INSTRUMENTATION

The Citation XLS is equipped with a Honeywell Primus 1000 Control Display System which includes display, flight director guidance, autopilot, yaw damper and pitch trim functions. The system consists of the following components:

IC-615 Integrated Avionics Computer (IAC) that includes:

- Flight Guidance System (FGS)
- Electronic Flight Instrument System (EFIS)

AZ-950 Air Data System (ADS)
Primus 880 Weather Radar
Attitude and Heading Reference System (AHRS)
Primus II Radio System

The IAC system is a fail-passive autopilot/flight director and display system that has a full complement of horizontal and vertical flight guidance modes. These include all radio guidance modes, long range navigation system tracking modes, and air data vertical modes. Either pilot's flight director (FD) can be coupled to control the airplane.

The IAC is the focal point of information flow in the system. It converts input data and information to the pilot-selected formats, then displays on the attitude direction indicator (ADI) and the horizontal situation indicator (HSI) within the confines of the primary flight display tube(s). The IAC also generates information that is displayed on the multi-function display (MFD), and it computes the flight director steering information for the autopilot function.

The two IACs are connected with high level data link control lines. This and other interconnects are used so that the flight guidance functions and symbol generator functions share, compare, and communicate blocks of information.

When engaged and coupled to the flight director commands, the system's autopilot controls the aircraft using the same commands that are displayed on the attitude director indicator. When the autopilot is engaged and uncoupled from the flight director commands, manual pitch and roll commands can be entered using the touch control steering (TCS) button or the autopilot PITCH wheel and TURN knob.

A GH-3000 standby flight display is installed which displays the airplane attitude, altitude, airspeed, Mach number, and magnetic heading. All of this information is displayed on an LCD display which is powered by its own battery. It receives data from a small standby air data computer connected to the standby pitot-static system.

A mechanical standby HSI is also installed to provide heading, short range navigation and approach information. It is comprised of a course deviation indicator (CDI or localizer) and a glide slope indicator.

PITOT-STATIC SYSTEMS

The airplane is equipped with three separate and independent pitot-static systems. The two primary systems serve the pilot's and copilot's systems. The third provides pitot and static air pressure to the standby flight display and provides a source of static pressure for the cabin pressure differential pressure gage.

The pitot tube on the left side of the nose of the airplane supplies pressure to the pilot's AZ-950 micro air data computer. The pitot tube on the right side of the nose of the airplane serves the same function in the copilot's system.

The standby pitot tube is on the right side of the fuselage below the copilot's aft window and provides pitot pressure to the standby airspeed indicator/altimeter on the standby flight display (SFD). Three static ports are located on each side of the airplane, approximately at fuselage station 153. The lower port on the left side and the upper port on the right side provide the static source for the pilot's system. The upper port on the left side and the lower port on the right side provide the static source for the copilot's system. The center ports on each side provide static pressure for the backup pitot-static system.

The two pitot tubes and four static ports of the primary pitot-static systems, as well as the two static ports and single pitot tube of the backup system, are electrically heated for ice protection.

AIRSPEED AND ALTIMETER INDICATIONS

Altitude and airspeed data is generated by the AZ-950 micro air data computers, which is transmitted through the IC-615 Display Guidance Computers to the PFDs. This information is then presented in color on the PFDs. The micro air data computers also send altitude information to the mode S (altitude) function of the transponders.

AIRSPEED INDICATION

The indicated airspeed display is to the left of the attitude display on the primary flight display. The display consists of a "rolling digit" window in the center of an airspeed vertical tape. The resolution of the rolling digits is one knot. The moving vertical tape moves behind the window and displays digital airspeed at 20 knot intervals above 200 knots and 10 knots intervals below 200 knots, with the larger numbers at the top of the scale. The range of the airspeed scale is 30 to 450 knots with tick marks at 10 knot intervals.

An airspeed trend vector, which displays an indication of the direction and rate of airspeed change, extends vertically from the apex of the current airspeed value display window. It extends upward for acceleration and downward for deceleration. The trend vector represents a prediction of what the airspeed will be in ten seconds if the current rate of change is continued.

