Beech 1900D Panel

Version 1.0
By Matt Laurita

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Being that this is a first release of this panel there are going to be some bugs and glitches. I will also admit that the programming is not complete and there are many unfinished systems. However, everything that you would need to get into the air, to your destination, and back on the ground is functioning and there are a few extras on top of that. Please read this manual as it contains valuable information on operating the systems that are currently working. I won't provide support on information that's covered in the manual. Future releases will incorporate more functioning systems.

Happy Flying!
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4/26/03
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Credits:
All gauge programming and development by Matt Laurita.

I would like to profusely thank Evan Jones for all of the Beech 1900D expertise and feedback he has provided me.

Contents

A. Panel Overview

The main panel contains the instruments and controls necessary to fly, navigate, monitor engine performance, and communicate. Details of each of these instruments will be explained in subsequent sections.

In addition to the main panel there are six sub-panels that you will use to control various aircraft systems:

 Fuel Panel – Fuel pumps and quantity indicators

 Captain's Lower Panel – Electrical systems, Anti-Ice, Starters, Autofeather

 Pedestal – Pressurization, Engine controls, Flaps, Trim

 Co-Pilot's Lower Panel – Environmental controls, Fire detection testing

 Overhead – Lights, Electrical system indicators

 Caution Annunciators

There are also pop-up controls for the EFIS displays and the cabin pressurization system that are accessed by clicking on certain instruments. All will be explained in further detail in the following sections.

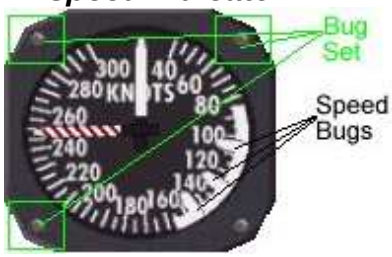
To the right of the sub-panel icons are icons for ATC and the FS2002 GPS.

B. Systems Descriptions

1. Pitot-Static Instruments

The pitot-static instruments include the Airspeed Indicator, Altimeter, and the Vertical Speed Indicator (VSI).

Airspeed Indicator



The Airspeed Indicator displays Indicated Airspeed (IAS) in nautical miles per hour (knots, or KTS) based on the difference between the static pressure at a given altitude and the ram pressure due to the aircraft's motion through the air. Note that at higher altitudes IAS is lower than the True Airspeed (TAS) due to the lower air density.

The barber pole represents the maximum cruising speed and decreases with altitude.

Three speed bugs are available for setting various reference speeds. When the sim starts they are all stacked up on zero knots. You can use the three click areas to reposition each bug individually.

Altimeter

The altimeter displays the aircraft's altitude in feet. The scrolling numbers indicate altitude in thousands and hundreds of feet. The sweeping pointer indicates the altitude to the nearest ten feet (the tick marks are spaced in 20-foot increments).

The altimeter set knob allows you to adjust the Kohlsman setting to account for variations in barometric pressure. The current setting is shown in both millibars (mb) and inches of Mercury (inHg). It is essential to have the correct altimeter setting so that the indicated altitude will represent the aircraft's true altitude. The

setting can be obtained from ATIS, ATC, or, if neither of those are available, by setting it so that the altimeter reads the field elevation of the departure airport.

Vertical Speed Indicator

The VSI displays the aircraft's vertical speed in thousands of feet per minute.

The vertical speed set knob allows you to set the vertical speed that you want the autopilot to maintain. The bug will reflect the desired setting.

2. EFIS Instruments

The Electronic Flight Instrument System (EFIS) instruments are the Electronic Attitude & Direction Indicator (EADI) and the Electronic Horizontal Situation Indicator (EHSI). In addition, there is an EFIS Display Selector Panel (DSP) for controlling how information is displayed on the screens.

EADI

The EADI replaces the gyroscopic attitude indicator and provides an indication of the aircraft's pitch and bank angles.

Along the top of the display are autopilot mode indicators that display when the autopilot master, yaw damper, and altitude hold modes are selected, respectively.

When the flight director is active a pair of magenta bars are displayed that represent the pitch and bank angles commanded by the autopilot.

