2A-23-10: General

The Gulfstream G550 communications system provides the flight crew audio links within the aircraft, and radio links to other aircraft and ground stations. Transmitter and audio reception selections are made using pushbuttons on the audio panels installed at the pilot, copilot and observer stations. (See Figure 1.)

The communications system is divided into the following subsystems:

- 2A-23-20: Audio Panels
- 2A-23-30: Voice Communication Systems
- 2A-23-40: MCDU and CCD Radio Tuning
- 2A-23-50: Selective Calling System
- 2A-23-60: Cockpit Voice Recorder System
- 2A-23-70: Emergency Locator Transmitter

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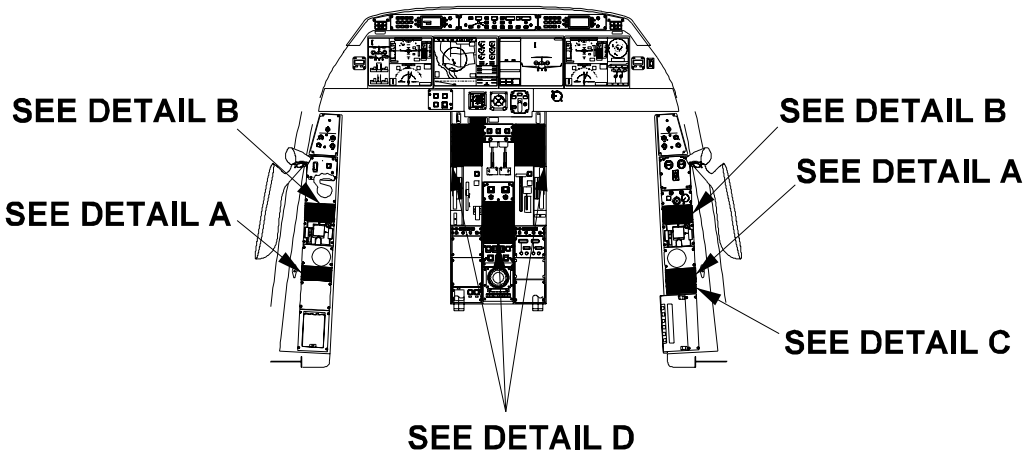

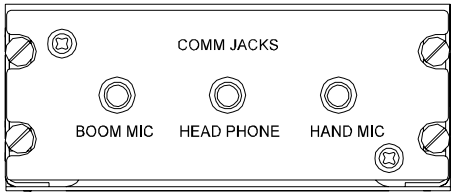

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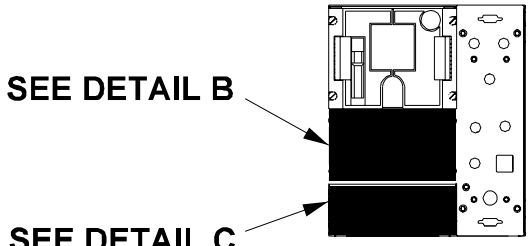
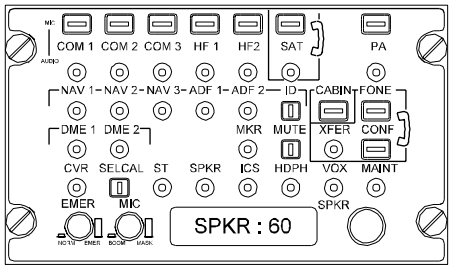


SYSTEM MONITOR PANEL



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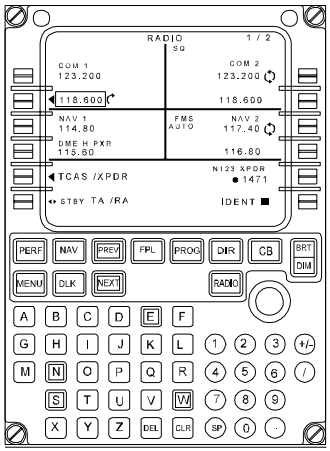

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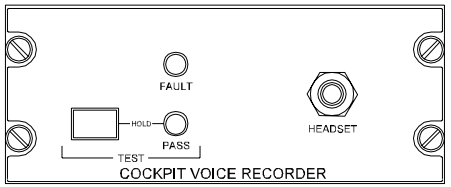

DETAIL C

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Communications System Components
Figure 1

2A-23-20: Audio Panels

1. General Description:

Three AV-900 audio panels are installed in the cockpit: one at each pilot seat and one at the observer station. All panels are identical, and a typical panel is shown in Figure 2. All three audio panels are linked over redundant digital buses. Digital busses carry microphone transmit and audio receive selection data to the Network Interface Modules (NIMs) in the Modular Radio Cabinets (MRCs). (The NIMs translate voice analog audio into digital data). The MRCs contain the communication and navigation radios (COM, NAV, ADF, DME and XPDR), a non-volatile memory that stores radio and audio configuration data, and an internally mounted cooling fan. Both the analog third dual function NAV / COM radio (NAV/COM 3) and the High Frequency (HF) radios are located outside of the MRC and interfaced to the audio panels through ARINC-429 connections to the MAUs.

The audio panels are configured to hold up to ten (10) rectangular transmit (mic) buttons and a combination of up to twenty (20) round audio reception button selections or square feature selections. Only one transmit selection may be made at a time, and selection of the transmit button will automatically activate the audio reception button for the associated radio. The audio panels at the pilot and copilot stations provide an output of eight (8) watts to the respective cockpit speaker on the overhead. The observer audio panel does not have the wiring installed for a speaker output. Transmit audio output from each panel is also provided to the Cockpit Voice Recorder (CVR) system.

The AV-900 audio panels provide the following functions to the flight crew:

- Ten available rectangular transmit button selections
- Twenty available round audio reception button selections
- Three function button selections including selected calling (SELCAL)
- Volume control
- Emergency volume control
- LCD display
- Warning audio outputs
- Volume control
- Cockpit speaker output
- Continuous transmit audio output to CVR

NOTE:

For a detailed description of the Audio Control Panels, see Section 2B-09-00 of this manual.

2. Controls and Indicators:

NOTE:

For a complete description including graphics illustrating ACP functions, see Section 2B-09-00 of this manual.

A. Transmit Button Selections:

The ten rectangular transmit buttons on the audio panel illuminate green when selected. Selection of a transmit button will automatically select the corresponding audio reception.

(1) COM 1, COM 2 and COM 3 selections transmit voice or data over the selected VDR / VHF radio, tuned with the MCDU.

(2) HF 1 and HF 2 selections transmit voice over the selected HF radio, tuned with the MCDU.

(3) SAT selection transmits voice or data over the SATCOM installation linked to the International Maritime Satellite Organization (INMARSAT) network. SATCOM communications are selected with MCDU entries or with a handset installed in the cockpit center console.

(4) PA selection transmits voice to the cabin speaker system. When this option is selected, the cabin stereo audio system is automatically muted. Only one pilot crew member may use the PA function at a time.

(5) CABN selection allows communication over the cabin interphone system.

(6) FONE selection allows MAGNASTART telephone operation including call pick-up, hang-up, hold, transfer and conference calls. Telephone dialing is accomplished using the MCDU or cockpit handset.

(7) CONF selection is used to participate in conference calling.

B. Audio Reception Button Selections:

Up to twenty round audio reception buttons can be installed on the audio panel below the transmit buttons. When one of the audio sources is selected, the button is internally illuminated green. Audio volume of the selected source is controlled by rotating the button.

Reception buttons are provided for identifying navigational radio sources, monitoring the cockpit voice recorder, cabin calls, selecting the cockpit speakers on or off, adjusting headphone volume, internal communications (ICS) on or off, communicating with the maintenance interphone panels at the nose and tail of the aircraft, controlling volume of the audio panel transmitted sidetone, and selecting a voice activated microphone feature.

