CRJ 200 AIRCRAFT SYSTEMS STUDY GUIDE

A Study Guide For The CRJ 200

A Complete Systems Oral Exam Guide for the CRJ 200 Pilot

Aviation Study Made Easy

THIRD EDITION

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Boone and Rile Publishing (boonerilepublishing.com) • Peachtree City, GA

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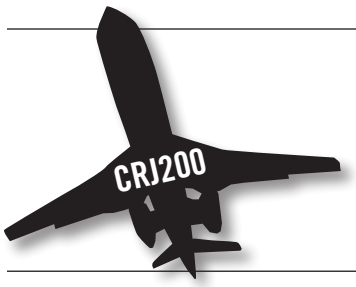


chapter 5

Electrical System

What is the voltage of the AC and DC system?

The voltage is 115-volt AC and 28-volt DC electrical power.

What are the sources of AC electrical power for the aircraft?

- The primary sources of AC electrical power are two engine driven integrated drive generators (IDGs).
- The APU has an AC generator mounted on it.
- An air driven generator (ADG) can provide AC power if there is a total loss of AC power.
- On the forward right side of the fuselage there is a receptacle for AC ground power.

What provides power if there is a total loss of AC electrical power in flight?

From the right side of the forward fuselage an air driven generator (ADG) is deployed to provide AC power.

What are the sources of DC electrical power?

- Five transformer rectifier units (TRUs)

- Two nickel cadmium (nicad) batteries
- 28-volt external power

How many circuit breaker (CB) panels are there and where are they located?

There are six CB panels, four on the flight deck, one in the aft equipment bay and one at the FA's station.

What is the kilo volt-amperes (KVA) rating of the integrated drive generators (IDG)?

The IDG rating is 30 KVA up to 35,000 feet, then 25 KVA to 41,000 feet.

What type of power do the IDGs supply?

The IDGs supply 115-volt AC, 400-hertz 3-phase electrical power.

Does the IDG RPM vary with engine RPM?

No, the generator must turn at a constant RPM to produce a steady 400-Hz. The constant speed drive (CSD) unit accomplishes this task.

How does the CSD accomplish a constant RPM?

The CSD is a hydro-mechanical unit and uses an integral oil system to drive the generator at a constant RPM. The CSD is driven by the engine accessory gearbox, which turns at a variable speed based on engine speed.

How is the internal oil of the CSD cooled?

The oil in the CSD is cooled by an air/oil heat exchanger. The air used to cool the oil is from the N1 fan.

What does the FAULT light in the IDG switch light indicate?

This light will illuminate when the IDG oil overheats or oil pressure drops below limits. This FAULT light will also illuminate an IDG caution message on the EICAS.

What are the ways that the IDG can disconnect from the engine gearbox?

- By pressing the associated IDG DISC switch.
- When CSD internal temperature raises to a certain temperature the IDG will disconnect.
- An over torque condition of the CSD will cause the shearing of the IDG drive shaft.

What monitors the generator system?

Each generator has a generator control unit (GCU) that controls and monitors the related generator system. The GCU provides protection and voltage regulation for the associated generator.

When will the engine generator automatically be tripped off line and removed from the bus system?

When any of the following occur:

- Generator or bus over current
- Over or under frequency
- Over or under voltage

What is the output of the APU generator?

115 volt AC 400 Hz, and 30 KVA from SL to 37,000 feet.

Where is the external AC receptacle located?

Forward right side of the fuselage.

What does the green AVAIL light on the flight deck electrical power services control panel and the external service panel indicate?

When external AC power is attached to the aircraft, the external monitor checks the AC ground power for proper voltage, frequency, and phase relationship. If it is good power and available for use these AVAIL lights will illuminate.

What occurs when the AC switch light on the flight deck electrical power services panel has the green AVAIL light illuminated and is pressed?

If there is no other AC electrical power available, the external AC power will supply power. The white IN USE of the switch light will illuminate and the green AVAIL will extinguish.

There is external AC power supplying the aircraft power, what will happen if an engine generator is selected on?

The buses will be supplied AC power from the engine generator and no longer from the AC external power. The green AVAIL lamp on the electrical control panel will illuminate and the white IN USE extinguish, even if the switch light is still selected in.

What buses are powered when external AC power is connected and the green AVAIL switch light on the external services panel is pressed?

The utility and services buses will be powered.

How many AC buses does the electrical system have?

6

What is the purpose of the bus priority system?

It is the automatic fault protection and transfer system of the AC electrical system. AC BUS 1 and 2 are important buses and the bus priority ensures that these buses will be powered.