Glide slope deviation indicators will appear vertically on either side of the screen when the active course is associated with an ILS. At the same time, the horizontal deviation indicator at the bottom of the screen will indicate deviation from the localizer. When the active course is associated with a VOR the horizontal indicator acts as a CDI. When there is no valid active course this indicator will not appear. (See below for information about the active course).

To the right of the CDI is a readout of the Decision Height (DH). The pilot can set this for the particular approach being used (see EFIS DSP). Above the DH, the radio altitude will display whenever the aircraft is less than 2500 feet AGL.

On an ILS approach, the Outer, Middle, and Inner (if applicable) markers will be displayed on the right side above the horizon bar.

Mounted on the bottom of the EADI is an inclinometer that shows whether the aircraft is slipping or skidding. Keeping the ball centered results in a coordinated and comfortable flight for your passengers.

EHSI

The EHSI provides information relating to navigation in either HSI(left) or ARC(right) mode. Each mode provides the same information.

A compass card indicates the current heading. A magenta heading bug indicates the current heading selected for the autopilot HDG hold mode.

Up to four pointers can be displayed. There are two bearing pointers that can each be individually linked to VOR1/VOR2/ADF1. One is a single barbed cyan arrow and the other is a double barbed magenta arrow. When a bearing pointer is displayed its controlling signal will be indicated in the lower left corner and will be colored to match the pointer. These are set via the DSP (see below).

There are also two course arrows associated with the active and preset courses, with each course arrow containing a CDI. A green arrow indicates the active course and its controlling signal is displayed on the left side of the display as

VOR1/VOR2/LOC1/LOC2, as appropriate. The preset course arrow is a double barbed cyan arrow, and its controlling signal is displayed below the active signal. More details about preset and active courses can be found in the section on the DSP below.

The remaining information on the screen relates to active course. The VOR/LOC identifier and distance to the station are displayed in the upper left corner. Ground speed or time to the station can be displayed in the upper right corner. The active or preset course is displayed in the bottom right corner. To the left of the course display is a TO/FROM indicator.

DSP

The EFIS Display Selector Panel (DSP) is used to adjust the information displayed on the EHSI. **The DSP can be toggled by clicking on the face of the EHSI.**

The heading (HDG) knob consists of an outer knob and an inner knob. The outer knob is used to select between the Ground Speed and Time to Station readouts. The inner knob is used to set the heading bug for the autopilot. Clicking on the center of the knob will sync the HDG bug to the current heading.

The center knob is used to switch between ARC and HSI modes.

The DH knob is used to set the decision height (DH) readout on the PFD.

The arrow buttons control the signal that is linked to each bearing pointer on the EHSI. The single-barbed arrow corresponds to the single barbed, cyan bearing pointer, while the double-barbed arrow corresponds to the double barbed, magenta bearing pointer. Pressing each arrow button will cycle between Off/VOR1/VOR2/ADF1 as the controlling signal.

The CRS SEL button is used in conjunction with the Course knob the set the active and preset courses. With the Course knob in the ACT position, press the CRS SEL button to cycle through Off/VOR1/VOR2 (or LOC1/LOC2, as appropriate) as the controlling signal for the active course. Then set the desired course as displayed on the lower right corner of the EHSI by using the inner Course knob. In addition, by pressing the center of the course knob you can set a direct course TO the station. To set a preset course, move the outer Course knob to PRE and repeat the above steps. The CRS display on the EHSI displays the active or preset course depending on whether the outer Course knob is set to ACT or PRE.

The ability to have active and preset courses is advantageous, for example, when transitioning airways over a VOR. The active course can be set TO the VOR, while the new radial FROM the station can be preset. As the station is approached, moving the outer Course knob to XFR transfers the preset controlling signal and course to the active signal and course.

3. Engine Instruments

Inter Turbine Temperature

Displays the temperature at the outlet of the high-pressure turbine in hundreds of degrees Celsius. A red line at 800 indicates the maximum temperature for normal operations, while a red line at 1000 represents the maximum temperature on engine start.

Torque

Displays the engine torque in hundreds of foot-pounds. Yellow arc is from 3751 to 3949 ft-lbs. Red line at 3950 ft-lbs.

Prop RPM

Displays the propeller RPM in hundreds of revolutions per minute.

Turbine

Displays the speed of the N1 turbine as a percentage of maximum RPM. Red line is at 104%.