C. MIC Selections:

Each audio panel interfaces with a corresponding jack box that provides plug-ins for a hand microphone, boom microphone and a headset. A microphone jack box is also mounted on each yoke column. The oxygen mask microphones are wired independently adjacent to the oxygen supply tube. A MIC pushbutton on the audio panel selects either the boom or mask microphone. Pushing in the selector transmits via the boom mic; oxygen mask mic is selected with the button out and the onside cockpit speaker is activated. For either of these microphones, the pilot and copilot transmit using the yoke mounted mic switches (forward for the audio panel selected transmitter of aft for aircraft interphone) or by using the voice activated mic function (VOX) described below. The observer transmits with a similar up and down transmit select button at the observer station or VOX option.

The hand held microphones may be used at any time regardless of the MIC pushbutton selection.

The EMER “backup” pushbutton on ACP 1 (pilot) and ACP 2 (copilot) controls a relay within the respective ACP that selects normal digitized audio panel operation when pushed in, or selects a direct analog wire connection from headsets and microphones to VHF COM #1 when pulled out. The pushbutton rotates to control volume. The EMER pushbutton can be used for communication over VHF COM #1 in the event of a failure of the ACP or NIM. There are no direct analog connections from ACP 3 to VHF COM #1.

In the event of an aircraft electrical failure that results in only the main aircraft batteries available for powering the Essential DC buses, all three digital audio panels remain operative, and communications are possible from any of the ACPs over VHF COM #1. If only the aircraft emergency batteries are available, only ACP 1 at the pilot position is powered by the emergency DC bus. When Essential DC buses are lost, ACP 2 is not powered, however the relay controlled by the EMER pushbutton on ACP 2 will switch to a direct analog wire path connecting the copilot headphones and microphone to VHF COM #1, enabling both crew members communicate over the radio.

NOTE:

Only the #1 VHF NAV and COM radios are available on emergency battery power (NIM #1 and XPDR #1 are also available). These radios are tuned using MCDU #3 that is powered by the emergency batteries and has a direct ARINC-429 connection to the #1 NAV / COM radios. Only the pilot’s cockpit speaker is available in emergency battery mode.

NOTE:

Selecting EMER on any ACP will not tune the VHF radios to the 121.5 mHz emergency frequency.

D. ON / OFF Feature Selections:

Three square on / off feature selectors are installed on the audio panel. The square selectors are illuminated green when the option is actively selected:

- ID turns on or off Morse code identifiers when monitoring the audio of navigational radios
- MUTE eliminates the audio of the marker beacon receiver if selected on with the round audio reception pushbutton
- SELCAL displays the selcal code address of the aircraft. Upon receipt of a selcal message, the selcal indicator light and the light within the reception button of the radio detecting the message will flash, and a message annunciation will appear in the LCD window. Pressing the selcal selector or selecting and keying the transmitter of the radio carrying the incoming message will cancel the selcal alert indications. See the selcal discussion section below.

E. Audio Panel Volume Control:

The large round knob on the audio panel labeled SET controls the overall volume setting of the selected audio inputs to the panel. A numerical value associated with the set volume level is displayed in the LED indicator to the left of the knob when the knob is used.

F. LCD Display:

The LCD display provides an alphanumeric readout of information related to the operation of the audio panel. The display annunciates the current transmit selection, an numerical value for volume settings, a notification of a stuck microphone, indicates the source of an incoming selcal message and displays faults associated with the panel.

G. Cockpit Speakers:

The pilot and copilot cockpit speakers are powered by the respective audio panels. There is no provision for an observers speaker. Each of the two speakers is selected on with the SPKR audio button and volume controlled by rotating the button. There are five source inputs in the NIM for the annunciation of aural messages over cockpit speakers. These messages includes EGPWS and TCAS warnings, autopilot disconnect warnings, tones associated with CAS messages, and fire warnings. Safety critical aural warnings, cautions and advisories that are required to be announced over cockpit speakers cannot be muted and are annunciated even if the speaker is selected off, and are therefore not controlled by the speaker volume control. Volume levels of safety critical aural annunciations are set in the initial audio system configuration.

NOTE:

The APU fire warning bell in the nose wheel well uses the speaker amplifier of the left (pilot) audio panel. When the APU fire bell is active (fire detected with aircraft on the ground - weight-on-wheels) only the copilot side cockpit speaker is available for audio.

H. Side Tone Adjustment (ST):

The ST rotary button sets speaker sidetone level to eliminate feedback from the speaker to the headset. The sidetone level is indicated in the LED window. The button is illuminated and the LED indication active only for five (5) seconds after adjustment. The sidetone may be adjusted with or without speaker sound on.

I. Voice Activated Microphone (VOX):

Selecting the VOX feature enables transmissions (both radio and ICS or Cabin) to be made without using the press to talk switches on the yoke or hand microphones. The sensitivity of the voice activation is controlled by rotating the selector, with the sensitivity level displayed in the LED indicator (the higher the number the higher the sensitivity).

3. Controls and Indications

See Figure 2.

A. Circuit Breakers (CBs):

The audio panels are protected by the following CBs:

Circuit Breaker Name:	CB Panel:	Location:	Power Source:
PILOT ACP	LEER	D-17	L EMER 28v DC Bus
COPILOT ACP	REER	D-6	R ESS 28v DC Bus
OBSERVER ACP	REER	D-7	R ESS 28v DC Bus

B. Crew Alerting System (CAS) Messages:

The following CAS message is associated with the Audio Control Panels:

Area Monitored:	CAS Message:	Message Color:
ACP	ACP 1-2 Fail	Amber
ACP	ACP 3 Fail	Blue

4. Limitations:

A. Flight Manual Limitations:

The flight crew shall wear headsets with acoustical protection when operating the aircraft in the “green” configuration.

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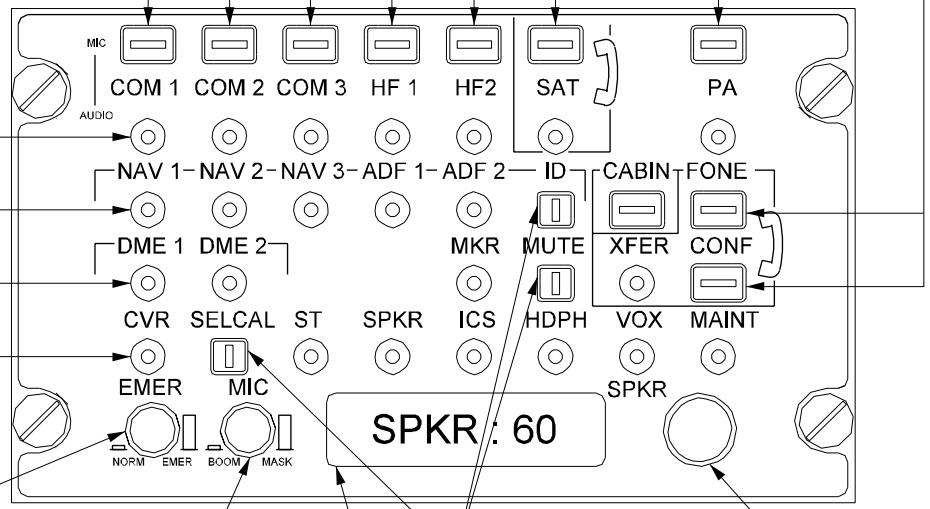
RECEPTION BUTTONS
(ROUND)
- Internal light (green) illuminated when selected
- Rotating button adjusts reception volume

TRANSMIT BUTTONS
(RECTANGULAR)
Internal light (green) illuminated when selected



EMER BUTTON
Provides a direct analog wire connection to COM 1 radio in event of electrical / data bus failure; controls volume in emergency mode

FUNCTION BUTTONS
(SQUARE)
Internal light (green) illuminated when selected

VOLUME CONTROL
- Rotating control sets audio volume level of entire panel
- A numerical value (0-99), associated with volume level, is shown in the LCD display

MIC BUTTON
Selects and controls volume of either boom or oxygen mask microphone

LCD DISPLAY
Provides annunciations of current audio panel selection status including volume levels, SECAL identifier, current transmitter, and stuck microphone

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Audio Control Panel
Figure 2

2A-23-30: Voice Communication Systems

1. General Description:

The voice communication system provides a means for the crew to exchange information and data with other aircraft and ground-based stations. It is composed of the following subsystems:

- Three Very High Frequency Data Radios (VDRs) - (COM 1, COM 2 and COM 3)
- Two High Frequency Radios (HF 1 and HF 2)
- Satellite Communications system (SATCOM)
- MagnaStarT radio telephone system

All five (VDRs and HF) radios are capable of selective calling (SELCAL) that allows the crew to receive messages from ground stations without actively monitoring the assigned frequency. The SATCOM and MagnaStarT systems have individual addressable number codes that allow calls to the aircraft in a manner similar to normal telephone systems. Radio subsystem status and health are checked by the Monitor and Warning System (MWS) that prompts the appropriate Crew Alerting System (CAS) message if flight crew attention is required.

