B737 NG CBT - ELECTRICAL

COURSE OUTLINES

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COURSE START

1-The material contained in this training program is based on the information obtained from current state, local and company regulations and it is to be used for training purposes only. At the time of designing this program contained then current information. In the event of conflict between data provided herein and that in publications issued by the authority, the authority shall take precedence.

ELECTRICAL SYSTEM

2-This chapter introduces you to the airplane electrical system and provides an overview of its organization, operation, controls and indications. Here is the chapter outline: • Electrical system in general • AC power system • DC power system • Standby power system • Electrical system controls and indications review

INTRODUCTION

3-The purpose of the electrical system is to produce, supply, and control electrical power. In modern aircraft, electrical power is needed for: heating such as anti-ice system and galley heating; interior and exterior lighting. It is also required to produce mechanical power for pumps, actuators and valves and to feed electronic devices such as computers, indicators and sensors. Let’s first review some basics of electricity to have a better understanding of the aircraft electrical system.

4-Electric current is the flow of electrons through a conductor. It is measured in ampere. There are two types of electric current: direct current (DC) and alternating current (AC).

5-Direct current is the electric current which flows constantly in the same direction. A battery produces direct electric current. If an electric current reverses its direction of flow at regular intervals, it is called an alternating current. An alternating current generator produces alternating current.

6-Voltage is the force which pushes electrons and creates the flow of current in a circuit. It is measured in volts.

7-The number of complete variations of alternating current in each direction in one second is called frequency. Its unit is cycles per second or Hertz. The frequency of alternating current used in aircraft has a frequency of 400 Hertz.

8-In the context of AC generation phase, in broad terms, represents the number of alternating currents produced by an AC source. A single phase AC source produces a single alternating current. A three phase AC source produces three individual alternating currents.

9-It is possible to convert electrical current from one form into the other form. A static inverter converts direct current into alternating current. A rectifier is used to convert alternating current into direct current.

10-The rectifier is usually combined with a transformer to form a transformer rectifier unit or TR unit. A transformer rectifier unit changes voltage level of alternating current and converts it into direct current.

11-In most types of airplanes, output from the electrical power source is sent to one or more conductors before distribution throughout the system. These conductors are called bus bars or briefly buses. Bus bars are distribution centers for electrical power in an aircraft and provide pre-determined routes to circuits and components throughout the aircraft. In its simplest meaning, you may consider a bus bar as a power strip.

ELECTRICAL POWER SYSTEM IN GENERAL

12-Aircraft electrical power system consists of two subsystems: electrical power generation and electrical power distribution. Power generation system produces electrical power with necessary parameters. Power distribution system supplies electrical power to all users. Both systems have automatic and manual controls and protection.

13-Both power generation and power distribution systems are further divided into AC subsystem and DC subsystem.

Electrical Power Generation

14-The Figure indicates simplified schematic of the available electrical power sources for the airplane. There are five power sources used for AC generation: the left and right engine integrated drive generators (IDGs), APU generator, external power and static inverter.

15-The integrated drive generators are the normal AC power source during flight. An IDG consists of a constant speed drive section and an AC generator, which are lubricated and cooled by a self–contained oil system. The constant speed drive section ensures that the generator turns at a constant speed regardless of the engine speed. There are two IDGs on the airplane. Each engine drives its own IDG. Each IDG supplies three-phase, 115 volt alternating current with a frequency of 400 Hertz.

16-The APU generator is driven by the auxiliary power unit. APU generator can provide AC power on the ground for ground operations and during flight as backup to the IDGs. The APU generator supplies 3 phase 115 volt AC power at 400 Hz and can meet the electrical power requirements for all ground conditions and most flight conditions.

17-External power is the normal AC power source on the ground. It is connected to the airplane through a receptacle on the lower right side of the fuselage.

18-The static inverter uses DC power to produce single phase, 115 volt, 400 Hertz AC power for the AC standby bus which feeds very important AC systems when no other AC power source is available.

19-There are two DC power sources on the airplane, the transformer rectifier units (TR units) and the batteries.

20-The TR units convert three phase, 115 volt AC into 28 volt DC. These units are the normal DC power sources.

21-There are two batteries with their chargers: the main battery and auxiliary battery. The batteries are the backup DC source if other sources do not operate. They provide 24 volt DC to the DC power distribution when no other power source is available.