Fuel Flow

Indicates the amount of fuel flow to each engine in hundreds of pounds per hour.

Oil Temperature/Pressure

A dual gauge that indicates oil temperature in degrees Celsius on the left and oil pressure in pounds per square inch on the right.

4. Radios

This Beech 1900D is equipped with dual Comm radios, dual Nav radios, an ADF, a Mode C Transponder, and an Audio Panel.

Nav/Comm Radios

The Nav and Comm radios operate in the same way. Each displays an active frequency and a standby frequency. You can adjust the standby frequency by clicking in the areas shown and then transfer it to the active frequency by clicking on the frequency swap button. Frequencies are tunable in increments of 0.025MHz. (***Note: Comm 2 is not functional in this simulation***).

ADF/Transponder

Both the ADF and Transponder are tunable by clicking on each of the digits.

Audio Panel

The Audio Panel is used to identify navaids. Clicking on the switches for the Nav, DME, or ADF will allow you to hear the Morse Code identifier of the navaid the corresponding radio is tuned to.

5. Autopilot

This panel currently uses the default King Air autopilot. Please see Microsoft's documentation for its use.

6. Prop Sync

Prop Sync is used to reduce engine noise and airframe vibration by syncing the RPM and adjusting the phase angle between the left and right propeller blades. The switch is located just below the VSI on the main panel. Prop Sync should not be engaged until the left and right prop rpm are within 50 rpm of each other and should not be used during takeoff or landing.

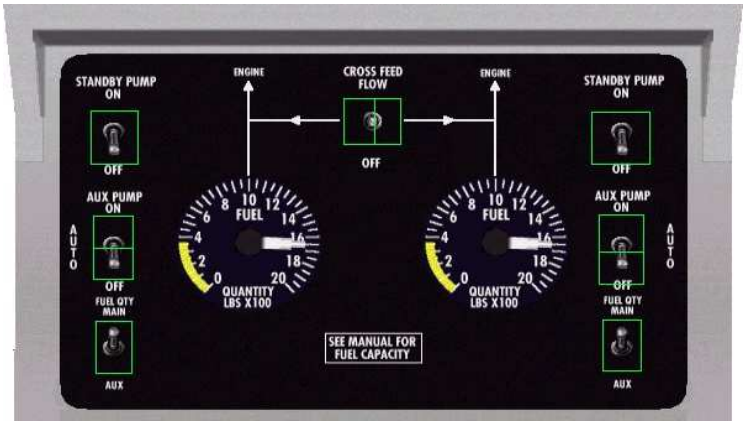
7. Engine Fire Suppression

The engine fire suppression system consists of the T-Handles, the extinguisher push buttons and the test panel. The T-Handles, located just above the audio panel, operate the firewall fuel shutoff valves. In the event of an engine fire pulling the handle will close the valve, instantly cutting off fuel and shutting down the engine. Pulling the handle will also arm the associated extinguisher push button. The extinguisher push buttons are located on the glareshield to the right of the Master Caution light. Pushing the extinguisher button will discharge Halon into the engine's exhaust area. **This portion of the system is under development**.

The fire suppression system can be tested by using the switches located on the Co-Pilot's lower panel and labeled EXT TEST. Moving the extinguisher test switches to A should illuminate the DISCH and OK lights on the associated extinguisher push button. Moving the test switches to B will illuminate only the OK light. The switches labeled DETECT test the fire detection system. Moving

the switches to LOOP should illuminate the L/R FIRE LOOP lights on the caution annunciator panel. Moving them to AMP tests the circuitry to light up the T-Handles.