Example: Generator 1 normally powers AC BUS 1. If there is a fault in generator 1, AC BUS 1 will then transfer to the APU generator. If the APU is not available, it will transfer to generator 2. If generator 2 is not available it will look for external power.

What happens when AC BUS 1 has a short and takes generator 1 off line?

The bus priority system will have AC BUS 1 try to receive power from the APU generator, generator 2, then external power in that order. This could take all the generators off line. The auto transfer inhibit will stop the transfer and a amber FAIL light in the AUTO XFER switch will illuminate. The FAIL means if has done its job. FAIL really means auto transfer inhibit of priority logic.

What are the six AC buses?

1. AC BUS 1 (main bus)
2. AC BUS 2 (main bus)
3. AC ESS (Essential) BUS
4. AC SERV (Service) BUS
5. AC UTIL (Utility) BUS 1
6. AC UTIL (Utility) BUS 2

Where in the aircraft are AC BUS 1 and AC bus 2 located?

AC bus 1 is behind the captain's seat on circuit breaker panel 1 and AC BUS 2 is located behind the co-pilot's seat on circuit breaker panel 2.

What other buses do AC BUS 1 supply power to?

Normally to the AC ESS BUS and AC UTIL BUS 1.

Which other buses does AC BUS 2 supply power to?

Normally to AC SERV BUS and AC UTIL BUS 2.

What is the bus priority for AC BUS 1?

1. GEN 1
2. APU generator
3. GEN 2
4. External power

What is the bus priority for AC BUS 2?

1. GEN 2
2. APU generator
3. GEN 1
4. External power

What does the AC ESS BUS power?

It powers equipment essential for flight and powers ESS TRU 1.

What bus normally powers the AC ESS BUS?

AC BUS 1 normally powers the AC ESS BUS. If there were a failure of AC BUS 1, the ESS BUS would sense this and automatically transfer to AC BUS 2 for its power source.

If AC BUS 1 fails, what would you do if the ESS BUS did not automatically transfer to AC BUS 2?

The ESS BUS could be manually transferred to AC BUS 2 by the AC ESS XFER switch light on the electrical power services panel. This will cause the AC ESS XFER switch light to illuminate white and there will be a white status message AC ESS ALTN on the status page. This electrically connects the ESS BUS to AC BUS 2.

What would occur to the AC ESS BUS if total AC power were lost in flight?

The air driven generator (ADG) would automatically deploy and the AC ESS BUS would be powered. The ADG BUS is powered by the ADG and this bus is connected to the AC ESS BUS.

Aircraft generator power is re-established after a total AC power loss and ADG deployment. Will the aircraft generator now power the AC ESS BUS?

To de-energize the relay between the AC ESS BUS and the ADG BUS, the PWR TXFR OVERRIDE button on the ADG AUTO DEPLOY CONTROL panel must be pressed. This will connect the AC ESS BUS to AC BUS 1.

What bus powers the AC SERVICE BUS?

The AC BUS 2 supplies 115-volts AC to the AC service bus.

What does the AC SERVICE BUS power?

This bus provides power to the service outlets that are used for lavatory and cabin cleaning. The AC SERVICE BUS also powers the service TRU that powers the DC SERVICE BUS.

The cleaning crew needs to clean the aircraft, how would you power only the buses needed for cleaning?

- External power available: If the AVAIL lamp in the EXT AC PUSH switch light on the external services panel is illuminated, the switch light could be pressed and if no other AC power were available to the aircraft, the AC SERVICE BUS and AC UTIL 1 and 2 buses would be powered. No other buses would be powered.

- APU is operating: If the APU is operating and the APU generator is selected off, selecting the APU SERVICE BUS switch light at the flight attendant station will energize the service configuration, which are the AC SERVICE BUS and AC UTIL 1 and 2. Note: Before using this option, refer to the AFM for limitations?

Where do the AC UTIL BUS 1 and 2 receive their power and what do they power?

They receive power from AC BUS 1 and 2 respectively. The AC UTIL Bus 1 and 2 provide power to the battery chargers and galley.

Explain the shedding of the utility buses?

During flight and single generator operation occurs, the utility buses will be automatically shed. This will reduce the electrical loading of the single generator.

The utility buses will also be shed during ground operations with a single generator providing power, the flaps are not up, and the main door and service door are closed. Any two generators (including APU) on line will allow the utility buses to be powered.

During single engine taxing with the APU generator operating and flaps not at 0 degrees, are the utility buses shed?

No, with any two generators on line the utility buses will not be shed.