Electrical Power Distribution

22-Now let's take a look at the supply of AC and DC electrical power distribution. Each engine IDG supplies power to its associated AC transfer bus via a generator circuit breaker or GCB. The GCB connects or disconnects the IDG to or from its transfer bus when necessary. AC transfer buses can be connected through a bus tie and 2 bus tie breakers or BTBs. BTBs allow an available AC source to supply power to an AC transfer bus when the generator that feeds this transfer bus fails. AC transfer buses supply AC power to other AC buses and transformer rectifier units.

23-The APU generator supplies power to each AC transfer bus through the APU breaker (APB) and the necessary BTB. The APU generator is able to supply all necessary power to both AC transfer buses for all ground conditions and most flight conditions.

24-External power supplies electrical power to each AC transfer bus through the external power contactor (EPC) and the necessary bus tie breaker (BTB). It provides electrical power sufficient for consumers needed on the ground.

25-The TR units are the normal power source for the DC distribution buses. Thus, their outputs are connected to the DC buses.

26-The main battery supplies power to critical airplane systems if the normal power sources are not available. It powers the hot battery bus, switched hot battery bus, battery bus and DC standby bus. The main battery also supplies DC power to static inverter which, in turn, powers AC standby bus. The auxiliary battery is normally isolated from the system. It helps the main battery to supply DC power to the critical airplane systems.

27-The battery chargers with the TR units convert AC into DC to keep the batteries at full electrical power. The main battery charger also serves as a normal source of DC power for hot battery and switched hot battery buses.

28-For ground servicing, a ground service switch on the forward attendant panel is used to supply external power to ground service bus 1 and 2 with external power connected. This makes it possible to supply electrical power for utility outlets, cabin lighting and the battery charger without powering all electrical buses.

29-You should note that operation of the 737 electrical systems is based on two basic principles. AC power sources cannot be connected to a transfer bus at the same time. Thus, there is no parallel operation of the AC sources. If a second AC source is connected to a transfer bus, the existing source automatically disconnects. From the point of operation, the electrical power system may be divided into three main segments: the AC power system, the DC power system, and the standby power system.

AC POWER SYSTEM

30-The AC power system has four power sources: the integrated drive generator 1 (IDG 1), integrated drive generator 2 (IDG 2), auxiliary power unit (APU) generator, and external power.

31-The AC portion of the electrical distribution system has separate, non-parallel left and right systems. Each AC power system consists of a transfer bus, a main bus, two galley buses, and a ground service bus.

32-The system design makes sure that two power sources never supply power to the same AC transfer bus at the same time. The left and right parts of the AC systems connect through the bus tie breakers if only one power source is available, which may results from any of the following conditions: loss of power to the left or right AC transfer bus, if the APU generator is the only source of electrical power or external power is the only source of electrical power.

33-The AC transfer buses receive power directly from an AC power source. The main buses and the galley buses receive power from their respective AC transfer bus. The ground service buses receive power either directly from their respective AC transfer bus or external source. AC transfer buses also supply AC power to TR units which will be discussed later. The AC standby bus usually receives power from AC transfer bus 1.

AC Electrical Power Controls And Monitoring

34-Control and monitoring of electrical power is provided through the metering panel, generator drive and standby power panel, and ground power and bus switching panel located on the forward overhead panel. In this section, alternating current electrical power controls and monitoring will be discussed.

35-Electrical power parameters for AC components or buses can be monitored through a metering panel. A display on the panel indicates voltage, output frequency and/or current or load of the source selected by the AC meter selector.

36-The AC meter selector is a rotary selector with seven positions: Standby power, ground power, generator 1, APU generator, generator 2, the static inverter and test.

37-The display shows voltage, output frequency and current for the three generators. For instance, in the figure shown display indicates electrical parameters for IDG1. If the selector is moved to, say, GEN2, the display indicates electrical parameters for IDG 2.

38-The display shows only voltage and frequency when you select standby power, ground power or static inverter. The TEST position is used by maintenance crews.

39-The “GALLEY” switch on the same panel controls power to the galley buses. The switch is a two-position switch and normally set to “ON” during preflight.

40-The generator drive and standby power panel have an IDG low oil pressure indication (or DRIVE lights) and the generator drive disconnect switches in relation to the AC power system.

41-Generator DRIVE amber caution light illuminates when low oil pressure is sensed in the IDG. IDG low oil pressure can be caused by one of the following: IDG failure, engine shutdown, IDG automatic disconnect due to high oil temperature, or IDG disconnected through generator drive switch.