2. Description of Subsystems, Units and Components:

A. Very High Frequency Data Radios (VDRs):

Two VDRs, COM 1 and COM 2, are identical and interchangeable Line Replaceable Modules (LRMs) installed in the two MRC-855 Modular Radio Cabinets (MRCs). The MRCs also contain the digital navigation radios: VHF NAVs with Data Link, ADFs, Mode S Transponders, DMEs, Glideslope and Marker Beacon receivers. A typical MRC is illustrated in Figure 3. Each provides standard voice communications on frequencies from 118.000 Mhz to 136.975 Mhz with channel spacing of 8.33 Khz and an optional extended range of 137.000 Mhz to 151.975 with 25 Khz channel spacing. In addition to voice communications, the radios are capable of transferring digital data at a rate of 31.5 kbps over channels with 25 Khz spacing. A third navigation / communication radio NAV / COM 3 is an additional independent digital unit that supports standard communications frequencies and VOR, LOC, G/S and marker beacon reception. COM 1 and COM 2 radios are internally interfaced with the MRCs through Network Interface Modules (NIMs), COM 3 is interfaced with the NIMs via an ARINC-429 connection. NIMs convert analog audio to digital format that is distributed to the cockpit audio panels for inputs / outputs (mic selections and transmissions, audio reception selections, etc.) over redundant digital audio and microphone buses.

COM 1, COM 2 and COM 3 are tuned and controlled by using pages and line select keys of the Multi-function Control and Display Units (MCDUs). Future system enhancements are planned that will enable the radios to be tuned and controlled with the Cursor Control Devices (CCDs) using indications on the Map display.

Each COM radio is connected to a dedicated blade-type antenna via RF coax cable. COM 1 antenna is located on the centerline of the aircraft belly just forward of the leading edge of the wing, COM 2 antenna is located on the centerline of the top of the aircraft aft of the first passenger compartment window, and COM 3 antenna is located on the underside of the aft part of the aircraft adjacent to the drain mast. COM 2 is most effective for ground communications because of the location of the

antenna,

B. High Frequency (HF) Communication System:

The HF communication system provides long range voice and data communication capabilities to and from the aircraft. HF # 1 and HF # 2 are independent receiver / transmitters (R/Ts) utilizing a dual coupler mount to interface with a common antenna. The radios can operate in simplex or half duplex mode, including Upper Side Band (USB) voice, Lower Side Band (LSB) voice, Amplitude Modulation Equivalent (AME), Continuous Wave (CW), and Upper and Lower Side Band (USB / LSB) data link. Tuning is accomplished using pages and line select keys on the Multi-purpose Control and Display Units (MCDUs).

Units and components of the HF communications system are as follows:

(1) HF transceivers:

Each of the two HF transceivers provide 99 user-programmable preset channels and 280,000 discrete operating frequencies covering the 2.0000 - 29.9999 MHz range in 100 Hz increments. In addition, six (6) emergency channels and two hundred forty–nine (249 ITU) Maritime Radiotelephone Network channels are stored in nonvolatile memory.

(2) HF antenna coupler unit:

The two coupler units provide an interface with their respective transceivers, and are designed to match the impedance of the HF shunt antenna. The transceivers send control signals to, and receive feedback information from, the antenna coupler units by a fiber optic path connection. A connection between both antenna coupler units also provides backup 28V DC power.

(3) Dual coupler mount:

The dual coupler mount connects both HF antenna coupler units to the single shunt antenna using a copper bus bar.

(4) Shunt antenna:

The shunt antenna is an integrated airframe component mounted in the leading edge of the vertical stabilizer. The antenna element is fed from the dual coupler mount through the copper bus bar. It is electrically tied into aircraft structure at the top, enabling the entire aircraft to act as a low frequency HF antenna.

NOTE:

Whenever the HF radios transmit, the bearing indication of the Automatic Direction Finder (ADF) navigation radio is interrupted. The ADF needle will freeze or “park” at the current direction indication until the HF radio transmission is completed. The ADF needle will then move to point toward the location of the tuned station.

C. Satellite Communications (SATCOM):

The satellite communications system allows the exchange of voice or data between aircraft peripherals (cockpit headphones and microphones,

telephone handsets, PC modems or FAX machines) and any operating telephone or data unit within the coverage of the International Maritime Satellite Organization (INMARSAT). Coverage is provided by four (4) or more geo-stationary satellites operating in the L band of the radio spectrum, providing global communications linkage except in the polar regions (north or south of seventy-five degrees latitude).

Equipment aboard the aircraft transmits voice or data in a digital signal to the best positioned satellite that in turn relays the signal to a ground station linked to telephone networks. Ground stations (as of this writing) are located in England (UK), France, Norway, Italy, Singapore, Japan, Australia, Thailand and the USA.

Aircraft SATCOM equipment includes the following units:

(1) Satellite antenna - located at the top of the vertical stabilizer, steerable in two (2) dimensions to establish a digital signal link with the satellite network. See Figure 4.

(2) High Power Amplifier (HPA) - located in the tail compartment, boosts aircraft digital signal power to levels sufficient for communication with the selected satellite.

(3) Satellite Data Unit (SDU) - located in the tail compartment, converts aircraft audio inputs into the digital signal that it amplified and transmitted to the satellite network. The SDU is interfaced with the aircraft Inertial Reference System (IRS #1 and IRS#2) in order to provide steering commands to the antenna installation for establishing a data link. The aircraft position is compared with the geo-stationary orbit positions of the satellites in the INMARSAT network and the antenna is positioned to communicate with the satellite providing the best communication link.

The SDU software contains the addressable aircraft identification data and provides seven satellite communication channels: six (6) for voice communication and one (1) for data communication. Communication channel selection is an automatic function of the software, predicated on voice or data communication and the triangulation of the aircraft with the satellite network.

The SDU software also determines the addresses of the peripherals installed on the aircraft by the presence of configuration pins and routes voice and/or data to or from the operating peripheral accordingly.

(4) SATCOM MASTER Switch - installed on the cockpit overhead panel, controls the operation of the aircraft SATCOM system through a relay that routes power from the system circuit breakers to the HPA, SDU and antenna installation. The MASTER switch is illustrated in Figure 5. When the SATCOM master switch is selected on, the blue OFF legend in the switch will extinguish and the system will initiate a Power On Self Test (POST). If all system parameters are valid, the SDU automatically steers the aircraft antenna to acquire a satellite link using the appropriate communication channel.

(5) Audio Control Panel (ACP) SAT transmit button - enables the flight crew to communicate over the SATCOM system using headsets and boom or conventional microphones. Each of the three (3) ACPs is connected via the Network Interface Module (NIM) in Modular Radio Cabinet (MRC) #2 to the SDU that converts analog voice into a digital signal for transmission to the relaying satellite. Calls are placed using inputs on the Multi-function Control and Display Unit (MCDU). SATCOM is accessed by selecting the MENU function button to display the MENU page. When SATCOM has completed the initial POST and is ready for use, a “SAT” selection is shown on the menu page. Depressing the Line Select Key (LSK) adjacent to the SAT selection will call up the SATCOM MAIN MENU page that contains the options for placing a call using DIRECTORY pages that store numbers held in memory or for manually dialing a call using the MCDU keypad.