When the aircraft is in the service configuration, what else is being powered besides UTIL BUS 1 and 2?

The battery chargers are powered so the batteries can be charged.

What are the volts, Hz and KVA provided by the ADG?

The ADG provides 115 volts, 400 Hz, 15 KVA.

What part of the electrical system does the ADG power?

The ADG powers the essential buses in flight, but only when all other AC generators are not providing AC power.

The ADG powers the AC ESS Bus, which powers the ESS TRU 1. The ESS TRU 1 powers the DC ESS Bus and the BATT Bus.

Where is the ADG located?

The ADG is located next to the nose gear on the forward right fuselage.

After deployment of the ADG in flight, how can it be retracted?

It can only be retracted on the ground by maintenance.

What are the general components of the ADG?

It has an AC generator and a variable pitch two-bladed propeller.

What are the two types of ADGs installed in the CRJ?

There is a wet and dry model. The wet is the older model and the constant speed of the generator is maintained by controlling propeller pitch angle hydraulically. The dry ADG is the latest model and the constant speed of the generator is maintained by a counterweight to control the propeller pitch.

What are the airspeed limitations of the ADG?

There are none for the dry model.

For the wet: Maximum continuous airspeed is 250 KIAS. Up to 330 KIAS for 12 minutes and 331 to 335 KIAS for four minutes.

What could be done if auto deployment of the ADG did not occur with the failure of all AC power in flight?

Pulling the ADG manual-deploy handle at the bottom of the center pedestal would manually deploy the ADG. Deployment will be indicated by an ADG shown on the ELEC synoptic page, and EMER PWR ONLY EICAS message.

What will the ADG power when it deploys with all other AC power inoperative in flight?

The ADG bus powers the AC ESS BUS and the ACMP 3B hydraulic pump. The AC ESS BUS then powers the ESS TRU 1, DC ESS BUS, and the BATT BUS.

When will automatic deployment of the ADG in flight occur?

When all three generators are not providing AC power and AC BUS 1 and 2 are not powered.

When the ADG is released manually or automatically, what is releasing the ADG from its uplock?

The wet and dry models have different methods. With the dry model, the ADG control unit sends an electrical signal to the release solenoid. With the wet model, the ADG control unit sends an electrical signal to fire a squib that is part of the ADG up-lock mechanism.

Explain the PWR TXFR OVERRIDE switch?

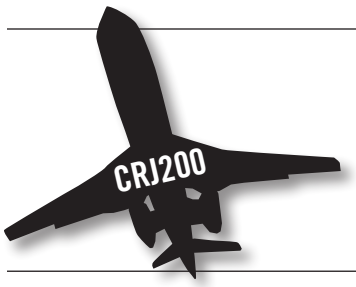
After ADG deployment it may be possible to get an aircraft generator on line. The generator would then be powering most of the AC buses and the PWR TXFR OVERRIDE switch would transfer the AC ESS BUS to the aircraft generator. It would also de-activate the hydraulic pump ACMP 3B.

Explain the LAMP/UNIT switch on the ADG AUTO DEPLOY CONTROL panel.

- LAMP position: This checks the light bulb on the AUTO DEPLOY CONTROL unit.
- UNIT position: AC BUS 1 and 2 must be powered and two generators must be operating for an accurate test. In the TEST position the control unit will check the logic circuit of the control unit and the transfer relay.

What are the sources of DC electrical power?

- 5 transformer rectifier units (TRUs)
- Two NiCad batteries
- DC external power



chapter 6

Engine

What type of engines does the CRJ have?

General Electric CF34-3A1 or CF34-3B1.

What is the normal takeoff thrust rating?

8,729 pounds per engine.

How much thrust is produced when the APR is activated?

9,220 pounds, which is a 2% increase.

Explain the general makeup of the N1 and N2 sections of the engine.

The N1 section is a single stage fan connected to a 4-stage low-pressure turbine by a shaft. The N2 section is a 14-stage axial flow compressor connected to a 2 stage high-pressure turbine by a shaft.

What section of the engine drives the accessory gearbox?

The N2 compressor.

What decreases the engines ability to create thrust?

- Increase in pressure altitude.
- Increase in temperature.

How are the N1 and N2 sections connected?

The N1 and N2 sections are independent.

Explain the two paths that air can take through the engine.

- Bypass air: This air is accelerated by the N1 fan and sent around the engine nacelle.
- Core air: This air is accelerated by the N1 fan and then sent to the N2 section where it is compressed, fuel is added and then ignited. This burned, accelerated gas then drives the N2 and N1 turbine.