8. Fuel Panel



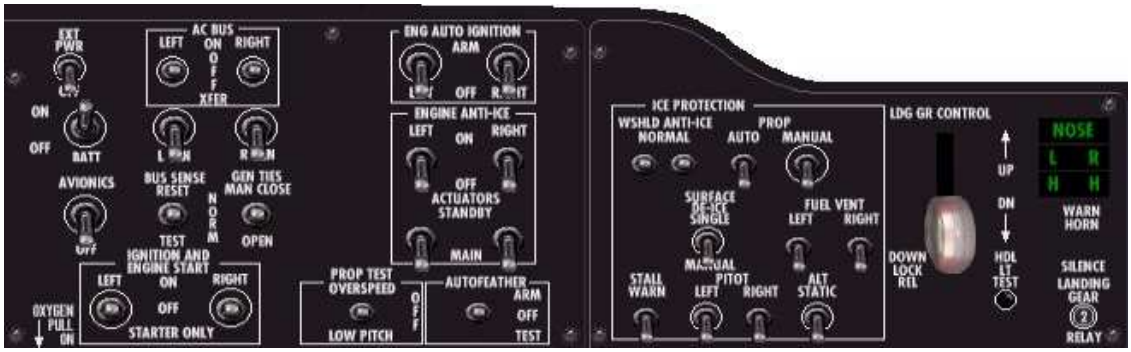
The fuel panel contains controls and indications for operating the fuel system.

The standby fuel pumps, aux fuel pumps, and crossfeed are clickable dummy switches. ***A fully functional fuel system is currently under development***.

The two gauges indicate the quantity of fuel in both the left and right main and aux tanks. Selector switches at the bottom right and left of the panel allow you to choose between main and aux.

9. Captain's Lower Panel

The Captain's lower panel contains switches for operating the electrical system, anti-ice systems, engine starters, autofeather system, and landing gear.



a. Electrical

The electrical controls consist of switches for the main battery, left and right engine-driven generators, external power, left and right AC busses, avionics master, and bus ties.

External power is available when the aircraft is on the ground and the parking brake is set. Currently, external power will not power all of the equipment on the aircraft. ***A complete electrical system is under development***.

The bus sense, gen ties, and AC bus switches are all non-functioning dummies, though the AC bus switches are linked to the AC bus warnings on the Warning Annunciator panel.

b. Anti-Ice

Anti-ice is controlled from the area labeled Ice Protection. Switches for the engine anti-ice systems are located just to the left. Many switches are clickable dummy switches, though others have been linked to FS2002 anti-ice systems where available.

The engine, prop, fuel vent, stall warning, pitot, and alt static de-ice systems can be either ON or OFF. The Surface Deice switch operates the de-ice boots on the wings and tail surfaces. With the switch in SINGLE, the outboard wing boots will inflate for six seconds, followed by the inboard wing and tail boots for six seconds. With the switch in MANUAL all boots will inflate for as long as the switch is in position.

c. Starters

Engine starters are located at the lower left of the panel. They can be clicked and held in the “on” position to spool up the turbine to approximately 10% RPM where, if the condition levers are forward, the engine will light off. Upon release the starter switches are spring-returned to the “off” position.

d. Autofeather

The autofeather system is currently under development.

e. Landing Gear

The landing gear controls and indications are located on the right side of the panel. The gear handle is used to operate the gear and will light up red when the gear is in transit. Just below and to the right of the gear handle is a test button for testing the gear handle light.

When the gear is down and locked green lights will appear to the right of the gear handle. The “NOSE”, “L”, and “R” lights indicate the nose gear and left and right main gear are down and locked. The two “H” lights are backups to the “L” and “R” and will therefore still illuminate if the “L” or “R” fails to display.

10. Co-Pilot's Lower Panel

The Co-Pilot's lower panel contains controls and indications for the environmental and bleed air systems, a vacuum gauge, and oxygen pressure gauges.

a. Environmental/Bleed Air

Environmental and bleed air controls include switches for bleed air valves and blowers, a cabin temperature gauge, temperature controls, a cabin temperature mode controller, and a pneumatic pressure gauge.

The pneumatic pressure gauge indicates the amount of instrument system bleed air available.

The cabin temperature mode controller can be switched between OFF and AUTO. When in AUTO, if the bleed air valves are OPEN the desired temperature can be set using the Cabin Temp knob. The cabin temperature is indicated on the gauge to the lower left and can be set to between 60 and 80 degrees Fahrenheit with the Cabin Temp knob. After making an adjustment allow a few minutes for the temperature to stabilize. When the mode controller is OFF or the bleed air valves are not OPEN the cabin temperature is not regulated and will slowly equalize with the ambient temperature.