(6) Telephone Handsets - installed as part of the MagnaStarT airborne telephone system (see the following paragraphs) and located in the cockpit and at customer designated seating in the aircraft cabin provide SATCOM calling through menu selections on the Liquid Crystal Display (LCD) on the inner face of the handsets. If SATCOM is selected on the handset display menu as the calling medium, the SATCOM system will interface with the handset(s) through a Conference of European Postal and Telecommunications (CEPT) E1 connection that permits the handsets to place telephone calls over the SATCOM system.

Provisions are available for the use of WH-10 analog handsets for SATCOM calls in the event of a MagnaStarT system failure.

To place an outgoing SATCOM call using the MCDU:

- Select SAT on the MCDU Main Menu
- Select DIRECTORY on the SAT page
- Enter the desired number in the scratchpad of the DIRECTORY page using inputs from the MCDU keypad in the following format: International access number (00), Country code (XXX), City code or Area code (XXX) and phone number (XXX-XXXX).
- Press MANUAL DIAL LSK and the number on the scratchpad will be shown between brackets ([- - -])
- Press the SAT mic button on the ACP or select the LSK adjacent to the MAKE CALL command. The MCDU will display the call status - DIALING, CONNECTED, etc. (The SATCOM mic button will flash at a 1 Hz rate if the mic button was used to initiate the call - if the LSK is used to make the call the mic button will not flash.)
- When the desired party answers the call, the SAT mic and audio select buttons on the ACP will illuminate steady
- Communicate through the boom or hand held microphone

To answer an incoming SATCOM call:

- An incoming call is indicated by the SATCOM mic button on the ACP flashing at a 1 Hz rate and by an audible chime
- Press either the SAT mic button on the ACP or select the LSK

adjacent to the ANSWER CALL command

- Communicate with either the boom or handheld microphone

To place current SATCOM call on hold:

- If other communications require a higher priority while making a SATCOM call, selecting any of the communication radio mic buttons (COM1, COM2, COM3, HF1, HF2) will automatically place the active SATCOM call on hold and the SAT mic button will flash at 3 Hz intervals indicating the hold status.
- To return to the SATCOM call on hold simply select the SATCOM mic pushbutton on the ACP

To end a SATCOM call:

- Either deselect (press) the SATCOM mic button on the ACP or select the LSK adjacent to the END CALL command on the MCDU

D. MagnaStarT Radio Telephone System:

The MagnaStarT airborne telephone system is a proprietary communications system linking the aircraft to a ground station network that is integrated with local and long distance telephone service. The system uses an Airborne Radio Telecommunication Unit (ARTU) and a duplexer located in the tail compartment in conjunction with a dedicated antenna on the underside of the aft fuselage to transmit in the 894-896 MHz band and receive over a frequency range of 849-851 MHz. A PHONE Master switch on the cockpit overhead, shown in Figure 5, controls power to the system. When the PHONE switch is in, the blue OFF legend within the pushbutton switch is extinguished and system is available for use throughout the aircraft.

The configuration of user interfaces with the MagnaStarT system is flexible, with features dependent upon customer selected options. Different models of Cabin Distribution Bus Repeaters (CDBRs) and/or CEPT interfaces support multiple device connections. The following installations are most common:

(1) Digital telephone handsets - located at convenient sites within the aircraft cabin and in the center pedestal of the cockpit. The handsets can be used to initiate and receive calls from outside the aircraft or to communicate within the aircraft, including cockpit/cabin communication. The handsets provide standard telephony features including conference calling and call waiting. Each handset can be configured with an independent telephone number if desired or all handsets can be assigned a single number associated with the aircraft. With appropriate modifications, the handsets may also be used for HF radio communications while airborne or for cell phone calls on the ground.

(2) Cockpit Audio Control Panel (ACP) interface - allows the flight crew to place and answer calls using headphones and boom or hand microphones without using the cockpit digital handset. The telephone symbol adjacent to the SAT, CABIN, CONF and FONE transmit buttons indicates that these functions are available through the MagnaStarT system. See the illustration in Figure 2. Selecting these buttons allows communication with the SATCOM system, occupants of the cabin calling the cockpit from digital handsets, or with multiple cabin handsets in a conference call. The FONE transmit button enables the crew to place a call using the MagnaStarT system by dialing the desired telephone number using the MCDU keypad. The XFER function button allows the transfer of a call received in the cockpit to a cabin handset.

(3) Personal Computer (PC) modem connections - located at selected areas of the cabin or cockpit, allow data transfer over the MagnaStarT system.

(4) FAX machines - sited at convenient cabin or cockpit locations, provide hard copy printouts of information.

(5) Call Alerting Switch (CAS) - co-located with the digital handsets, furnish a visual and/or aural notification of an incoming MagnaStarT system or SATCOM call.

NOTE:

For more information regarding the use of the MagnaStarT and SATCOM systems, see the vendors user guides.

3. Controls and Indications:

A. Circuit Breakers (CBs):

The voice communications systems are protected by the following CBs:

Circuit Breaker Name:	CB Panel:	Location:	Power Source:
MRC #1	POP	G-4	L EMRG DC Bus
MRC #2	CPOP	G-4	R ESS DC Bus
VHF COMM # 1	POP	F-6	L EMER DC Bus
VHF COMM # 2	CPOP	F-6	R MAIN DC Bus
NAV / COM	CPOP	G-6	R MAIN DC Bus
HF R/T # 1	LEER	F-18	L MAIN DC Bus
HF R/T # 2	REER	F-6	R MAIN DC Bus
HF CPLR # 1	LEER	E-18	L MAIN DC Bus
HF CPLR # 2	REER	E-6	R MAIN DC Bus
SATCOM PRI	REER	E-5	R MAIN AC Bus ϕA
SATCOM CTL	REER	F-5	R MAIN DC bus
RADIO TEL RT	REER	E-7	R MAIN DC Bus
RADIO TEL CONT	REER	F-7	R MAIN DC Bus

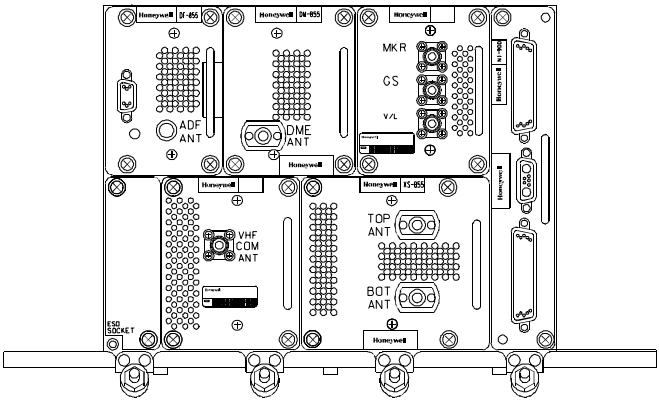
B. Crew Alerting System (CAS) Messages:

CAS messages associated with the voice communication systems are:

Area Monitored:	CAS Message:	Message Color:
MRCs	MRC 1-2 Overheat	Amber
MRCs	MRC 1-2 Fail	Amber
VDRs	VHF COM 1-2 Overheat	Amber
MRC	MRC 2 Fail	Blue
VDRs 1-2	VHF COM 1-2 Fail	Blue
VDRs/VHFs	VHF 1-2-3 SELCAL (With ASC 015)	Blue
HFs	HF 1-2 SELCAL (With ASC 015)	Blue
SDU	SATCOM Call	Blue
SDU	Satellite Data Not Ready	Blue
SDU	Satellite Voice Not Ready	Blue
SDU	SATCOM Fail	Blue
MagnaStarT / SATCOM	Phone Call*	Blue
*Numerous CAS messages associated with the aircraft telephone system are possible - the message text is dependent upon interior configuration and the location of the handset used by the calling party.		

4. Limitations:

There are no limitations regarding the operation of the aircraft radios as of this writing.