The bypass N1 airflow on takeoff produces how much of the thrust?

80%

Do the thrust reversers direct the core or bypass airflow forward to assist in braking?

The bypass airflow is diverted forward.

What improves the efficiency of the N2 compressor and protects against stall and surge damage?

A Variable Geometry Compressor (VG). The VG changes the angle of attack of the inlet guide vanes and the first five stages of the stator vanes. The changing of the angle of attack optimizes the airflow for best efficiency. The Fuel Control Unit (FCU) uses fuel to hydraulically change the angle of the vanes.

Where is the ITT measured?

Between the high and low-pressure turbine.

What equipment does the accessory gearbox drive?

- Alternator, which powers the N1 control amplifier.

- Lubrication pumps for the engine.
- Hydraulic pump.
- Fuel control unit and engine fuel pump.
- Integral drive generator (IDG).

What are the different jobs of the fuel system?

- Provide motive flow to the main ejector pumps and scavenge pumps.
- Lubricate and actuate servos in the FCU.
- Cool engine oil.
- Adjust the variable geometry compressor linkage.

What are the different ways to stop fuel flow to the engine?

- Shut off the thrust lever.
- Press the fire switch light on the glare shield panel.

What is the purpose of the fuel oil heat exchanger?

The exchanger warms the fuel and cools the engine oil.

Are any of the fuel filters displayed on the fuel synoptic page?

Yes, one for each engine.

How would you know the fuel temperature at the fuel filter?

The temperature is displayed next to the fuel filter on the fuel synoptic page.

What occurs when a fuel filter is clogged?

The fuel will bypass the filter. There will be an EICAS caution message along with an amber fuel filter on the fuel synoptic page.

What controls the VG Inlet Guide Vanes and Stator Vanes of the engine compressor?

The Fuel control unit (FCU).

Explain N2 speed control.

During low power settings up to 79% N1, the FCU hydro-mechanically controls the N2 speed of the engine. This is so that matched movement of the thrust levers produces fairly matched N2 rpm.

Explain N1 speed control.

Above 79% N1 the N1 control amplifier controls engine rpm. The engine speed switches have to be on for this to occur. This is so that matched movement of the thrust levers produces fairly matched N1 rpm.

What would happen at cruise flight if the ENG SPEED switches were turned off?

There would be an increase in RPM and ITT that could exceed limitations.

How would you know if there were an impending oil filter bypass?

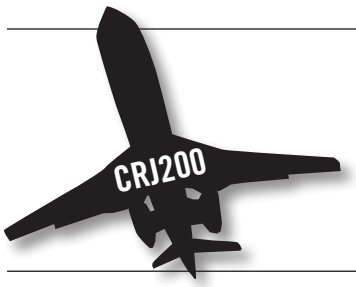
There are no EICAS indications. In the aft equipment bay there are associated indications.

How would you know if a chip detector had detected some metal in the engine oil?

There are no EICAS indications. In the aft equipment bay there are associated indications.

How can the engine oil be checked and replenished?

Located on the captain's side panel is the ENGINE OIL LEVEL control panel. The level can be tested and filled from this panel.



chapter 7

Environmental Control

What stage of the engine do the packs get air from?

The 10th stage is where pack air is extracted.

Where are the air condition units located?

They are located in the aft equipment bay.

Where is the air distributed that comes from the left and right pack?

The left pack will normally supply the cockpit and the right pack will supply the cabin.

What regulates the pressure of the air from the 10th stage before it enters the pack?

Due to the extreme pressure of the air from the 10th stage, the air could damage the pack if the pressure was not reduced. This is the job of the pack pressure regulating shutoff valve (PRSOV) and is used to reduce the pressure of the air before it enters the pack.

What would occur if the PRSOV failed?

The valve would close, the pack would shut down and a pack high pressure EICAS message would be displayed.

How does the PRSOV help a single pack supply sufficient pressure to the flight deck and the cabin during single pack operations?

There are two pressure settings, one for dual pack and one for single pack. When two packs are available, the PRSOVs reduce the 10th stage pressure to a normal pressure. During single pack operations the single PRSOV will increase the operating pressure, which will permit the single pack to supply the cabin and flight deck with sufficient airflow. It will not be at the same volume as with both packs operating.

What is the single pack operating altitude limit?

25,000 feet

What cools the hot air for the air conditioning system?

An air cycle machine and heat exchangers cools the hot compressed air.

What is the purpose of the ram air scoop at the base of the vertical stabilizer?

