115	108
V_{FTO}	165		
V_{ER}	175		
Landing Flaps	33°	24°	
V_{REF}	111	124	
Abnormal Flaps	30°	18°	0°
V_{REF}	116	135	171

34000 kg			
Take Off Flaps	18°	24°	30°
V_R	120	110	102
V_2	127	117	109
V_{FTO}	167		
V_{ER}	177		
Landing Flaps	33°	24°	
V_{REF}	113	126	
Abnormal Flaps	30°	18°	0°
V_{REF}	118	137	173

35000 kg			
Take Off Flaps	18°	24°	30°
V_R	122	112	104
V_2	139	118	111
V_{FTO}	170		
V_{ER}	180		
Landing Flaps	33°	24°	
V_{REF}	115	128	
Abnormal Flaps	30°	18°	0°
V_{REF}	120	139	176

36000 kg			
Take Off Flaps	18°	24°	30°
V_R	124	114	106
V_2	131	120	113
V_{FTO}	172		
V_{ER}	182		
Landing Flaps	33°	24°	
V_{REF}	116	129	
Abnormal Flaps	30°	18°	0°
V_{REF}	121	140	178

37000 kg			
Take Off Flaps	18°	24°	30°
V_R	126	116	108
V_2	132	122	114
V_{FTO}	174		
V_{ER}	184		
Landing Flaps	33°	24°	
V_{REF}	118	131	
Abnormal Flaps	30°	18°	0°
V_{REF}	123	142	181

38000 kg			
Take Off Flaps	18°	24°	30°
V_R	128	118	109
V_2	134	123	116
V_{FTO}	177		
V_{ER}	187		
Landing Flaps	33°	24°	
V_{REF}	119	132	
Abnormal Flaps	30°	18°	0°
V_{REF}	124	143	183

39000 kg			
Take Off Flaps	18°	24°	30°
V_R	130	120	111
V_2	136	125	117
V_{FTO}	179		
V_{ER}	189		
Landing Flaps	33°	24°	
V_{REF}	121	134	
Abnormal Flaps	30°	18°	0°
V_{REF}	126	145	186

40000 kg			
Take Off Flaps	18°	24°	30°
V_R	132	122	113
V_2	137	127	119
V_{FTO}	181		
V_{ER}	191		
Landing Flaps	33°	24°	
V_{REF}	123	136	
Abnormal Flaps	30°	18°	0°
V_{REF}	128	147	188

41000 kg			
Take Off Flaps	18°	24°	30°
V_R	134	124	115
V_2	138	128	121
V_{FTO}	184		
V_{ER}	194		
Landing Flaps	33°	24°	
V_{REF}	124	137	
Abnormal Flaps	30°	18°	0°
V_{REF}	129	148	190

42000 kg			
Take Off Flaps	18°	24°	30°
V_R	136	126	117
V_2	140	130	122
V_{FTO}	186		
V_{ER}	196		
Landing Flaps	33°	24°	
V_{REF}	125	139	
Abnormal Flaps	30°	18°	0°
V_{REF}	131	149	193

43000 kg			
Take Off Flaps	18°	24°	30°
V_R	137	127	118
V_2	142	132	124
V_{FTO}	188		
V_{ER}	198		
Landing Flaps	33°	24°	
V_{REF}	127	140	
Abnormal Flaps	30°	18°	0°
V_{REF}	132	151	195

44000 kg			
Take Off Flaps	18°	24°	30°
V_R	139	129	120
V_2	144	133	125
V_{FTO}	191		
V_{ER}	201		
Landing Flaps	33°	24°	
V_{REF}	128	142	
Abnormal Flaps	30°	18°	0°
V_{REF}	133	152	198

45000 kg			
Take Off Flaps	18°	24°	30°
V_R	141	131	122
V_2	146	135	127
V_{FTO}	193		
V_{ER}	203		
Landing Flaps	33°	24°	
V_{REF}	130	143	
Abnormal Flaps	30°	18°	0°
V_{REF}	135	154	200

46000 kg			
Take Off Flaps	18°	24°	30°
V_R	143	132	124
V_2	147	136	128
V_{FTO}	195		
V_{ER}	205		
Landing Flaps	33°	24°	
V_{REF}	131	144	
Abnormal Flaps	30°	18°	0°
V_{REF}	136	156	203

Legend:

V_R = Rotation Speed
V_2 = Take Off safety speed
V_{FTO} = Final Take Off velocity
V_{ER} = En-Route climb speed
V_{REF} = Reference approach speed

