T-6B Electrical System
Objectives

• Identify power sources of electrical system
• Understand electrical distribution within system
• Identify location and understand operation of circuit breaker panels

(Utilize electrical system schematic while reviewing this slideshow)
References

• **T-6B NATOPS Manual**
  - **Section 1**
    - Electrical Power Supply System
    - Starter/Generator
    - Battery
    - Auxiliary Battery
    - External Power
    - Bus Tie Switch
  - **Section 8, Chapter 4**
    - Visual Communications

• **Section 5**
  - Figure 5-1 Instrument Markings
  - Battery/Starter Limitations
  - Generator Limitations
Electrical System Overview

- System mainly a DC system
- System power supplied by Starter/Generator
- Battery allows for stored power and engine starts
- Auxiliary Battery utilized as emergency source of power
- Electric power distributed by numerous electrical bus & avionics bus (separated by battery or generator side)
- Ability to isolate generator side from battery side through use of Bus Tie
Power Sources (Starter/Generator)

- Dual use system as starter or generator
- 28V/300amp
- Location
  - Left side of engine accessory compartment
  - Cooled by air intake duct routed from left side of engine cowl
- Primary aircraft power
- Generator Control Unit (GCU)
  - Located in rear cockpit, under panel immediately aft of OBOGS regulator
  - Keeps generator output within system limits
- **Battery charging**
  - Generator needs to supply a minimum of 25V to charge battery
  - Bus Tie Switch must be NORM (closed) to allow charging

- **Auxiliary Battery charging**
  - Normally generator powers Fwd Bat Bus which in-turn charges Aux Bat
  - Bus Tie Switch must be NORM (closed) to allow charging
Power Sources
(Starter/Generator)

- **Controls & Indicators**
  - Right Forward Switch Panel
    - GEN switch and GEN Reset button (both cockpits)
    - Metal flap for turning off Bat & Gen together
    - Magnetic switch
    - Selecting GEN switch “ON” in one cockpit will de-energize/turn switch off in other cockpit
    - Reset button resets generator when generator malfunctions
  
- **EICAS**
  - Information sent to EICAS by EDM
  - Displays system volts and amps in environmental section
  - Positive amps = battery charging
  - Color codes for normal/caution/exceedance
  - A GEN CAS warning illuminates when generator inoperative

- **Limits**
  - Inflight: +50 to -2 amps
  - Ground/Inflight: 28.0 to 28.5 volts (notify mx if outside)
  - If generator voltage is continuously below 25V battery power is degraded and land as soon as practical

Amps/Volts Indications

Generator Switch

Generator Reset Button
• 24V/42amp, lead-acid battery

• Located in left side of engine accessory compartment

• Provides power for engine starts

• Provides power to electrical system when generator fails
  • Capable of powering entire system (except air conditioning)
  • 30 min of power with Bus Tie Switch “OPEN” (generator side de-energized)

• Battery charging
  • Accomplished by generator or external power
  • Generator needs to supply a minimum of 25V to charge battery
  • Bus Tie Switch must be NORM (closed) to allow charging by generator
**Power Sources**

(Battery)

- **Battery** (24v/42a hr)
- **Starter/Generator** (28v/300a hr)

- **Control & Indicators**
  - Right Forward Switch Panel
    - BAT switch for power application (both cockpits)
    - Metal flap for turning off Bat & Gen together
    - Magnetic switch
    - Selecting BAT switch “ON” in one cockpit will de-energize/turn switch off in other cockpit
  - **EICAS**
    - Displays system volts and amps in environmental section
    - Positive amps = battery charging
    - Color codes for normal/caution/exceedance
  - **Limits**
    - Do not connect external power below 22.0V
    - 23.5V minimum for engine start using battery start
Power Sources
(Auxiliary Battery)

- 24V/5amp
- Located in left avionic compartment (left E-bay)
- CB on Battery CB Panel (front cockpit left side)
  - Aux Bat will not charge if CB popped
- When generator & battery fail, provides power to:
  - Backup Flight Instruments (BFI)
  - Com 2 (standby VHF)
  - Fire detection loop #1
- Provides 30 minutes of power
- Auxiliary Battery charging
  - Normally generator powers Bat Bus which in-turn charges Aux Bat
  - Bus Tie Switch must be NORM (closed) to allow charging
Power Sources
(Auxiliary Battery)