Air enters this scoop and is used as the cooling means for the air-to-air heat exchangers. The ram air flows across the pre-cooler and dual heat exchangers thus cooling the pack air. The cooling ram air exits through the vents located on the lower right and left sides of the fuselage in the aft area. When the aircraft is on the ground there is no ram air to enter the scoop, so a fan that is driven by the air cycle machine draws the air in the scoop.

Explain the RAM AIR switch light on the air conditioning panel.

This switch light controls the ram air shut off valve. When selected open, it will direct air that enters the ram air scoop to enter the left distribution duct. This duct will ventilate the flight deck and cool the EFIS and EICAS equipment. Only a small portion will ventilate the cabin. This switch will only work with the packs off.

What are the sources of air conditioning bleed air?

- APU
- Engines
- External air cart

What is the altitude limit for extracting bleed air from the APU for air conditioning? What will happen if the APU is used for bleed air above his altitude?

The limit is 15,000 feet. If this altitude is exceeded the EICAS caution message APU BLEED AIR ON will appear.

Where is the left pack air distributed?

The air will be sent to the flight deck gaspers, vents and side console outlets. It will also be used for EICAS and EFIS display cooling.

Where is the right pack air distributed?

It is distributed to the floor outlets in the passenger cabin, lavatory, galley, and the gaspers on the PSUs.

Where is the cabin air exhausted?

The air sent under the floor to outflow valves on the aft pressure bulkhead.

Where is the low-pressure ground air connection?

It is located behind the wing on the right side of the aircraft.

Does the low-pressure air cart supply air to the packs for the aircraft cooling?

No, the air is sent directly to the distribution manifold, which then travels to all the outlets.

What must be done before the low-pressure air can be turned on?

The main cabin door or avionics bay door must be open.

Explain how suitable airflow is maintained in the cargo bay.

A fan draws re-circulated passenger cabin exhaust air from under the floor into the cargo bay to maintain suitable airflow and temperature.

In addition to the re-circulated air, there is an optional automatic temperature control that uses right fresh pack air for cooling and an electric heater for increasing temperature. This controller maintains the temperature in the cargo bay that is better suited for live animals.

What happens to the cargo SOVs if the cargo smoke detectors detect smoke?

The SOVs used for circulation of air will automatically close. If COND AIR is selected, the SOV from right pack for air-conditioned air will close and the heater turned off.

What happens when FAN is selected on the cargo fan switch?

A fan is energized and the cargo re-circulation and exhaust shutoff valves are opened. Air is then taken from the passenger cabin exhaust duct and used to supply suitable airflow to the cargo bay.

What happens when COND AIR is selected on the cargo fan switch?

An SOV is opened that allows right pack air into the cargo fan ducting. The air then flows to a heater before flowing to the cargo bay. Temperature is controlled by a heater cycling on and off as commanded by a thermostat located in the exhaust ducting.

Is overheat protection provided in the cargo bay?

Overheat protection is provided only with the condition air option selected.

What does an amber CARGO OVHT on the EICAS indicate?

This EICAS message will only occur if the conditioned air option is installed. If the cargo bay temperature reaches 35 degrees C and conditioned air is selected, an overheat condition is detected. The heater is de-energized and the EICAS CARGO OVHT is presented. The CARGO COND AIR switch should be selected to FAN.

When there is a CARGO OVHT with the condition air option, and the cargo fan switch is selected from COND AIR to FAN, what does this do?

This takes the power away from the over temperature circuitry and removes the indication from the EICAS display. This cargo intake and exhaust SOV's are still open so there is suitable airflow. It matches the condition since the heater is automatically turned off.

How is cabin pressurization maintained?

By the two outflow valves controlling the rate the air leaves the vessel.

What happens to the cargo air when one or both of the cargo smoke detectors detect smoke?

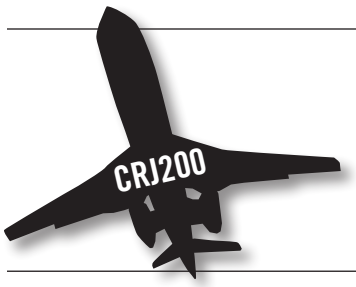
The cargo intake and exhaust SOVs close, the cargo fan shuts down, the optional condition air valve closes and the heater shuts down.

Briefly explain how the outflow valves operate.

There are two outflow valves located on the aft bulkhead that control the amount of air leaving the aircraft. Vacuum pressure from a jet pump driven from the 10th stage bleed air manifold is used to open the outflow valves, which are held closed by springs.

Explain the automatic mode of the cabin pressure controllers (CPCs).