42-The generator drive disconnect switch disconnects its IDG from the engine drive when the electrical power is available and the related engine start lever is in the idle position. The guard holds the switch in the “NORMAL” position. You must lift the guard to move the switch. Once an IDG is disconnected, it cannot be reconnected in the air. Reconnection can only be done on the ground by maintenance crew.

43-The ground power and bus switching panel allows you to control the generators and indicates the status of transfer buses. Other functions of the panel will be discussed later.

44-The engine generator switches allow for manual selection of IDG power. Each switch is a three-position switch and is spring-loaded to the center (neutral) position. The ON and OFF positions are momentary positions. To connect an IDG to its transfer bus you must momentarily move the respective switch to the ON position.

45-The APU generator switches give manual control for APU generator power source selection. There are two APU generator switches which operate like the engine generator switches. You may wonder why there are two switches for APU generator, although there is only one APU generator. This is because there are two bus tie breakers (BTBs) that supply power to the AC transfer buses.

46-Selecting just one APU generator switch “ON” will cause both bus tie breakers to close and both AC transfer buses will receive APU power if both AC transfer buses do not have power initially or if external power is the only source on the AC transfer buses.

47-If both AC transfer buses do have power initially from their IDGs, then only the AC transfer bus on the same side as the APU generator switch you operate will energize with APU power.

48-The ground power switch allows you to control external power to the AC transfer buses.

49-The ground power and bus switching panel also contains annunciator lights which indicate the status of transfer buses.

50-The amber “TRANSFER BUS OFF” light comes on when the related AC transfer bus does not have power. There is one light for each AC transfer bus.

51-The amber “SOURCE OFF” light supplies indication that the related AC transfer bus is not powered by the selected source. This means that either manually selected source is not connected to the related transfer bus or selected source is replaced by a different source. Thus, the illuminated “SOURCE OFF” light does not necessarily mean that the AC transfer bus has no power.

52-The blue “GENERATOR OFF BUS” light illuminates when the AC transfer bus is not powered with the associated IDG. This means that the generator circuit breaker (GCB) is open. The light goes off when the generator is connected to its transfer bus.

53-The blue "APU GEN OFF BUS" light shows that the APU is running and ready to supply electrical power, but the generator is not connected to a bus. The light goes off when the APU generator is connected to a bus or you shut down the APU.

54-The bright blue “GRD POWER AVAILABLE” light illuminates when external AC power is connected and the quality is good.

55-Let’s see a typical sequence of operation of AC electrical power controls and indications. We will start with the aircraft on the ground and the battery switch is ON.

56-When both generator power switches are in the "OFF" position or when both engines are shut down, momentarily positioning the ground power switch to "ON" connects external power to both AC transfer buses through the tie bus. When good quality external AC power is connected, the “TRANSFER BUS OFF” and “SOURCE OFF” lights extinguish.

57-The blue “APU GEN OFF BUS” light comes on when the APU is ready to supply electrical power. Positioning either APU switch to “ON” disconnects the external power and APU generator feeds both AC transfer buses. The APU generator bus off light extinguishes. You see the “SOURCE OFF” light illuminates, because the source that you have selected manually before, has been automatically disconnected. Note that APU generator and external power cannot be connected to the electrical system at the same time.

58-With engine number 2 running, when you temporarily put generator 2 switch to the “ON” position, its generator circuit breaker closes, the bus tie breaker 2 opens and the respective blue generator off bus light goes off. IDG 2 starts to supply power to AC transfer bus 2. The other AC transfer bus continues to be powered by the APU generator or external power, if it is connected to the system.

59-With engine number 1 running, you use generator 1 switch to supply IDG 1 power to AC transfer bus 1. You will see APU generator off bus light illuminate blue, because APU generator is disconnected from the system.

60-In flight, each engine generator normally powers its own transfer bus. If an engine generator is no longer supplying power, the bus tie breakers automatically close to allow the other engine generator to supply both transfer buses through the tie bus. The APU generator can power either or both buses through the bus tie breakers.

61-AC electrical system incorporates an automatic generator on–line feature which is armed when the APU generator is still supplying power to both AC transfer buses after takeoff. If the APU is either shut down or fails, the IDGs are automatically connected to their associated transfer buses. This feature is available only under the circumstances described above, only in flight and only once per flight.