PITOT-STATIC SYSTEM SCHEMATIC

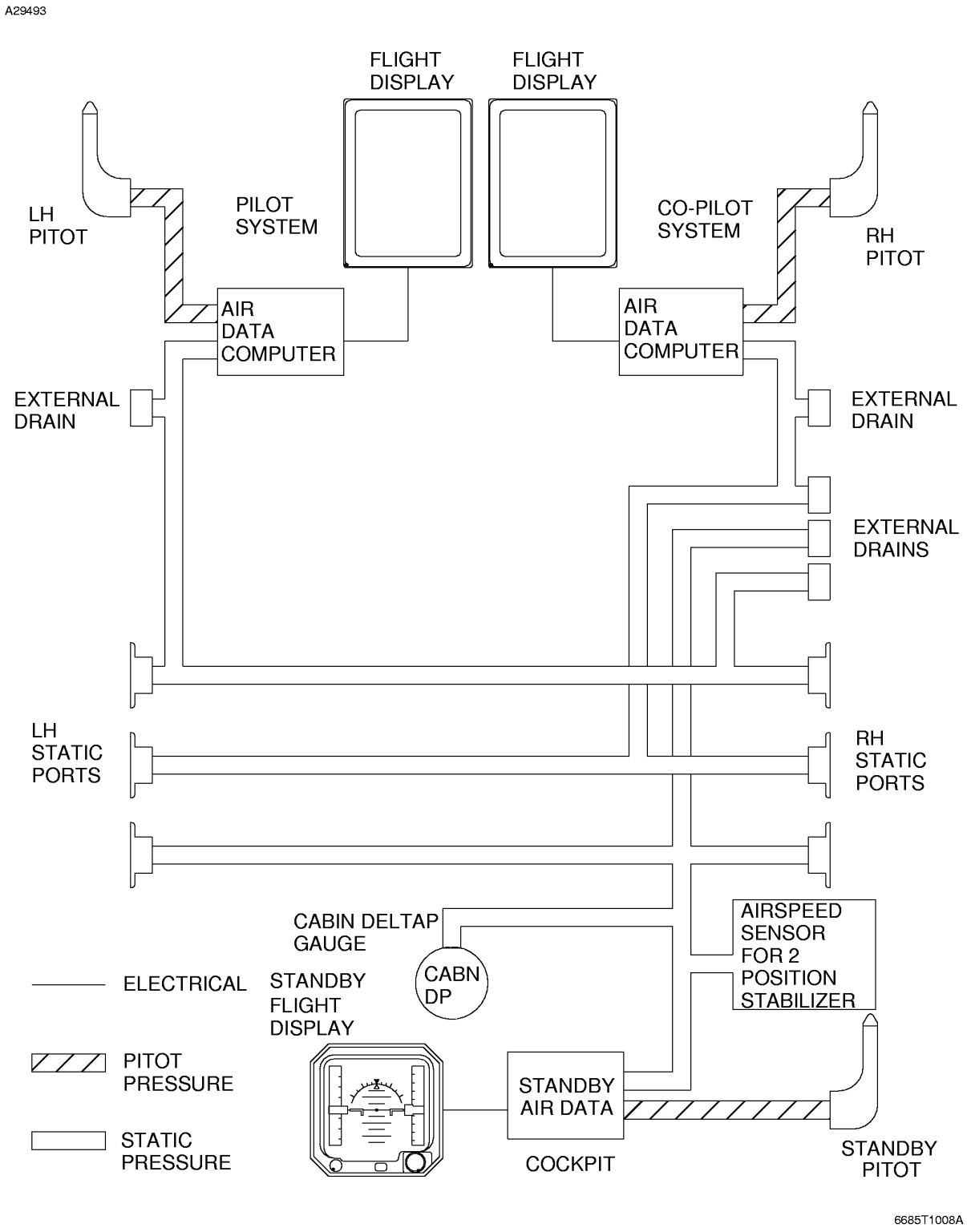


Figure 3-1*

V-Speeds can be selected by use of the menu pushbuttons located on the Multi-function Control Display Units (MCDUs). The bugs are labeled 1 (V_1), R (V_R), 2 (V_2), E (V_{ENR}), (this airspeed is automatically displayed whenever V_1, V_R, or V_2 is selected for display; V_{ENR} is permanently selected to 160 knots), RF (V_{REF}), and AP (V_{APP}). In manual mode, the bugs are positioned on the right outside edge of the airspeed tape. They consist of a horizontal T-shaped symbol with its respective label positioned to the right of the symbol. All the takeoff set bugs will be removed from the display when the airplane airspeed exceeds 190 knots and the landing speed bugs are removed upon touchdown.

When the airspeed is below 40 knots and weight on wheels is indicated, V_1, V_R, V_2, and V_{ENR} are displayed in the bottom portion of the airspeed tape in the form of a digital readout. The digital readout of the set value is displayed along with the bug symbol and are labeled in ascending order, starting with V_1. Upon power up, the digital readouts for the set bugs will be dashes. As the V speeds are set, the digital readouts will follow the readout on the MFD (PFD menu) and set accordingly. The digital readouts are removed from the display when the first V speed value comes into view on the airspeed tape.

Standby altitude and airspeed are available, in case of main electrical system failure, from the standby altimeter and the standby airspeed indicator, which are located in the standby flight display. These indicators receive their data from a standby micro air data computer (MADC). The standby MADC, powered by its own battery source, obtains its pneumatic data from the standby pitot-static system and converts it to digital electrical outputs for the indicators.