• Controls & Indicators
  • Right Forward Switch Panel
    • AUX BAT switch for power application
    • Front cockpit only
  • System Test Panel
    • Front cockpit only
    • Tests aux battery power level
    • Hold switch for a minimum of 5 seconds ensuring light remains illuminated

- EICAS Volts
  - Normal
  - Caution
  - Exceedance

- Starter/Generator
  - (28v/300a hr)
  - Inflight: +50 to -2 amps
  - Ground/Inflight: 28.0 to 28.5 volts

- Starter Relay
- Bus Tie Switch
- Gen Switch
  - OPEN
  - NORM

- External: 22v
- Normal: 29.5v
- Exceedance: 32.2v

- Aux Battery
  - Switch
  - (24v/42a hr)
  - Min 22v Ext Pwr
  - Min 23.5v Batt Start
  - To Hot Bus

- Controls & Indicators
  • Right Forward Switch Panel
    • AUX BAT switch for power application
    • Front cockpit only
  • System Test Panel
    • Front cockpit only
    • Tests aux battery power level
    • Hold switch for a minimum of 5 seconds ensuring light remains illuminated

- Aux Battery
  - Switch
  - Test Switch
  - Test Light

- System Test Panel
  • Front cockpit only
  • Tests aux battery power level
  • Hold switch for a minimum of 5 seconds ensuring light remains illuminated

- Aux Battery
  - Switch
  - Test Light

- System Test
  • AUX BAT
  - Switch
  - Test Switch

- Aux Battery
  - Test Switch

- EICAS Volts
  - 22v
  - 29.5v
  - 32.2v
  - Normal
  - Caution
  - Exceedance

- Controls & Indicators
  • Right Forward Switch Panel
    • AUX BAT switch for power application
    • Front cockpit only
  • System Test Panel
    • Front cockpit only
    • Tests aux battery power level
    • Hold switch for a minimum of 5 seconds ensuring light remains illuminated

- Aux Battery
  - Switch
  - Test Switch
  - Test Light

- System Test Panel
  • AUX BAT
  - Switch
  - Test Switch

- Aux Battery
  - Switch
  - Test Switch

- EICAS Volts
  - 22v
  - 29.5v
  - 32.2v
  - Normal
  - Caution
  - Exceedance
- Located on left side, below left avionics bay door
- Controlled by BAT switch (must be on & minimum of 22V)
- Connects power to Fwd Bat Bus for distribution to electrical system
- Internal protection for over/under voltage (automatically disconnects from system)
**Electrical Bus Bar**
- Main way to mass distribute electricity in a system
- Physically a “bus” is a metal bar
- Place various systems on one or numerous electrical bus for ease of isolation or electrical loading

**Circuit Breaker (CB)**
- Placed between electrical bus and equipment wired to bus
- Prevents too much current (amps) from damaging equipment
- Number on CB indicates max amperage at which CB will “pop”
Power Distribution
(Circuit Breaker Panels)

Battery
(24V/42A hr)

Ext Pwr
Bat Switch

Gen Switch
Bus Tie
Switch

Aux Battery
(24V/5A hr)

22V
29.5V
32.2V

EICAS Volts
Normal
Exceedance

OPEN
NORM
BAT
GEN
ON
OFF
Charge
Charge

Starter/Generator
(28V/300A hr)

Starter
Relay

Inflight: +50 to -2 amps
Ground/Inflight: 28.0 to 28.5 volts

Min 22V Ext Pwr
Min 23.5v Batt Start

To Hot Bat Bus

To Bat Bus

To Gen Bus

To Aux Bat Bus

Battery CB Panel
Generator CB Panel
Power Distribution
(Hot Battery Bus)

- Bus has power anytime the Battery is connected and has voltage
- Items on the bus are considered essential to always have power
- Circuit breakers in left side of accessory compartment above Battery
• **Forward Gen Bus**
  - Powered when GEN switch placed ON
  - Powers various systems (air conditioning being highest power consumption)
  - A GEN BUS CAS warning illuminates when Fwd Gen Bus inoperative

• **Bus Tie**
  - Switch on right forward switch panel (front cockpit only)
  - Allows Generator to power battery bus side of electrical system
  - NORM position closes relay
  - A BUS TIE CAS caution illuminates when Bus Tie is open or inoperative
    - Generator & Battery Bus are isolated from each other
    - Bat/Aux Bat will not be charged
**Power Distribution (Forward Battery Bus)**