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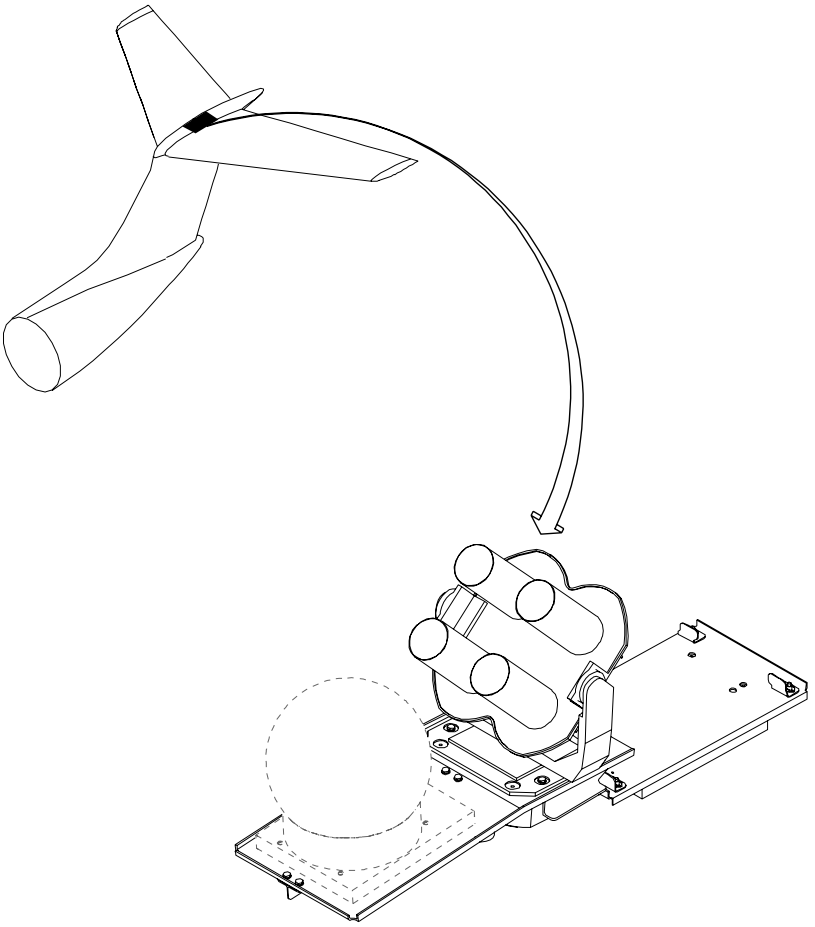
Modular Radio Cabinet
Figure 3



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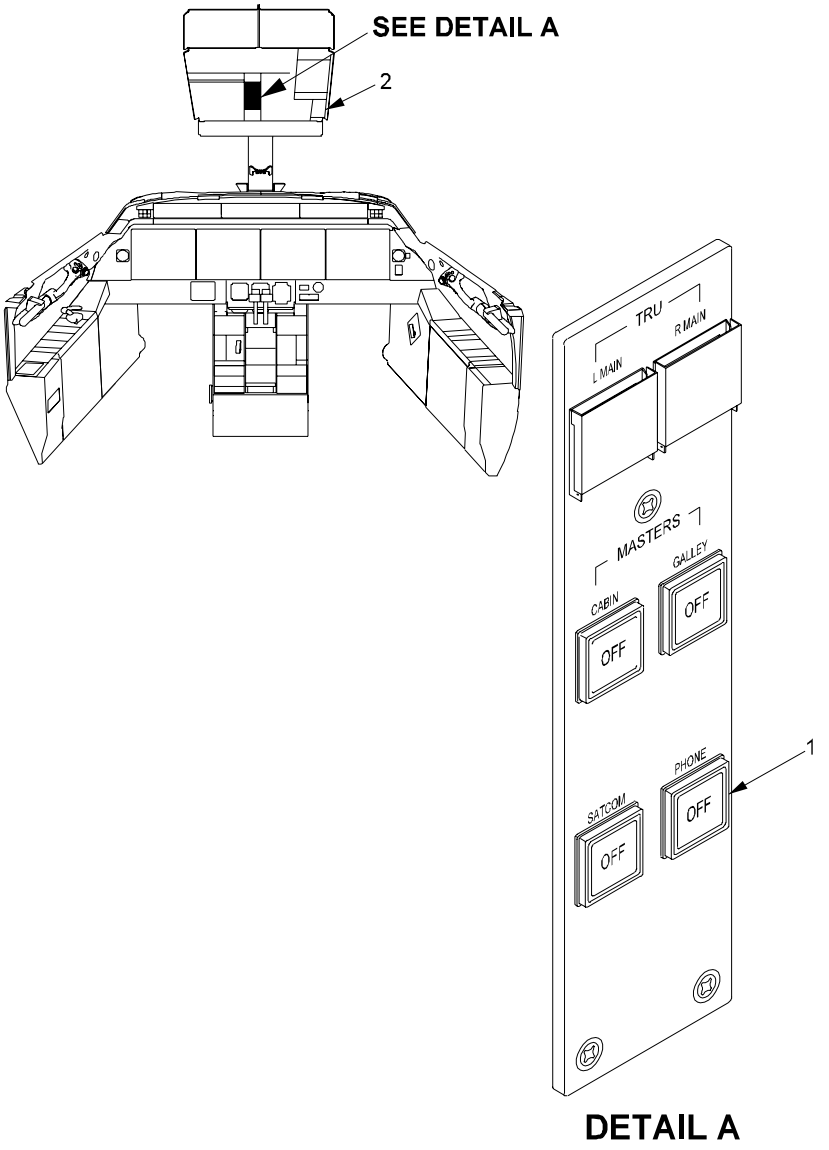
SATCOM Antenna
Figure 4



SATCOM and MagnaStarT MASTER Switches
Figure 5

2A-23-40: MCDU and CCD Radio Tuning

1. General Description:

Communication and navigation radios are tuned using functions contained in the Multi-function Control and Display Unit (MCDU) RADIO pages or by commands using the Cursor Control Device (CCD) and frequency data on the Display Units (DUs). A typical MCDU radio page is shown in Figure 6.

2. Description of Subsystems, Units and Components:

A. Radio tuning using the MCDU:

Any of the three MCDUs installed on the cockpit pedestal may be used to tune the COM and NAV radios. Tuning is accessed by selecting the RADIO function key on the MCDU and toggling between the RADIO 1/2 and RADIO 2/2 pages with the NEXT or PREV function keys. The RADIO 1/2 page contains the tuning information for COM 1 and COM 2, NAV 1 and NAV 2, DME 1 and DME 2, and XPDR code. The RADIO 2/2 page contains tuning information for HF 1 and HF 2, ADF 1 and ADF 2, and COM/NAV 3. The current active frequency is displayed in green.

Tuning commands entered using the MCDU keys and tuning knob are communicated to the corresponding Modular Avionics Units (MAUs) via ARINC-429 busses (MCDU #1 to MAU #1, etc.). The MAU then forwards the tuning data in ASCB-D format to the Network Interface Module (NIM) of the appropriate Modular Radio Cabinet (MRC #1 contains the #1 COM and NAV radios, MRC #2 the #2 radios). The NIM then translates the ASCB-D data to tuning commands for the selected radio. COM/NAV 3 is tuned via an ARINC-429 connection to MAU #3.

In the event of ASCB-D tuning path failure, the MCDU tuning commands are communicated directly to the MRCs over a secondary ARINC-429 bus. During electrical system malfunctions / emergencies when the aircraft is operating the emergency batteries, a backup tuning path using a dedicated ARINC-429 bus linking MCDU #3 and MRC #1 allows the crew to tune only the #1 radios using functions of the MCDU #3 RADIO pages.

The radio tuning functions include a timing protocol for the bus pathways. If a tuning command is not accomplished by the selected radio in the MRC and a confirmation received by the MCDU within a specified interval, the selected frequency display illuminates amber and an appropriate message is displayed in the MCDU scratchpad.

For a complete description of the radio tuning process using MCDU commands, see Section 2B-09-00 of this manual.

B. Radio tuning using the CCD:

The procedures for tuning the COM and NAV radios using commands from the CCDs and the frequency display formats on the DUs have not been finalized as of this writing. Information regarding CCD radio tuning will be included when it becomes available.