5.3 Appendix 3 Take-Off % N1 Settings

5.3.1 Engine Anti-Ice Off

TAKE OFF OR GO-AROUND % N1 SETTING (ENG A-ICE OFF)		Ambient Temperature DEG. C																				
Pressure Altitude ft (,000)		-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50
8	N1	95,3	96,1	97,0	97,0	97,0	97,0	97,0	97,0	97,0	97,0	97,0	97,0	96,0	95,1	94,3	93,4	92,6	91,7	90,9	90,0
6	N1	92,5	93,3	94,2	95,0	95,9	96,7	97,0	97,0	97,0	97,0	97,0	97,0	96,2	95,4	94,5	93,7	92,8	92,0	91,1	90,3
4	N1	89,7	90,5	91,4	92,2	93,1	93,9	94,8	95,6	96,5	97,0	97,0	97,0	96,5	95,6	94,8	93,9	93,1	92,2	91,4	90,5
2	N1	86,9	87,7	88,6	89,4	90,3	91,1	92,0	92,8	93,7	94,5	95,3	96,1	96,9	96,0	95,2	94,3	93,5	92,6	91,8	90,9
1	N1	85,5	86,3	87,2	88,0	88,9	89,7	90,6	91,4	92,3	93,1	93,9	94,7	95,5	96,1	95,2	94,4	93,5	92,7	91,8	91,0
0	N1	84,1	84,9	85,8	86,6	87,5	88,3	89,2	90,0	90,9	91,7	92,5	93,3	94,1	94,9	95,3	94,4	93,6	92,7	91,9	91,0
-1	N1	82,7	83,5	84,4	85,2	86,1	86,9	87,8	88,6	89,5	90,3	91,1	91,9	92,7	93,5	94,3	94,5	93,6	92,8	91,9	91,1

AIRFRAME ANTI-ICE OFF

AIRCRAFT BLEED AIR OFF

(Settings based on the ARJ TRP setting – not on the BAe 146 settings)

5.3.2 Engine Anti-Ice On

TAKE OFF OR GO-AROUND % N1 SETTING (ENG A-ICE ON)

Pressure Altitude ft (000)		Ambient Temperature DEG. C																				
		-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50
8	N1	95,5	96,3	97,0	97,0	97,0	97,0	97,0	97,0	97,0	96,0	95,3	94,6	93,9	93,2	92,5	91,8	91,1	90,4	89,7	89,0
6	N1	92,7	93,5	94,4	95,2	96,1	96,9	97,0	97,0	97,0	96,2	95,5	94,8	94,1	93,4	92,7	92,0	91,3	90,6	89,9	89,2
4	N1	89,9	90,7	91,6	92,4	93,3	94,1	95,0	95,8	96,7	96,5	95,7	95,0	94,3	93,6	92,9	92,2	91,5	90,8	90,1	89,4
2	N1	87,1	87,9	88,8	89,6	90,5	91,3	92,2	93,0	93,9	94,7	95,4	94,2	93,5	92,8	92,1	91,4	90,7	90,0	89,3	88,6
1	N1	85,7	86,5	87,4	88,2	89,1	89,9	90,8	91,6	92,5	93,3	94,0	94,7	93,6	92,9	92,2	91,5	90,8	90,1	89,4	88,7
0	N1	84,3	85,1	86,0	86,8	87,7	88,5	89,4	90,2	91,1	91,9	92,6	93,3	94,0	93,0	92,3	91,6	90,9	90,2	89,5	88,8
-1	N1	82,9	83,7	84,6	85,4	86,3	87,1	88,0	88,8	89,7	90,5	91,2	91,9	92,6	93,1	92,4	91,7	91,0	90,3	89,6	88,9

AIRFRAME ANTI-ICE OFF

AIRCRAFT BLEED AIR OFF

(Settings based on the ARJ TRP setting – not on the BAe 146 settings)

6 Saving a flight with the current panel configuration

Since version 4.0 it's possible to save the cockpit configuration automatically. This includes the switch positions and several important values, like cabin altitude and other things.

The former cold and dark function of the panel is no longer included. This means, that you now could decide yourself if you would like to start with a cold and dark cockpit or with running engines and all systems on. When you leave the aircraft with running engines and all systems on, you will start the BAe 146 the next time with running engines and activated systems. When you switch off everything before leaving the aircraft, you will start with a cold and dark cockpit the next time.