- **Forward Battery Bus**
  - Normally powered by Generator thru Bus Tie
  - Can also be powered by Battery (if Generator failure)
  - Powers some important but basic systems
    - Start up: IAC #1/RH MFD (to get EICAS display) & UFCP (radios)
    - Eng Start: Starter/Boost Pump/Ignition/PMU/EDM
    - Flight: Landing Gear Control/Flap Control/Prop System/Trim
  - Generator charges Aux Bat via the Fwd Bat Bus
  - Generator or Battery powers Aux Bat Bus via the Fwd Bat Bus
  - A BAT BUS CAS warning illuminates when Fwd Bat Bus inoperative or when bus voltage drops below 11.8V

- **Auxiliary Battery Bus**
  - Critical items for continued flight during emergencies
    - Backup Flight Instruments (BFI)
    - Com 2 (standby VHF)
    - Fire detection loop #1
  - CB section labeled “STANBY” on Battery CB Panel to isolate bus items & Aft Bus
  - Normally powered by Generator or Battery via the Fwd Bat Bus
  - Powered by Aux Bat in emergency
    - Gen & Bat inoperative
    - AUX BAT switch ON
    - 30 min of power (time dependent on amount of radio transmissions)
**Power Distribution (Aft Generator & Battery Bus)**

- **Aft Generator Bus**
  - Powered by Fwd Gen Bus
  - CB on Gen CB Panel
  - Can isolate aft bus from front cockpit if single-pilot

- **Aft Battery Bus**
  - Powered by Fwd Bat Bus
  - CB on Bat CB Panel
  - Powers RH MFD & UFCP for rear cockpit
  - Can isolate aft bus from front cockpit if single-pilot
**Power Distribution (Avionics)**

- **Avionics Master Switch**
  - On front right switch panel (front cockpit only)
  - De-energizes avionics relay (relays close) allowing power to avionics buses
    - Fwd Bat Bus powers Fwd Avi Bat Bus
    - Fwd Gen Bus powers Fwd Avi Gen Bus
- **Circuit Breaker**
  - On Bat CB Panel
  - If CB pops, relays de-energized and close, turning on avionics regardless of switch position
Power Distribution
(Forward Avi Generator Bus)

- **Powered by Fwd Gen Bus**
- **Powers important avionics items critical for instrument flight**
- **Circuit Breakers**
  - CBs on Gen CB Panel
  - Individual CBs for items
  - One CB for entire bus isolation

![Diagram of Power Distribution](image-url)
Power Distribution
(Aft Avi Generator Bus)

- Powered by Fwd Avi Gen Bus
- Powers LH MFD in aft cockpit
- Circuit Breakers
  - CB on Gen CB Panel
  - Can isolate aft bus from front cockpit if single-pilot

- Min 22v Ext Pwr
- Min 23.5v Batt Start
- Inflight: +50 to -2 amps
- Ground/Inflight: 28.0 to 28.5 volts

- EICAS Volts
  - 22v: Caution
  - 29.5v: Normal
  - 32.2v: Exceedance
- Powered by Fwd Bat Bus
- Powers Ctr MFD in front cockpit
- Circuit Breakers
  - CBs on Bat CB Panel
  - Individual CBs for item
  - One CB for entire bus isolation
Power Distribution
(Aft Avi Battery Bus)

- Powered by Fwd Avi Gen Bus
- Powers Ctr MFD in aft cockpit
- Circuit Breakers
  - CB on Bat CB Panel
  - Can isolate aft bus from front cockpit if single-pilot
Aircraft made to fly single pilot from front cockpit so need the ability to isolate various equipment and buses from front cockpit.

Battery CB Panel has:
- Fwd Bat Bus (individual item CBs)
- Aft Bat Bus (Bus CB)
- Aux Bat Bus (individual item CBs)
- Aft Aux Bat Bus (Bus CB)
- Fwd Avi Bat Bus (Bus CB & individual item CBs)
- Aft Avi Bat Bus (Bus CB)

Generator CB Panel has:
- Fwd Gen Bus (individual item CBs)
- Aft Gen Bus (Bus CB)
- Fwd Avi Gen Bus (Bus CB & individual item CBs)
- Aft Avi Gen Bus (Bus CB)
Conclusion

- Identified power sources of electrical system
- Discussed basic electrical distribution within system
- Identified and discussed location and operation of circuit breakers

Abnormal Electrical Scenarios located in Procedures Section/EPs