Complete environmental and bleed air systems are currently under development.

b. Vacuum Gauge

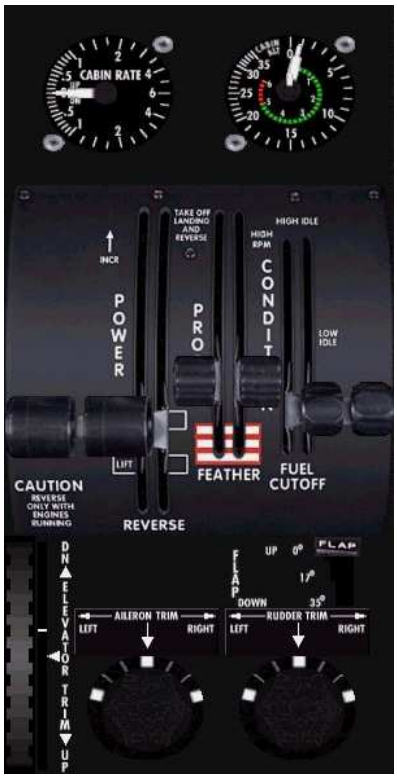
The vacuum gauge indicates the amount of vacuum for use by the gyroscopic backup instruments (not included in this panel).

c. Oxygen

The oxygen gauges indicate the pressure of the breathing oxygen available to the crew and passengers in the event of a cabin depressurization. A minimum of 100 PSI is required for the system to operate.

11. Pedestal

The pedestal contains controls for cabin pressurization, engine management, flaps, and trim.



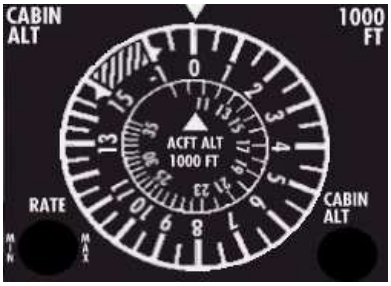
a. Pressurization

The pressurization system can maintain a sea-level cabin up to 11000 feet. Beyond that altitude it can maintain a differential pressure between the cabin and the atmosphere of 5 PSI, giving a ceiling of 25000 feet at a cabin altitude of 10000 feet.

The Cabin Rate gauge indicates the rate in feet per minute that the cabin is climbing or descending. Note that the cabin may climb or descend independent of the aircraft.

The Cabin Altitude gauge shows the current altitude being maintained in the cabin on the outer scale, as well as the differential pressure on the inner scale.

Clicking on the cabin altitude area of the pedestal opens up the Cabin Altitude Controller.



The desired cabin altitude can be selected using the knob on the bottom right. As the cabin is climbing or descending the rate can be adjusted from 200 to 2000 fpm by using the knob on the bottom left. A safety switch prevents the cabin from being pressurized on the ground, and upon landing the pressure will equalize with the outside.

b. Engine Controls

Engine controls consist of throttles, propeller levers, and condition levers.

Condition levers control the fuel supply to the engine. Fully aft, in the cutoff position, fuel is cutoff to the engine and the engine will shut down. The engines are started by positioning the levers to high idle and activating the starters. Most normal operations are conducted in low idle or high idle.

The propeller levers control the RPM of the propellers by controlling the blade pitch angle. With the levers fully forward the blades are in the low pitch/high RPM setting. Moving the levers aft increases the pitch and lowers the RPM. Pulling the levers into the feather region aligns the blade parallel to the relative wind. This is useful for stopping a windmilling propeller and reducing the drag after an engine failure. The propellers will also feather on shutdown regardless of the propeller lever positions.

The throttles control the amount of power developed by the engines by adjusting the fuel flow rate and N1 RPM.

For ground operations with the propeller levers full forward at the low pitch setting, the throttles can be moved aft over a detent into the Ground Fine region. This lowers the blade pitch even more resulting in less thrust for taxiing. Moving the throttle further aft over a second detent causes the blade angles to go negative and reverses the direction of engine thrust for assisting in deceleration after landing.

c. Flaps

The flaps switch is located just below the condition levers and can be positioned to 0, 17, or 35 degrees. A flap position indicator is on the main panel.

d. Trim

On the bottom of the pedestal are controls for the elevator, aileron, and rudder trim. The aircraft can be trimmed by using keyboard shortcuts or by clicking on the trim knobs.