62-Other feature of the AC power system is the automatic load shedding. Load shedding is the reduction of the electrical load incrementally in a part of the electric distribution system when an overload condition is detected. Let’s see how the

load shedding is achieved for different overload conditions and power configurations.

63-In single engine generator operation, if an overload condition is detected, the power from the galleys on the transfer bus 2 are removed first. If the overload condition continues, the system removes power from the galleys on transfer bus 1. If the overload condition still continues, main bus 1 and main bus 2 are shed. When a second source of AC power is available automatic load restoration of the main buses and galley buses occurs. Manual restoration of galley power can be attempted by moving the GALLEY Power Switch to OFF, then back to ON.

64-If an over current condition is detected when both generators are working, the system removes the power from the galleys supplied by the affected generator. If the overload condition continues, the power from the affected generator's AC transfer bus is removed. You move the generator switch to OFF and then back to ON to re-ignite the generator.

65-If an overload condition is detected when the APU is the only source of AC power in flight, all galley buses are automatically shed. If electrical overload still exists, both main buses are also automatically shed.

66-If the APU is the only source of power on the ground and an overload condition is detected, power from the all galley buses and then main buses is removed until the load is within the capacity of its generator. Manual restoration of galley power can be attempted by moving the GALLEY Power Switch to OFF, then back ON.

DC POWER SYSTEM

67-The DC power system has the following power sources: three transformer rectifier units (TRUs), main and auxiliary batteries and main and auxiliary battery chargers.

68-Transformer rectifier units change three-phase, 115 volt ac, 400 hertz AC power into 28V DC to supply the main DC system loads.

69-The DC generation system has three transformer rectifier units denoted as TR 1, TR 2 and TR 3. The TR units are the normal power source for the DC power system. Any two TR units are capable of supplying the total connected DC load.

70-TR 1 gets power from AC transfer bus 1 and usually supplies power to DC bus 1. TR 2 gets power from AC transfer bus 2 and its output connects directly to DC bus 2. TRU 3 normally gets power from AC transfer bus 2; but AC transfer bus 1 can also supply back up power if normal power is lost. The primary use of TRU 3 is as a power source for the battery bus.

71-DC bus 1 and DC bus 2 are connected by cross bus tie relay. The relay is normally closed. It automatically opens when the glide slope is captured during a flight director or autopilot ILS approach. This isolates DC bus 1 from DC bus 2 and prevents a single failure from affecting both navigation receivers and flight control computers. The relay also opens when the bus transfer switch is selected to OFF.

72-DC system incorporates two nickel–cadmium batteries. The main battery and the auxiliary battery. Each battery is a nominal 24 volt DC power source.

73-The primary function of the main battery is to supply emergency power to the standby system when the normal power sources are not available. It also supplies power for the APU start. The auxiliary battery helps the main battery when the battery is powering the standby system during non-normal conditions. With full charge, the batteries supply a minimum of 60 minutes of standby AC and DC power.

74-When the normal power sources do not operate, battery power is supplied to the battery bus, DC standby bus, switched hot battery bus and hot battery bus. The battery also supplies power to static inverter, which in turn, energizes the AC standby bus.

75-Switched hot battery bus connects the battery through a relay. Hence, in order to supply power to the switched hot battery bus, you must position the battery switch to “ON”.

76-The hot battery bus is directly connected to the battery. There is no switch in this circuit; thus its consumers are always powered as long as the battery voltage is above a minimum.

77-DC system also incorporates a main battery charger and an auxiliary battery charger. Each battery charger receives 3-phase, 115 volt AC power and changes it to DC power.

78-The main battery charger has two functions: it keeps the main battery at full charge and supplies DC power to the battery buses. The auxiliary battery charger maintains the auxiliary battery at full charge.

79-Each battery charger has two basic modes of operation: battery charge mode and transformer rectifier or TR mode.

80-A battery charger goes to the charge mode when its battery voltage is less than 23V DC. In this mode, the charger supplies constant current power.

81-Usually battery chargers are in the transformer rectifier mode. In the transformer rectifier mode, the main battery charger supplies constant voltage DC power to the hot battery bus and the switched hot battery bus. The main battery charger TR also powers the battery bus if TR3 fails.

82-The auxiliary battery charger and auxiliary battery are isolated from the power distribution system under normal operation.