When starting the BAe 146 panel for the very first time, you will find a cold and dark cockpit configuration. This means, that all switches are in the off position and the engines are not running. This configuration is saved in the files ML-BAe146v40_Config.ini and ML-BAe146v40_Config2.ini. Every time you're leaving the BAe 146 cockpit, the switch positions and some system values will be saved automatically in these files. From here they will be loaded when you start the panel in another session or when the panel or aircraft has to be reloaded. The autopilot buttons will not be saved, because they have very complex functions which could not be stored. Nevertheless the AP settings, like altitude for example, will be saved. So when you reload a saved situation, you just have to pull the necessary AP buttons and everything is like it was when leaving the aircraft.

The Comm frequencies, Transponder setting and the current weather will not be saved. If you would like to save also those things, it's necessary to save the flight with the flight simulator before leaving the BAe 146. This saved flight reloads the Comm and Transponder setting and the weather, while the new BAe 146 gauge loads everything else.

7 Hardware Panel Control

With my last panels it was not possible to control the BAe 146 panel with a hardware. Version 4.0 of the BAe 146 panel contents now some minor modifications to allow a limited control of the autopilot.

For this you need the address the MS standard keyboard commands on your hardware. For example: when you want to address the autopilot main switch of the BAe 146 panel to your hardware, you need to address the keyboard command for the autopilot main switch. The following BAe 146 autopilot commands are realized:

Autopilot main switch (autopilot master), yaw damper button, GSL (use APR hold to command this button), altitude hold (ALT), IAS (airspeed) and mach hold, V / L (VOR / LOC) mode (use VOR or NAV hold to command this button), BLOC (use BC hold to command this button), TURB (use the wing leveller to command this button) and heading hold (HDG).

AP commands which are currently not realized are the pre-selected altitude hold, the LNAV mode and the flight director switch.

The SYNC mode is realized and could be addressed on your hardware. For this you must use the keyboard “K” key. When pressing K, SYNC will be switched on and a second pressing switch it off. As the real SYNC button is on the yoke, it is very useful to place this command on your hardware yoke too.

The current way of realizing this hardware control commands is just a first trying. I will continue with this idea and extend it in later versions. Also the idea of making an easy to edit file which contents all possible keyboard commands is planned.

8 Known Bugs and FAQ's

- Why takes it such a long time to load the aircraft and the panel?

  When loading the first thing the panel do is to deactivate the Flight simulator systems (especially the electrical system) then this panels it's own systems for the electricity, the fuel system and the hydraulics. This takes a while but it will not brake down the frames as it is ju8st necessary one time when loading the panel.

- The letters in the overhead panel are too small. I couldn't read them!

  I know this but it was necessary to give the panel a realistic look. For a better handling I recommend to print this manual. Another way is to move the mouse upon the switch or instrument and you will a tootip text which shows you what for the switch or instrument is.

- After installing the panel almost all of the gauges are missing!

  The reason is, that you didn't unzip the ML-BAe146v40.cab into the gauges folder or you have completely unzipped the files of the cab file into the gauges folder. Do not unzip the cab file itself. The Flight simulator unzips this cab file automatically when he needs it. Just take care, that the file is in your gauges folder!

- All Instruments are off when I start the panel!

  That's correct and happens when you load the panel for the very first time. You need to go through the startup procedure or use the invisible autostart button to start the systems and the engines. From now on, the panel always stores the system values, switch positions and the engine state when leaving the aircraft.

- Is it possible to start the panel with the FS autostart Strg+E?

  No this is not possible. You have to go through the complete start-up procedure to activate the panel or you could use the invisible auto starter of the overhead panel. Please read the corresponding chapter in this manual.

- Do I need FSUIPC.dll for this panel?

  No! The complete panel based fully on FS2004 variables and did not require any FSUIPC function.

- I have problems adjusting the Nav and ADF radios.

  *The frequencies of the Nav and ADF radios were stored in the ML-BAe146v40_Config.ini and ML-BAe146v40_Config2.ini. Those files and the two *.gau files with the same name MUST be directly in the gauges folder. It's not possible to install those files in a separate subfolder.*

- It seems that the panel state will not be saved from my system.

  Same as above. The ML-BAe146v40_Config.ini and ML-BAe146v40_Config2.ini files MUST be installed directly in the gauges folder. The panel state will be stored in those files.

- How could I restore the original cold and dark situation?

  As written above, the original cold and dark cockpit situation is saved in the files ML-BAe146v40_Config.ini and ML-BAe146v40_Config2.ini. This file will always be modified when leaving the BAe 146 panel. To restore the original cold and dark cockpit situation, just unzip those files once again into the gauges folder (overwrite the existing files) when the Flight Simulator is not running.

- I could not switch on or off the HP fuel cut-off switch in the pedestal panel.