3. Controls and Indications:

A. Circuit Breakers (CBs):

The radio tuning system is protected by the following CBs:

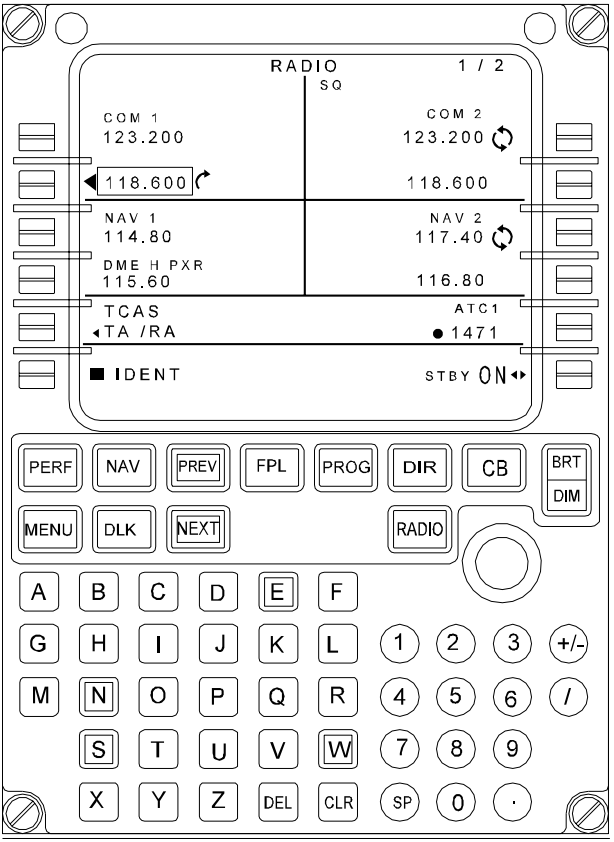
Circuit Breaker Name:	CB Panel:	Location:	Power Source:
MCDU #1	POP	D-7	R EMER DC Bus
MCDU #2	CPOP	D-7	R MAIN DC Bus
MCDU #3	POP	E-7	EMER DC Bus
L CCD	POP	B-10	L ESS DC Bus
R CCD	CPOP	B-10	R ESS DC Bus

B. Crew Alerting System (CAS) Messages:

There are no CAS messages associated with radio tuning. See CAS messages for the MCDUs and CCDs.

4. Limitations:

There are no limitations established for Radio Tuning at the time of this writing.



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MCDU Radio Tuning
Figure 6

2A-23-50: Selective Calling System

1. **General Description:**

   The selective calling (SELCAL) system provides a means for ground stations to address specific aircraft over normal communication frequencies without requiring the flight crew to continually monitor the frequencies for incoming transmissions. The SELCAL system incorporates a coded data address module for each individual aircraft. Ground stations that make use of the SELCAL system to route messages to aircraft are furnished with the aircraft address code. The address module in the aircraft continuously monitors communications frequencies, and when the data address of the aircraft is recognized, triggers an audio tone and/or a CAS message alert prompting the crew to monitor the SELCAL frequency for an incoming message.

2. **Description of Subsystems, Units and Components:**

   The SELCAL function is integrated into the MRCs, with the aircraft unique selcal code set during radio configuration. (The aircraft unique selcal code may be read for five seconds on the audio panel LED by pushing in the SELCAL function button.) The NIMs in each MRC filter incoming communications frequencies (regardless of whether the audio reception button is selected or not) to detect the assigned aircraft address code. If the proper SELCAL code is received, a discrete bit is set on the audio buses. Upon receipt of the discrete, each audio panel displays SELCAL in the LED indicator and the transmit and audio reception buttons of the radio receiving the selcal message flash slowly. The selcal function button also flashes. In addition to these indications, a signal is sent to the Monitor and Warning System (MWS) to display a SELCAL CAS message. An audio chime is also heard in the cockpit headsets and over the cockpit speakers if selected on.

   The flight crew cancels the visual and aural notifications by pushing in the selcal feature button on the audio panel or by selecting and keying the microphone of the radio receiving the selcal message.

3. **Controls and Indications:**

   A. **Crew Alerting System (CAS) Messages:**

      CAS messages associated with the Selective Calling system are:

Area Monitored:	CAS Message:	Message Color:
SELCAL coded address	VHF 1-2-3 SELCAL	Blue
SELCAL coded address	HF 1-2 SELCAL	Blue

4. **Limitations:**

   There are no limitations established for the selective calling (SELCAL) system at the time of this writing.

2A-23-60: Cockpit Voice Recorder System

1. **General Description:**

   The cockpit voice recorder (CVR) system provides a means for recording the most recent thirty (30) minutes of all cockpit spoken conversation and ambient noise, communications radio traffic and audio signals received by aircraft crew members. The recorded data is stored within a crash-resistant casing to preserve the data for investigatory purposes. The CVR system is composed of the following units and components:

- CVR unit
- Voice Recorder Control Unit (VRCU)
- Cockpit area microphone
- Bulk erase switch
- Impact switch

2. Description of Subsystems, Units and Components:

A. CVR Unit:

The CVR is mounted in the tail compartment. A solid-state unit, it continuously records four channels of analog audio information: pilot audio panel, copilot audio panel, observer audio panel and cockpit area audio. The CVR converts the analog audio to a digital format and then stores the data on to solid-state memory. The recorder medium is contained within a protective enclosure to guard against potential damage resulting from an aircraft accident.

An underwater acoustic locator beacon is physically attached to CVR unit to aid in retrieving the unit. The acoustic beacon is automatically triggered upon contact with water and operates from internal battery power.

CVR status is monitored by two generic Input / Output (I/O) modules, one in MAU 1 and one in MAU 2. If the CVR fails, the I/O modules signal the Monitor and Warning System (MWS) to generate a Crew Alerting System (CAS) message. The MAUs also provide the CVR with a continuous time reference signal from the active Flight Management System (FMS) in order that all recorded data may be chronologically ordered.

B. Voice Recorder Control Unit (VRCU):

The VRCU is located on the copilot's side console. The unit contains a press-to-test switch and test pass indicator, an erase button (presently inoperable) and a headphone jack that allows monitoring the cockpit area microphone for satisfactory operation. See the illustration in Figure 7. The VRCU also contains a pre-amplifier to boost cockpit area microphone reception prior to output to the CVR unit.

NOTE:

A planned future provision will allow operation of the cockpit voice recorder to be monitored by selecting the CVR button on the audio control panels. Use of the CVR button would avoid the necessity of connecting a headphone into the jack of the VRCU, allowing system monitoring with the existing headphone configuration. When implemented and the CVR button is selected on the audio panel, audio from other selected sources is blocked in order to monitor the operation of the recording function. When the CVR button is deselected, audio from currently selected sources is restored.

C. Cockpit Area Microphone:

The cockpit area microphone is located on the windshield center post between the NO GND SPLRS annunciator lights. It is positioned to

maximize the reception and recording of human conversation and other ambient sound in the cockpit area.

D. Bulk Erase Switch:

The bulk erase switch is located on the Test and Monitor Panel at the Right Electronic Equipment Rack (REER). To safeguard the integrity of recorded data, the switch will only operate if the aircraft is on the ground (weight-on-wheels) and the main cabin door open. See Figure 8.

E. Impact Switch:

The CVR impact switch is located in the tail compartment adjacent to the CVR. If the switch is subjected to a force of approximately two and one-half times the force of gravity (2.5 G) the switch activates to stop CVR recording, saving the previously recorded data. If the impact switch is activated for any reason, an indicator light illuminates until an adjacent reset switch is reset. The installation is shown in Figure 9.