DC Power Control And Monitoring

83-The display on the AC/DC metering panel indicates voltage and current or amperage of the DC source or DC bus selected by the DC meter selector. The display shows voltage and current when you put the selector in any of the battery positions or any of the TR unit positions. Only voltage is shown when you put the selector to the battery bus or standby power positions. The test position is used by maintenance crew.

84-When the discharge rate of main battery or auxiliary battery is very high, the amber battery discharge light

illuminates. It is normal for the light to temporarily illuminate during an APU start with battery power.

85-The amber TR UNIT light gives indication of transformer rectifier unit (TRU) failure. The light illuminates when any transformer rectifier unit fails on the ground. Inflight, the TR unit light illuminates if TR1, or TR2 and TR3 has failed.

86-The amber electric light comes on when there is a failure in the DC system or standby system. The light illuminates only when the airplane is on the ground. If the electric light comes on before the flight does not takeoff.

87-The momentary push-button maintenance switch is used by maintenance crew.

88-You may note that we haven't talked yet about the bus transfer switch on the bus switching panel. Now it is to time to see its functions. The bus transfer switch provides you with manual control of the bus tie breakers and the DC cross bus tie relay while de-energizing the TR3 transfer relay. The switch has two positions: "AUTO" and "OFF". The switch is normally in the "AUTO" position. In the "AUTO" position, the bus tie breakers and the DC cross bus tie relay work automatically as necessary. In the "OFF" position, the DC cross bus tie relay opens. The operation of the bus tie breakers when the switch is in the "OFF" position depends on the electrical power source conditions before you move the switch. Let's see a few cases to have a better understanding of bus transfer switch's function.

89-The aircraft is on a normal flight with both generators "ON". If a failure occurs in IDG 1 which causes the generator "OFF" bus and source "OFF" lights to illuminate; with the bus transfer switch in the "AUTO" position, transfer bus 2 automatically connects to transfer bus 1 to supply power.

90-You may use the "OFF" position of the bus transfer switch in abnormal conditions. When you move the switch to "OFF", the bus tie breakers and cross bus tie relay open. This isolates the two sides of the electrical system. In this scenario, electrical power is removed from transfer bus 1 and its associated buses.

91-Now consider a case that the IDGs are not operating and the APU generator is the only available source of power either on the ground or in flight. When you move the bus transfer switch to the "OFF" position, the DC cross bus tie relay opens and bus tie breakers arm to open. For instance, if you move APU generator 2 switch to "OFF", the bus tie breaker 2 opens and electrical power is removed from transfer bus 2 and its associated buses.

STANDBY POWER SYSTEM

92-The standby power system supplies AC and DC power to critical systems necessary to maintain safe flight in the event of loss of all engine or APU driven generators.

93-The standby system comes into play in the event of loss of all engine or APU driven generators. The system makes use of main battery, auxiliary battery and static inverter as power source. The standby power is distributed through AC standby bus, DC standby bus, battery bus, hot battery bus and switched hot battery bus. A standby power control unit controls the distribution of AC and DC standby power.

94-Operation of the standby power system is controlled through the battery switch on the metering panel and the standby power switch on the generator drive and standby power panel.

95-Battery switch provides power to the switched hot battery bus and energizes necessary buses to provide automatic switching of standby electrical system to battery power when normal power is lost. The battery switch is a two-position switch. The guard holds the switch in the “ON” position.

96-The standby power switch provides for automatic or manual control of power to the standby buses. The switch is a three position switch. The guard holds the switch in the “AUTO” position.

97-Standby power off light comes on when a low voltage condition occurs in AC standby bus, DC standby bus or battery bus.

98-Standby power system has two modes of operation: normal operation and alternate operation.

99-Normal operation occurs when AC power from engine or APU generators is available. During normal operation the standby power switch is in the “AUTO” position and the battery switch is in “ON” position. With this configuration of switches, AC standby bus is powered from AC transfer bus 1, and DC standby bus is powered by AC transfer buses through TR1, TR2 and TR3. The battery bus is powered through TR3. The battery and the battery charger supply power to hot battery bus and switched hot battery bus.

100-Alternate operation occurs when AC power from all engine or APU generators is lost. In this mode the batteries are the only power sources.

101-When the standby power switch is in the “AUTO” position, switching from normal to alternate power automatically occurs in the event of loss of all engine or APU AC power. The AC standby bus is powered from the batteries via the static inverter. The DC standby bus, battery bus, hot battery bus, and switched hot battery bus are powered directly from the batteries. If the battery switch is “OFF”, the switched hot battery bus is not powered.