12. Overhead Panel

The overhead panel contains switches for operating the interior and exterior lights, and gauges for monitoring the electrical systems.

a. Lights

Light switches are located along the top two-thirds of the overhead panel. The rocker switch at the top left controls panel lights. Exterior lights are just below the panel light switch, and cabin lights are to the right of the exterior lights.

b. Electrical

Along the bottom of the overhead are gauges and controls for monitoring the electrical system. Two loadmeters show the load on the engine-driven DC

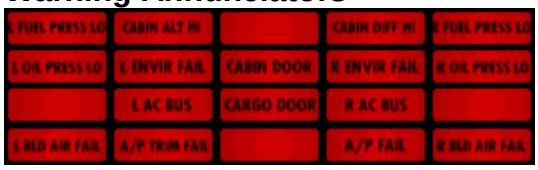
generators as a percentage of full load. To the right of the loadmeters is a combination voltmeter/ammeter. The ammeter shows the rate of battery charging or discharging. The voltmeter displays the voltage of a number of sources, such as the battery, generators, or external power via a voltmeter selector switch. The battery produces 24 volts while the generators and external power provide 28 volts.

To the right of the voltmeter selector is an AC selector switch for selecting either the right or left inverter. The selected inverter's frequency will display on the AC meter to the right of the switch. To display the inverter's voltage, press and hold the button at the bottom left of the AC meter. Normal indications are 120V and 400Hz.

13. Caution and Warning Annunciators

Warning annunciators are red and alert the pilot to situations requiring immediate attention. Caution annunciators are amber and alert the pilot to situations that, if left unattended, may lead to a more serious condition. On the caution annunciator panel are also green and white indicator lights that inform the pilot of the status of aircraft systems. The warning annunciators are located on the main panel above the audio panel**. Caution annunciators are located below the engine instruments. They can be displayed by clicking on the icon to the right of the Master Caution light**. Located to the left of the warning annunciators is a press to test button. Press and hold this button to test both the warning and caution lights. The Master Warning and Caution lights are not functional yet in this version.

Warning Annunciators



L/R FUEL PRESS LO – Illuminates when the engine-driven fuel boost pump fails.

CABIN ALT HI – Illuminates when cabin altitude is above 10000 ft.

CABIN DIFF HI – Illuminates when cabin differential pressure is >5psi.

L/R OIL PRESS LO – Illuminates when the associated engine oil pressure falls below 60psi.

L/R ENVIR FAIL – Not Simulated.

CABIN DOOR – Illuminates when the cabin door is open. **In this sim, the door is assumed open when the aircraft is on the ground and the rotating beacon is off.**

L/R AC BUS – Illuminates when the associated AC bus is off.

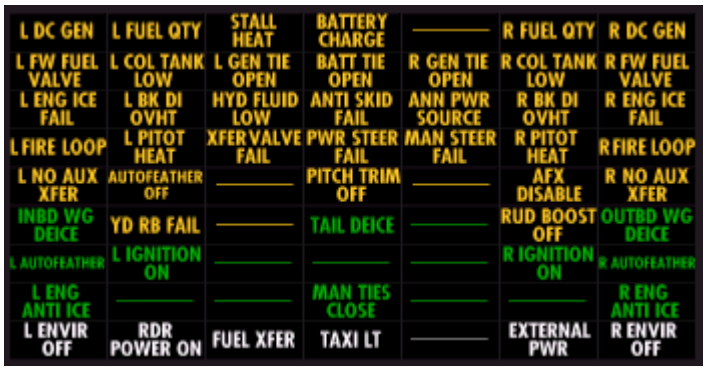
CARGO DOOR – Illuminates when the cargo door is open (not simulated)

L/R BLD AIR FAIL – Both lights will illuminate when both bleed air valve switches are positioned to 'INST AND ENVIR OFF'

A/P TRIM FAIL – Not Simulated.

A/P FAIL – Not Simulated.

Caution Annunciators



L/R DC GEN – Illuminates when the associated generator is switched off. Also comes on when associated engine fails. Will also be on when engine and ignition start switch is in 'STARTER ONLY' position.

L/R FUEL QTY – Illuminates when the associated tank has less than 324lbs of usable fuel (approx. 30 min).