In the automatic mode the outflow safety valves open via CPCs sending electrical signals to control the vacuum. The CPC will open and close the outflow valves to control cabin pressure.



chapter 9

Flight Controls

What is the purpose of the spoilerons?

The spoilerons aid the ailerons to provide greater roll response at low airspeeds.

How are the aileron, elevator and rudder surfaces moved?

Through the controls on the flight deck, control movement is transmitted via cable and/or push rods to the power control units (PCU) that will hydraulically move the surface.

How many PCUs are on each aileron?

2

Explain how the aileron control system is actually two separate systems.

The pilot controls the left aileron and the co-pilot controls the right aileron. Under normal operations the aileron controls are interconnected with coordinated movement of the control surfaces.

How are the spoilerons moved?

Hydraulically, but electronically controlled by fly-by-wire.

Explain the Spoiler Electronic Control Units (SECU 1 and SECU 2).

The SECUs receive an electrical signal from the control wheels when they are moved. The SECUs then take this control movement information with other information like airspeed to determine the amount of spoileron deflection. The spoilerons will operate only on the wing that goes down to assist with roll.

What keeps the aileron control surface from fluttering in flight if all hydraulic pressure is lost to a PCU?

Each aileron has a flutter damper to prevent flutter.

What serves as a gust lock for the ailerons on the ground?

The flutter damper along with the PCUs. Hydraulic pressure is locked in the system to prevent movement.

What is the purpose of the aileron disconnect function (roll disconnect)?

Allows the crew to separate the left control wheel and associated cable system from the right. This can be useful in case of a jammed aileron control system or a PCU runaway.

What happens when the ROLL DISC handle is pulled?

The control wheel interconnect (torque tube) is separated and it will advise the SECU that the interconnect torque tube has been disconnected. The pilot has control of the left aileron and the right spoileron. The co-pilot has control of the right aileron and left spoileron.

Twenty seconds after pulling the ROLL DISC handle, the SECU will illuminate the two amber ROLL SEL lights on the glare shield to illuminate and display the EICAS caution SPOILERONS ROLL message. The pilots then need to determine which side is not jammed and select the ROLL SEL switch light on the non-jammed side and this will provide the flying pilot with the use of the onside spoileron.

Selecting the ROLL SEL will remove the amber ROLL SEL lights on the glare shield and the EICAS caution. The green PLT ROLL CMD or CPLT ROLL CMD will appear on glare shield and on the EICAS depending which ROL SEL switch light was selected.

What happens if an aileron PCU causes an un-commanded roll, with a runaway aileron?

A bungee breakout switch with the aileron system that is running away sends a signal to the SECU. The SECU then will command both spoilerons to respond to control wheel inputs and will present on the EICAS PLT ROLL CMD or CPLT ROLL CMD. The SECU will also illuminate the green ROLL SEL switch light on the glare shield in front of the pilot that should take control prior to ordering the ROLL DISC handle to be pulled.

What are the two situations that would require the use of the ROLL DISC handle?

- A jammed aileron.
- An un-commanded displacement of an aileron PCU.

How many PCUs power the rudder?

3

How is rudder jam protection provided?

Anti-jam/breakout protection (spring tension breakout) is provided to both sets of pedals. In case of a jammed rudder control, both sets of pedals will remain working but additional pedal force will be required to move the rudder.

Is there any gust lock protection for the rudder?

When the hydraulic systems are depressurized, the trapped fluid will prevent rudder movement.

How many degrees will the rudder move?

The rudder will move 25 degrees in both directions.

What is the purpose of the yaw dampers (YD)?

They improve directional stability and turn coordination. If these oscillations were not corrected by the YDs it could cause dutch roll.

Are the yaw dampers connected to the autopilot?

The yaw dampers operate separately.

What commands the movement of the yaw dampers?

The flight control computers (FCC) operate the yaw dampers. FCC 1 controls yaw damper 1 and FCC 2 control yaw damper 2.

What is the function of the YD 1 and YD 2 button on the YAW DAMPER panel?

They engage the associated yaw damper.

How are the yaw dampers disengaged?

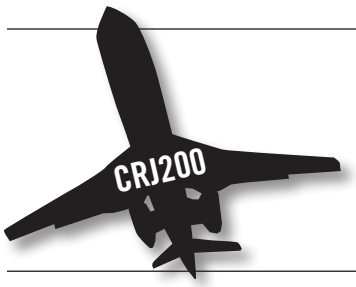
- The yaw damper DISC button on the YAW DAMPER panel.
- If the YD channel fails.
- Upon landing.