102-If the standby power switch is selected to battery position, automatic switching is overridden. The AC standby bus, DC standby bus, and battery bus is supplied by battery power regardless the position of the battery switch which may be “ON” or “OFF”.

103-If the standby power switch is moved to “OFF” when the battery switch is in the ON position, the AC standby bus and DC standby bus are disconnected from all power sources either in normal or alternate operation, and the standby power off light illuminates.

104-Now let us take a look at the significant equipments that operate when the main battery and the auxiliary battery are the only source of electrical power.

105-General airplane equipment: oxygen system; flight crew oxygen, and passenger oxygen. Lighting: white dome lights, standby compass light and emergency instrument flood lights

106-Air Systems: air condition pack valves, “BLEED TRIP OFF” lights, “PACK” lights, manual pressurization control and altitude warning horn.

107-Anti-Ice system: Captain’s pitot probe heat.

108-Communication system: flight interphone system, service interphone system, passenger address system and VHF No. 1 radio.

109-Engines and APU : upper display unit with N1, N2, fuel flow, EGT, fuel quantity, oil pressure, oil temperature, oil quantity, hydraulic pressure and hydraulic quantity indications; thrust reversers; starter valves; right igniters; APU operation (start attempts not recommended above 25,000 feet).

110-Electric system: “STANDBY POWER OFF” light.

111-Fire protection system: APU and engine fire extinguisher bottles, APU and engine fire detection system and cargo fire extinguisher bottles.

112-Flight Instruments: Captain’s outboard display unit with primary flight display, Captain’s inboard display unit with navigation display, clocks, left EFIS control panel, standby instruments.

113-Flight Management and navigation systems: Left FMC, Left CDU, heading/track indications, VHF NAV No. 1, ILS No. 1, left IRS, left GPS, marker beacon, ADF No. 1, transponder No. 1 and DME No. 1.

114-Fuel system: crossfeed valve, engine fuel shutoff valves, spar fuel shutoff valve, “FUEL VALVE CLOSED” lights and fuel quantity indicators.

115-Hydraulic system: Engine hydraulic shutoff valves and standby rudder shutoff valves.

116-Landing gear system: Inboard antiskid system, “ANTISKID INOP” light, parking brake, landing gear indicator lights and air/ground system.

117-Warning system: Stall warning system, aural warnings and master caution light recall.

ELECTRICAL SYSTEM CONTROLS AND INDICATIONS REVIEW

118-Let’s review the controls and indications on electrical power control panels.

119-AC and DC metering panel: Panel incorporates a LED display which shows the following information: amperage and voltage of the selected DC source; frequency, amperage and voltage of the selected AC. DC meter selector selects the DC

source for DC ammeter and DC voltmeter indications. AC meter selector selects the AC source for AC voltmeter, AC ammeter and frequency meter indications. The TEST position on both selectors is used for maintenance.

120-The amber battery discharge light illuminates when discharge rate of main battery or auxiliary battery is high. The “TR UNIT” light in amber gives indication of TR unit failure. The light comes on when any TR fails on the ground. In flight, the light illuminates when TR1 fails or TR2 and TR3 fail. Electrical light illuminates when there is a failure in DC power system or in standby power system. The light operates only when the airplane is on the ground. Do not takeoff if the ELEC light is on. Maintenance switch is used by the maintenance crew.

121-The battery switch is a two-position switch, with the normal position is “ON”. In the “ON” position, the switch: supplies power to the switched hot battery bus and energizes the battery bus, static inverter, AC standby bus and DC standby bus to provide automatic switching of standby electrical system to battery power with loss of normal power. “OFF” position removes power from battery bus and switched hot battery bus when operating with normal power sources available. If the battery is the only power source, selecting the “OFF: position removes power from battery bus, switched hot battery bus, DC standby bus, static inverter, and AC standby bus. The galley switch controls power to galley buses. In the “ON” position, it energizes galleys when AC transfer buses are powered. In the “OFF” position, it removes electrical power from the galleys.

122-Some of the airplanes have a different panel. Most of the configuration is similar to the previous panel except the galley switch is replaced by two other switches. Cabin /Utility Switch: the “ON” position supplies electrical power to galley and some utility systems including all 115volt AC galley busses, left & right recirculation fans, forward and aft door area heaters, drain mast heaters, lavatory water heaters, logo lights, potable water compressor, 115 volt AC shaver outlets when installed. LED cabin lighting also energizes in some airplanes. The “OFF” position removes electrical power from the galley and utility systems. In-flight entertainment and passenger seat switch: “ON: position supplies electrical power to passenger in-flight entertainment, cabin phones and passenger seat outlets. The “OFF” position removes electrical power from installed components of the passenger seats, in-flight entertainment systems, and other power systems. Please consult your AFM for different configurations.