3. Controls and Indications:

A. Circuit Breakers (CBs):

The cockpit voice recorder system is protected by the following CBs:

Circuit Breaker Name:	CB Panel:	Location:	Power Source:
VOICE RCDR	REER	E-3	R ESS DC Bus

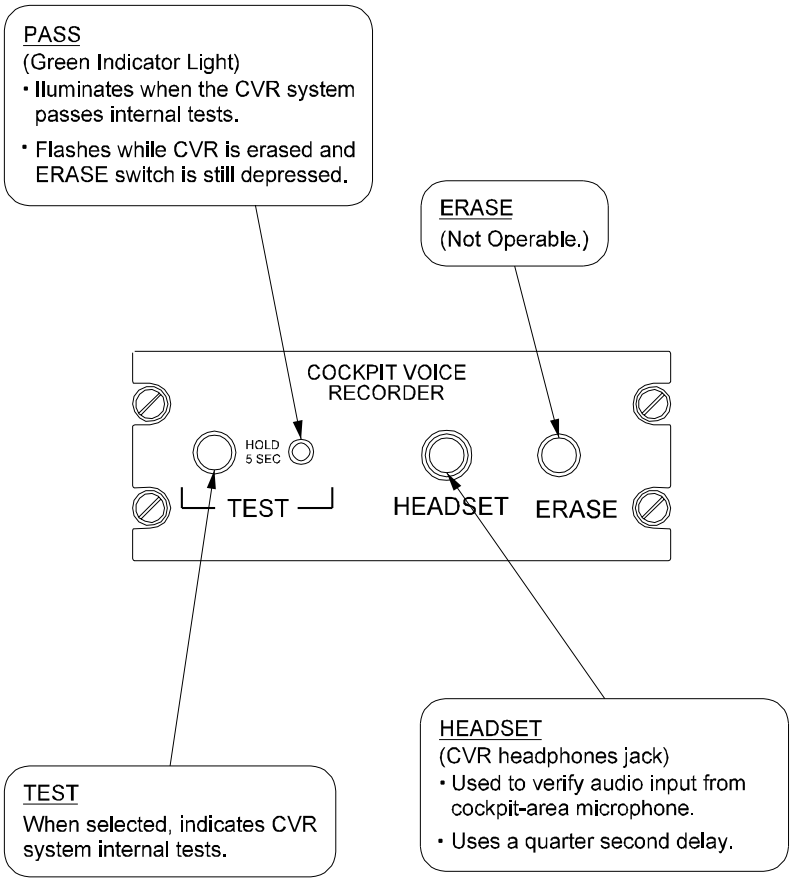
B. Crew Alerting System (CAS) Messages:

CAS messages for the cockpit voice recorder system are:

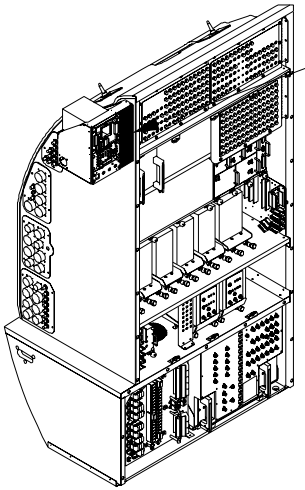
Area Monitored:	CAS Message:	Message Color:
CVR	Cockpit Voice Recorder Fail	Blue

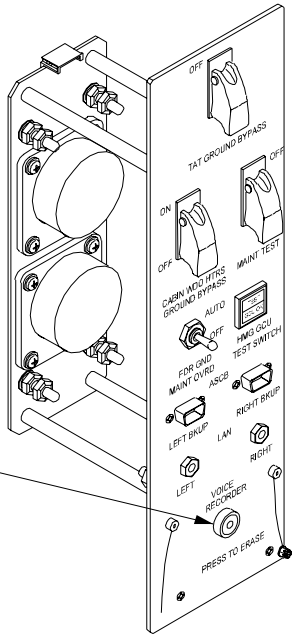
4. Limitations:

There are no limitations established for the cockpit voice recorder system at the time of this revision.



Voice Recorder Control Unit
Figure 7





CVR BULK ERASE BUTTON
Pressing button for seven (7) seconds will delete existing information on the cockpit voice recorder. The erase feature will only operate when the aircraft is on the ground (weight on wheels).

DETAIL A

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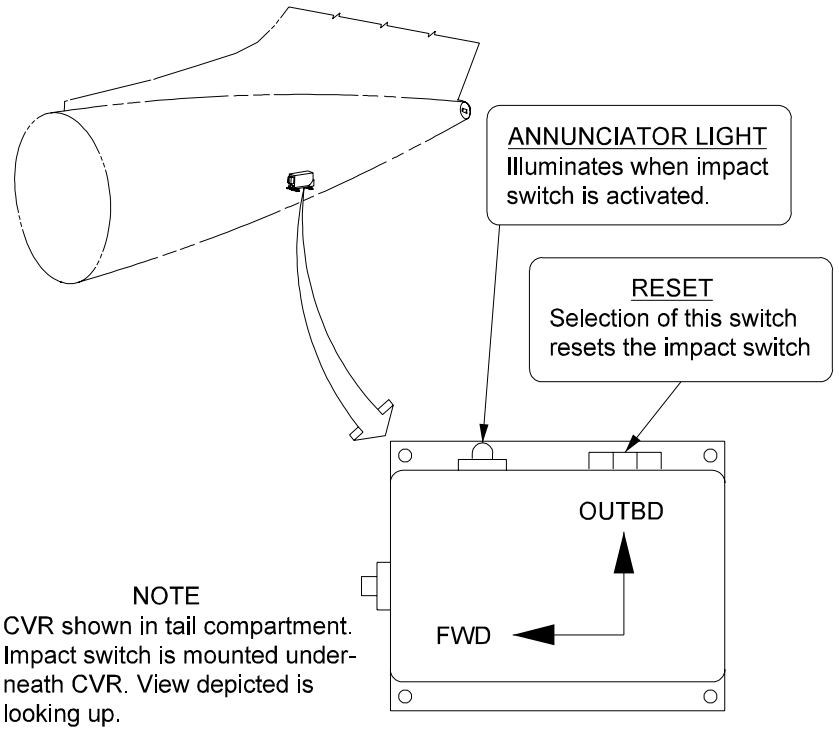
Voice Recorder Bulk Erase Switch
Figure 8



Voice Recorder Impact Switch
Figure 9

2A-23-70: Emergency Locator Transmitter

1. General:

A. Description:

A battery powered Emergency Locator Transmitter (ELT) unit is installed in the upper shelf of the Aft Electronic Equipment Rack (AEER) in the baggage compartment. The unit is activated either in automatic mode by a G-force switch on the unit set at a velocity change of four point five feet per second (4.5 fps) or manually by a switch installed on the copilot instrument panel below the clock.

Once activated, the ELT transmits signals over a dedicated antenna on the upper fuselage just forward of the Auxiliary Power Unit (APU) air intake scoop. The ELT uses three frequencies to facilitate locating the aircraft:

- 121.5 MHz - standard civil emergency frequency
- 243.0 MHz - military emergency frequency

- 406.025 MHz - emergency satellite locating frequency

The transmission over the emergency satellite frequency (406.025) consists of a digital data block that includes the aircraft tail number, country of registration and position coordinates. (The aircraft specific digital data is strapped into the ELT unit upon initial installation.) Position data is continually furnished to the ELT over an ARINC-429 link with Inertial Reference Unit (IRU) #1. Upon receipt of the data block by the emergency satellite, information particular to the aircraft is activated in the emergency satellite network database. Database information typically includes:

- Type of aircraft
- Address of aircraft owner
- Telephone number of aircraft owner
- Aircraft registration number
- Alternate emergency contact telephone number

The satellite frequency data transmission occurs every fifty (50) seconds for five hundred twenty (520) milliseconds, with the transmissions continuing for the first twenty-four (24) hours after the ELT is activated. After twenty-four (24) hours, the satellite transmission ceases to preserve battery power for the other two frequency transmissions that will continue to broadcast a pulsing audio tone signal between three hundred and sixteen hundred Hertz (300 - 1,600 Hz) until the unit batteries are exhausted, normally seventy-two (72) hours after activation. (The ELT is normally powered by the aircraft twenty-eight volt (28v) emergency DC bus to provide continuous IRU position information to the unit, but the ELT has four internal “D” size lithium / manganese dioxide batteries enabling the ELT to transmit independent of aircraft power.) The system is designed to immediately provide the satellite network with the aircraft position in order to initiate a search and rescue effort and subsequently provide a homing signal over standard emergency frequencies for as long as battery power is available.