  It's just possible to switch the fuel cut-off switches if the throttles are in the Idle position. If the fuel cocks are closed (switch is off) and you are using a hardware throttle, you couldn't see the real position of the throttles in the panel. Please take care that your throttle is moved back to the zero position. Sometimes it could also be that your throttle calibration is not correct. When you load the pedestal panel and you move the mouse over the throttle or over one of the throttle movement areas (not directly over the fuel cut-off switches!) you should not read more than 9% in the tool tip text. If you read more than 9% you should recalibrate the zero position of your throttle.

- The EPR gauge shows always zero also when the engines are running.

  Some BAe 146 aircraft did not have the necessary EPR entry in the airfile. Please use the included airfile which correct this.

- I couldn't activate the reverse thrust!

  Well, the reason for this is simple. The ARJ and BAe 146 didn't have any reverse thrust.

- Why did the TMS not hold the exact TGT temperature or N1 RPM when it is active?

  The TGT and N1 hold function of the TMS is very complex and it is realized with a lot of tricks because the Flight Simulator did normally not support such a function. Because of this, the tolerance area is greater than with the real world TMS. Nevertheless the tolerance should not be too big. When you have too much problems holding a calculated N1 or adjusted TGT, you should check if you are using the correct replacement flight dynamics.

- I could not activate the autopilot on ground

  Yes, that's correct. The autopilot could just be used when you're airborne. However the Flight Director also works on ground.

- Why will IAS hold disconnected when pressing ALT hold?

  Well, this is a normal function. IAS and Mach hold uses pitch changing for holding the speed and pitch changing is not possible when ALT hold is active.

- Sometimes I hear the autopilot disconnect sound of the flight simulator although the autopilot is still engaged.

  The BAe 146 panel has an own autopilot disconnect sound which is controlled from a gauge. This is necessary because of the very complex autopilot functions of this panel. To eliminate the wrong AP disconnect sound, please follow the installation description of chapter 2.3.

- Could I use a separate navigation gauge (GPS, FMS or GNS) or FSNavigator to control the BAe 146 autopilot?

  Yes, that's possible but like in the real aircraft, only for lateral navigation. To follow the route of your additional navigation tool, you must use the LNAV function of the BAe 146 autopilot.

- How could I fly a standard MS flightplan?

  To activate the standard Flight Simulator flight plan, the autopilot must be engaged. It is now very important FIRST to activate VOR/LOC before activating the GPS mode. After that, the BAe 146 autopilot follows the standard flight plan.

- The gauges stays dark after deactivating the panel flood light.

  This happens because the main panel bitmap with all gauges will not refresh sometimes. To solve this just switch on and off or off and on the gauge lights.

- I could not set the lift spoilers?

  Please take care that you have installed the correct panel version. Every aircraft designer use a different way to set the lift spoilers. Because of this there are different panel versions for the model of Paul Hannity, Jon Murchison or other aircraft designers. Some Models did not support visual lift spoilers (Mike Stone's model for example). Nevertheless you could simulate a real working function when installing the panel files for the models of Jon Murchison and other aircraft designers.

- How could I open the second door or the cargo doors?

  Opening the second aircraft entry or the cargo doors is possible with the standard key command. However there are a few things which are important for this. The cargo doors just could be opened I the fuel cocks in the pedestal panel are opened, the batteries are switched on and at least the DC pump of the hydraulic system is on (brake pressure must be available). After this, the key command work.

- Why is it not possible to activate different throttles with the key command "E +" in flight?

  The reason for this is the complexity of he panel. There are a lot of processes active while flying (AP commands, system commands, …) which have to use standard MSFS key commands. Because of this, the second key command gets lost. Nevertheless there is a solution for this problem if it's necessary for you to use key sequences in flight. Just download and install "rcbse-10.zip" from Rob Barendregt. This file could be found on Avsim or Flightsim.com and should solve the problem.

9 Credits

I had a lot of help from real BAe 146 and Avro ARJ pilots and ARJ enthusiasts to realize this panel as it is now. Here is a listing of all people I would like to thank for their patience, detailed descriptions and further help:

The real world pilots: **Andrè Cormann** and **Peter Hufschmidt** for their extremely detailed descriptions of the real aircraft and patience with my many questions about the aircraft, **Darren Taylor** for his very detailed and pictured description of the ARJ TRP which was also helpful for realizing the BAe 146 TMS.

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If you need help for this panel, if you have some critic or comments or if you just want to say thank you, please use the support forum of the BAe Panel Project website http://www.baepanelproject.com rather than sending me an Email.

And now have fun flying the BAe 146!