What occurs if both YDs fail?

If the autopilot is engaged it will disconnect and their will be an EICAS caution message that both YDs are off line.

How is pitch control provided?

By the elevators and assisted by a moveable horizontal stabilizer.



chapter 10

Flight Instruments

What formats can be selected on the multi-function display (MFD)?

- Radar
- FMS plan map
- TCAS
- FMS map
- Navaid sector
- HSI

What is the purpose of the Display Reversionary Panel (DRP)?

The switch is used to change the format on the associated MFD to a PFD or EICAS format.

What is the purpose of the Source Selector Panel?

If there is a failure of an air data computer, attitude/heading computer, EICAS or display control panel (DCP), this panel will allow an alternate source for the system to be selected.

Explain the ATT HDG switch on the source selector panel.

- *Norm*: The pilot and co-pilot electronic flight displays receive data from onside AHRS.

- *Position 1 and 2*: The pilot's and copilot's electronic flight displays receive data from AHRS 1 in position 1 and AHRS 2 in position 2. There will be an amber message on the PFD and or MFD displaying the source.

Explain the AIR DATA switch on the source selector panel.

- *Norm*: The pilot and co-pilot electronic flight displays receive data from the on-side air data computer (ADC).

- *Position 1 and 2*: The pilot and copilot's electronic flight displays will display data from ADC 1 in position 1 and ADC 2 in position 2. On both PFDs there will be displayed an amber ADC 1 or 2 depending on selection.

Explain the DSPL CONT switch on the source selector panel.

- *Norm:* The pilot and copilot's electronic flight displays are controlled by the respective DCPs.

- *Position 1 and 2:* In position 1, the pilot and copilot's electronic flight displays are controlled by the pilot's DCP. In position 2, the copilot's DCP controls the pilot and copilot's electronic flight displays. On both MFDs and PFDs there will be an amber source message.

Explain the EICAS switch on the source selector panel.

When either ED1 or ED2 EICAS display fails, the remaining operative ED can display all EICAS pages.

Example: ED1 fails and the primary page automatically transfers to ED2 and this makes the ECP inactive. To regain the use of the ECP, select ED2 on the source selector panel. This will reactivate the ECP and all pages can now be displayed on ED2. If ED2 fails, selecting ED1 allows all pages to be viewed on ED1 through the ECP.

What is the name of the panel that allows airspeeds to be set?

The Air Data Reference Panel (ARP).

What is the name of the panel that allows the NAV SOURCE to be set?

The Display Control Panel (DCP).

What is the name of the panel that allows autopilot commands to be set?

The Flight Control Panel (FCP).

Explain the EFIS Comparison Monitor.

The primary flight display (PFD) continuously monitors itself in comparison to the other PFD. When the EFIS PFDs detect a comparison disagreement between each other an amber EFIS COMP MON is displayed on the primary page of the EICAS. The data message associated with the disagreement will flash for 5 seconds on the PFDs and then stay steady as long as the comparison error exists.

What does an amber HDG message on the PFDs indicate?

There is a difference of more than 6 degrees between each AHRS.

What does an amber ROL message on the PFDs indicate?

There is a difference of more than 4 degrees roll or 3 degrees if the glide slope is captured.

What does the amber PIT message on the PFDs indicate?

There is a difference of more than 4 degrees pitch or 3 degrees after the glide slope is captured.

What does the amber IAS message on the PFDs indicate?

There is a difference of more than 10 knots between PFDs.

What does the amber ALT message on the PFDs indicate?

There is more than 60 feet difference between PFDs.

What does the amber LOC message on the PFDs indicate?

There is a difference between the localizer receivers.

What does the amber GS message on the PFDs indicate?

There is a difference between the glide slope receivers.

What does the amber RA message on the PFDs indicate?

There is a difference between the radio altimeters below 1000 feet AGL.

What systems do the pitot static system supply information to?

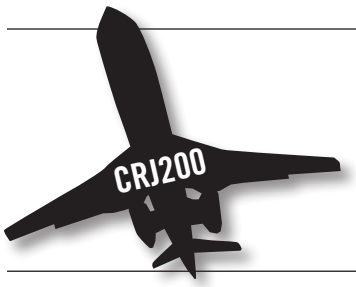
- Air data computers (ADC)
- Stall protection system (SPS)
- Cabin pressure acquisition module (CPAM)
- Standby air data system (ADS)
- Mach transducer of the stall protection system

Where is the total air temperature (TAT) probe located?

Located under the copilot's side window.

Explain the TAT probe.