B. Operation:

The ELT is controlled with either of two switches: the guarded copilot side instrument panel switch (see Figure 10) or a switch installed on the exterior of the unit in the AEER (shown in Figure 11). The normal position of the unit switch is OFF and the normal position of the cockpit switch is ARM to enable automatic G-force activation of the unit. If either switch is placed in the ON position, the ELT will begin transmitting, a loud buzzer audio signal will be produced by the unit at the AEER, and a red light located adjacent to each switch will flash to indicate that the ELT has been activated.

If the ELT has been inadvertently activated, the unit may be reset by either placing the cockpit switch to ON then back to ARM or by selecting the switch on the unit at the baggage compartment to ON and back to OFF.

C. ELT Test Procedures:

If it is necessary to test the function of the ELT, the following protocol must be strictly observed in order to avoid erroneously activating a search and rescue operation:

(1) Any ELT test should only be performed within the first five (5) minutes of the hour. Obtain a valid Universal Coordinated Time (UTC) reading prior to testing.

(2) Notify any control tower or ATC facility within reception range of the intention to test the ELT and the time of the test.

(3) No test should exceed five (5) seconds in duration - if a test is prolonged, the digital data transmission to the satellite network may be initiated as early as forty-seven (47) seconds after turning on the ELT. All data transmissions to the satellite network are deemed valid signals and cannot be overridden.

(4) Provide aircraft power to the ELT unit for a least thirty (30) seconds prior to testing in order for the position reporting system to be validated.

(5) Tune a communications receiver to 121.5 MHz to monitor the locator beacon.

(6) Turn either the cockpit or baggage compartment switch ON, monitoring the emergency frequency for three (3) audio tone pulses that should be completed within approximately one (1) second and verifying illumination of the adjacent red indicator light, then select the switch back to the ARM or OFF position. If the ELT is operating normally, the red indicator light should remain illuminated for one second and then extinguish. This test procedure verifies the G-force switch, the satellite transmitter integrity and validity of the IRU position information. (Locator beacon radio transmission is verified by monitoring the 121.5 radio frequency.)

(7) If a malfunction is revealed during the test, the indicator light(s) will flash a coded signal to identify the problem:

- One (1) flash indicates a G-force switch failure
- Three (3) flashes indicate a satellite frequency transmitter problem
- Five (5) flashes indicate a lack of position information from the IRU
- Seven (7) flashes indicate an internal battery malfunction

2. Controls and Indications:

(See Figure 10 and Figure 11).

A. Circuit Breaker (CB):

The following CB normally powers the ELT:

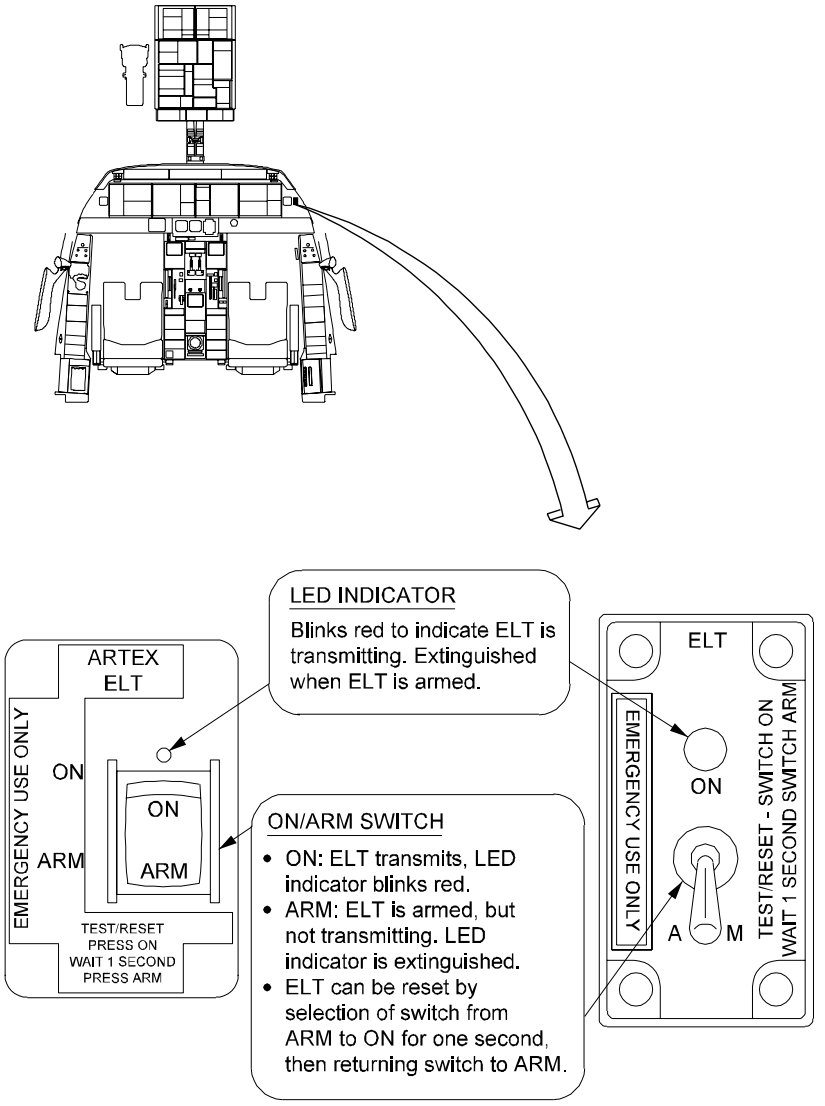
Circuit Breaker Name:	CB Panel:	Location:	Power Source:
ELT	POP	G-6	EMER DC Bus

B. Crew Alerting System (CAS) Messages:

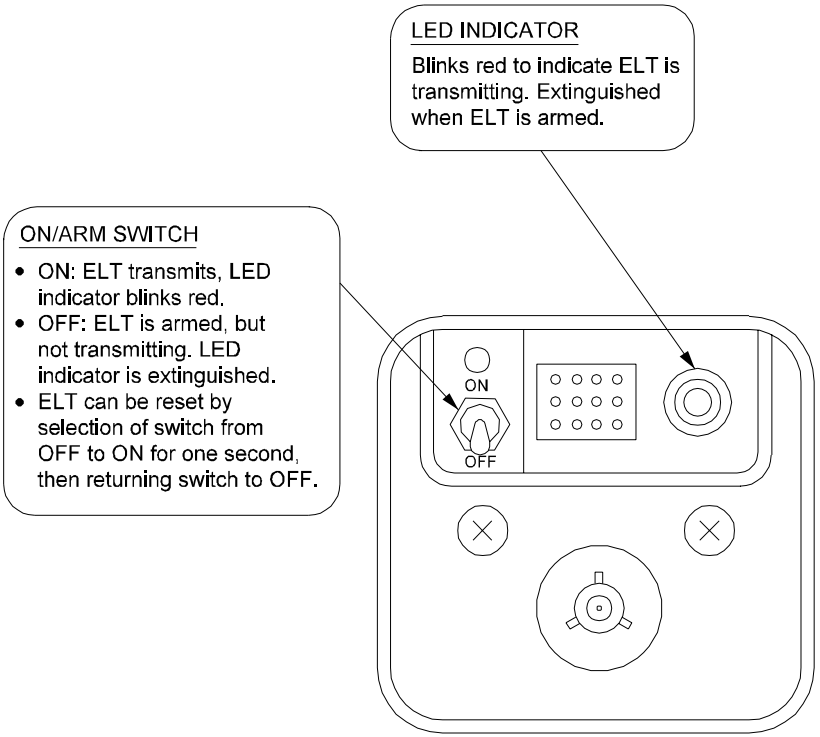
There are no CAS messages associated with the ELT.

3. Limitations:

There are no limitations regarding operation of the ELT as of this writing.



Cockpit ELT Switch Panel
Figure 10



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Baggage Compartment ELT Switch Panel
Figure 11

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