STALL HEAT – Illuminates when the STALL WARN switch on the ice protection panel is in the OFF position.

BATTERY CHARGE – Not Simulated.

L/R FW FUEL VALVE – Illuminates when the associated T-Handle is pulled, shutting down the associated engine.

L/R COL TANK LOW – Not Simulated.

L/R GEN TIE OPEN – Will be EXTINGUISHED when either one of the generators is online. Will also be extinguished if GEN TIES switch is in MAN CLOSE position.

BATT TIE OPEN – Illuminates when MASTER BATT SWITCH is in ON position and neither one of the generators is online.

L/R ENG ICE FAIL – Not Simulated.

L/R BK DI OVHT – Not Simulated.

HYD FLUID LOW – Not Simulated.

ANTI SKID FAIL – Not Simulated.

ANN PWR SOURCE – Not Simulated.

L/R FIRE LOOP – Not Simulated.

L/R PITOT HEAT – Illuminates when the associated pitot heat switch is off.

XFER VALVE FAIL – Not Simulated.

PWR STEER FAIL – Not Simulated.

MAN STEER FAIL – Not Simulated.

L/R NO AUX XFER – Not Simulated.

AUTOFEATHER OFF – Illuminates if the Autofeather is not ARMed with the landing gear extended.

PITCH TRIM OFF – Not Simulated.

AFX DISABLE – Not Simulated.

INBD WG DEICE – Illuminates when the Surface Deice switch is in MANUAL or SINGLE (when in SINGLE the inboard de-ice boots will cycle for six seconds after the outboard boots, after which the light will extinguish).

YD RB FAIL – Not Simulated.

TAIL DEICE – Illuminates when the Surface Deice switch is in MANUAL or SINGLE (when in SINGLE the tail surface de-ice boots will cycle for six seconds after the outboard boots, after which the light will extinguish).

RUD BOOST OFF – Not Simulated.

OUTBD WG DEICE – Illuminates when the Surface Deice switch is in MANUAL or SINGLE (when in SINGLE the outboard de-ice boots will cycle for six seconds, after which the light will extinguish).

L/R AUTOFEATHER – Illuminates when Autofeathers are ARMed.

L/R IGNITION ON – Illuminates when associated ENG AUTO IGNITION switches are in the ARM position and associated engine torque falls below 750 ft-lbs.

L/R ENG ANTI ICE – Illuminates when the associated engine anti-ice system is ON.

MAN TIES CLOSE – Illuminates when the GEN TIES switch is in MAN CLOSE position.

L/R ENVIR OFF – Illuminates when the associated bleed air valve switch is in the ENVIR OFF or INST AND ENVIR OFF position.

RDR POWER ON – Not simulated.

FUEL XFER – Not Simulated.

TAXI LIGHT – Illuminates when the taxi light is ON.

EXTERNAL POWER – Illuminates when external power is connected.

C. Operations

When the panel loads it will be placed in the “Cold and Dark” configuration. Essentially, this means that the aircraft will be shutdown with all systems off. The checklists are included as a separate file and will take you from preflight to shutdown.

Engine Starting

There is no checklist for starting the engines, so the following procedure is used:

1. Ensure that there is power supplied to the aircraft by the battery or external power.
2. Move the Condition lever for the desired engine to “High Idle”
3. Move the Propeller lever for the desired engine to “High RPM”
4. Check the desired engine’s Power lever is set to “Idle”
5. Engage the engine starter
6. At approx. 10% N1 the engine will light off. Release the starter switch.
7. Observe ITT. It is allowed to exceed 800C up to a maximum of 1000C for 5sec on engine start. If time or temperature is exceeded shut the engine down and inspect for damage.
8. Observe other engine parameters for normal indications.
9. Repeat for the other engine.

Cabin Altitude Control

When the aircraft is on the ground a safety switch prevents the cabin from pressurizing. Prior to takeoff, as directed by the checklist, you should set the cabin altitude controller to 1000ft above your planned cruising altitude. This provides a more than adequate safety margin if turbulence is encountered. Prior to landing you should set the cabin altitude to 500ft above the airport’s elevation. Again, upon landing the safety switch will ensure that the cabin pressure is equalized with the outside prior to opening the doors.