Total air temperature is determined by this probe and supplied to the ADCs. The ADCs then use the TAT information to calculate and display on the EFIS the true airspeed (TAS), static air temperature (SAT), and total air temperature (TAT).



chapter 11

Fuel System

What provides static and dynamic venting for the fuel tanks?

NACA vent scoops under the wings provide static and dynamic venting.

Where are the collector tanks located?

The two collector tanks are located in the center tank at a point that is lower than the left or right wing tanks.

What are the maximum fuel tank capacities?

	Pressure	Gravity
Left Wing	4760 lbs. (2159 kg)	4488 lbs. (2036 kg.)
Right Wing	4760 lbs. (2159 kg)	4488 lbs. (2036 kg.)
Center	4998 lbs. (2267 kg.)	4930 lbs. (2237 kg.)
Total	14518 lbs (6585 kg)	13906 lbs. (6309 kg)

Explain the construction of the wing fuel tanks.

The wing tanks are a wet wing design. A sealant is used to seal the tanks so this makes the wing the tank.

How is gravity defueling accomplished?

A gravity defueler adapter can be inserted into the fuel drain valves to accomplish gravity defueling.

How is fuel prevented from flowing to the wing tip during wing low maneuvers?

There are one-way flow valves in each wing tank that prevent the flow of fuel to the wing tip.

Explain the fuel vent system.

The NACA scoops have vent lines connected to the tanks to provide static and dynamic pressure. In flight the NACA vents will provide ram air pressure to maintain a positive pressure on the fuel in the tanks.

Static ventilation of the tanks during ground operations is provided through the NACA vents. They will also relieve pressure caused by fueling or thermal expansion. To prevent fuel from coming out of the NACA vent when the aircraft is being refueled, the NACA vent line drains the fuel trapped in the vent lines back into the center tank.

During climb you notice the total fuel in the center tank increase by 300 lbs, is this a problem?

This is not a problem. It is possible for fuel to flow to the center tank from the vent system during climb and cause the fuel quantity readings of the center tank to increase as high as 300 lbs.

What monitors and controls the operation of the fuel system?

A dual-channel fuel system computer.

Do both fuel computer channels operate at the same time?

One channel operates at a time. When the active channel fails, the standby channel will assume control.

Where is the temperature of the fuel measured?

- Left wing tank
- In the fuel line to each engine

Explain the general operation of ejector pumps.

Motive fuel flow must come from a source like the engine high-pressure fuel pump. This motive flow is passed through a venturi-shaped nozzle. The fuel exits the nozzle at an increased velocity that creates a low pressure. This low pressure creates a suction that draws fuel out of the tank.

What powers the fuel ejectors?

Motive flow from the engine high-pressure pump. High-pressure fuel flows through a venturi-shaped nozzle of the ejector, which creates a low pressure. This then draws fuel out of the tank by suction.

How is fuel transferred from the wing tanks to the collector tanks?

Fuel is transferred by scavenge ejectors. A scavenge ejector is located at the lowest inboard point of each wing tank.

How is fuel moved from the collector tank to the high pressure engine driven fuel pump?

There is one main ejector pump for each collector tank. Motive flow to operate the main ejector is provided by the high-pressure output of the engine driven fuel pump.

How are the boost pumps powered?

The boost pumps are DC powered.

What are the purposes of the electric fuel boost pumps?

- To transfer fuel from the collector tanks to the engines.
- As a backup to the main ejectors when the ejector fails.
- Provide fuel pressure during engine start.

Are the electric boost pumps required for engine start?

No, the engines will start without them.

When will the electric boost pumps operate with the L and R boost pump switch light selected?

Both pumps will operate when the fuel computer detects low fuel feed pressure in either feed manifold.

Which electric boost pump will operate with just DC power?

The left DC pump.

Explain the transfer ejectors?

There are two transfer ejectors located in the aft section of the center tank and perform the job of transferring fuel from the center tank to the wing tanks. Motive flow created by the high-pressure output of the main ejectors operates the transfer ejectors.

Explain the engine fuel shutoff valves (SOV).

The associated ENGINE FIRE PUSH switch light on the glare shield electrically controls the SOV. Their purpose is to stop the flow of fuel to the engines. This switch light is located on the emergency bus so it is always powered.

Where is the engine fuel temperature indication located?

On the FUEL synoptic page.

How is the fuel heated before it enters the engine?

The fuel is heated by a fuel/oil heat exchanger located on each engine. Hot engine oil passes through the heat exchanger to heat the fuel.

How many fuel filters are installed?

There is one fuel filter per engine.