123-Generator Drive and Standby Power Panel: The panel incorporates Generator Drive lights which illuminate when low oil pressure is sensed in the related IDG. IDG low oil pressure is caused by any of the conditions listed here. Generator Drive Disconnect Switches : Disconnect IDG from engine drive if electrical power is available and engine start lever is in IDLE. IDG cannot be reconnected in the air. STANDBY Power OFF illuminates in amber when any of these buses do not have power: AC standby bus, DC standby bus, battery bus.

124-STANDBY POWER Switch: When the switch is in the “AUTO” position and AC transfer bus 1 has power, then these buses are powered in flight or on the ground. The AC standby bus is powered by AC transfer bus 1; DC standby bus is powered by TR1, TR2 and TR3. In the event of loss of all AC power, in flight or on the ground, the AC standby bus is powered by the battery through the static inverter, DC standby bus is powered by battery and battery bus is powered by

battery. “OFF: position: Standby power OFF light comes on. AC standby bus, static inverter, and DC standby bus are not powered. Battery position: AC standby bus is powered by battery through static inverter and DC standby bus and battery bus are powered directly by the battery.

125-Ground power panel and bus switching panel incorporate following components. Ground Power Available Light illuminates in bright blue when external AC power is connected and the quality is good. The Ground Power Switch: is a three-position switch and is spring-loaded to the center (neutral) position. The “ON” position, if ground power is available, disconnects previously connected power from the AC transfer buses and connects ground power to AC transfer buses if power quality is correct. The “OFF” position disconnects ground power from the AC transfer buses.

126-Transfer bus off lights come on in amber when the related AC transfer bus does not have power. The “SOURCE OFF” lights illuminate in amber when the related AC transfer bus is not powered by the selected source. This may result from the following: the selected source is not connected to the transfer bus, or selected source is replaced by a different source. The “Generator Off Bus” lights illuminate in blue when related AC transfer bus is not energized by its IDG.

127-Generator switches: the switches have three positions and are spring–loaded to neutral. ON position: removes the previous power source and connects the IDG to the related AC transfer bus by closing the generator circuit breaker. The “OFF” position: disconnects the IDG from the related AC transfer bus. The “BUS TRANSFER Switch”: is guarded in the “AUTO” position. The “AUTO” position: the bus transfer switches and the DC cross tie relay operate automatically as necessary. The “OFF” position: the DC cross bus tie relay opens to isolate DC bus 1 from DC bus 2. BTBs open and isolate AC transfer buses from each other if one IDG is supplying power to both AC transfer buses.

128-APU Generator Off Bus Light: Illuminates in blue when the APU is running and its generator is not connected to a bus. APU Generator Switches: Switches have three positions and are spring–loaded to neutral. If both AC transfer buses do have power initially, moving a single switch to “ON” will energizes both AC transfer buses with APU power. External power is removed if connected. The “Opposite SOURCE OFF light illuminates: when the switch is positioned to “ON”, the SOURCE OFF light extinguishes. When both AC transfer buses do have power initially from their IDGs and if a single switch is selected to ON, only the AC transfer bus on the same side as the APU GEN switch you operate will energize with APU power and other AC transfer bus continues to receive power from its IDG. If APU generator is powering both AC transfer buses, moving a single switch to OFF causes the related SOURCE OFF light to illuminate and the APU continues to power AC transfer buses. Moving other APU GEN switch to OFF disconnects the APU generator and removes APU power from the AC transfer buses. If the APU generator is powering one AC transfer bus and IDG is powering other AC transfer bus, moving the related APU GEN switch to OFF disconnects APU generator from the system. IDG powers both AC transfer buses.

129-The “GROUND SERVICE Switch” on the forward attendant panel: is a momentary push–button switch which illuminates in white. In the “ON” position: it supplies external power to the ground service buses. In the “OFF” position: it removes external power from ground service buses.

130-Circuit braker panels in the B737 NG cockpit are named as P6 and P18. Additionally there are some CBs which are located behind the yokes.

COURSE END

131-End of COURSE. ?