OVERSPEED INDICATIONS

Below 8000 feet altitude the limiting airspeed (V_{MO}) is 260 KIAS; between 8000 feet and 28,907 feet the limiting airspeed is 305 KIAS. When one of these limits is exceeded, the airspeed indication in the window to the left of the attitude display in the PFD will be changed to red and an amber annunciation. Also, to the left of the attitude sphere, will announce MAX SPEED. A red indicator tape is also presented on the inside of the airspeed scale. The thermometer extends from V_{MO}/M_{MO} to larger airspeeds on the tape and appears in the indication as the airspeed reaches into the range near V_{MO}/M_{MO}. When the limiting airspeed is exceeded the overspeed warning aural alert will sound, and will continue to sound until the airspeed is reduced below the limit speed.

NOTE

The aural warning system consists of two separate units which receive input from airplane anomalies of overspeed, autopilot off and altitude alert. The units will output aural signals to both the headphones and speakers.

TYPICAL AIRSPEED DISPLAY

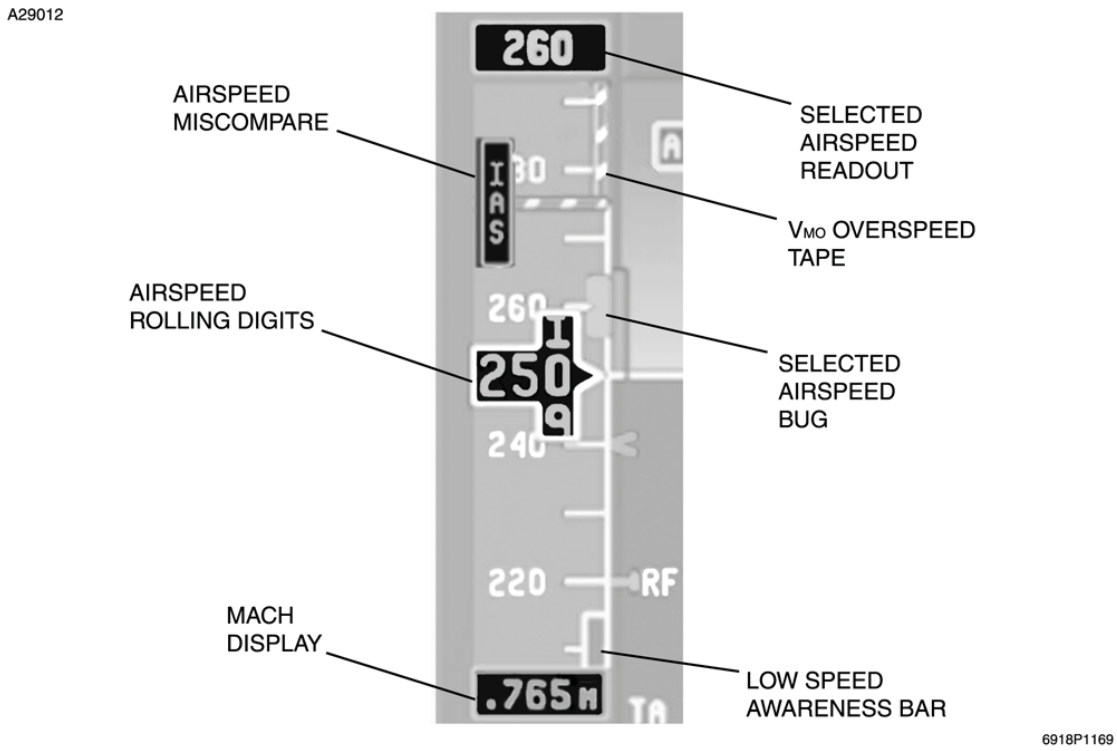


Figure 3-2

LOW AIRSPEED AWARENESS

A red thermometer type display located on the inside of the airspeed tape gives indication of low airspeed. The red thermometer extends from the bottom of the airspeed tape up to 1.1Vs (approximately stick shaker speed).

MACH NUMBER DISPLAY

A digital readout of indicated Mach number is displayed below the airspeed tape. The Mach number will come up on the display when Mach exceeds 0.450, and is removed when it is falls below 0.400 Mach. Resolution of the Mach display is 0.001 Mach. The standby flight display has a Mach indication which begins to read out when the Mach reaches a minimum of 0.35.

ALTITUDE INDICATION

The altitude display is located to the right of the attitude display on the primary flight display. The altitude is indicated by means of a vertical tape display which has a “rolling digit” window in the center of an altitude vertical tape. The resolution of the digits to 20 feet. The hundreds, thousands, and ten thousands digits are larger digit numerals than the others. The vertical tape moves behind the window and displays a tape 550 feet both above and below the present indicated altitude, with the larger numbers at the top of the scale. The range of the altitude window is from -2,000 to 60,000 feet with tick marks located at 100 foot increments.

The scale is labeled in 500 foot intervals, and single line chevrons are located at each 500 foot increment. Double line chevrons are located at each 1000 foot increment. The chevrons extend back to the approximate midpoint of the altitude tape and are connected with each other by a vertical line. The left side of the “rolling digit” window will has the same angle as the chevrons.

The barometric pressure setting is controlled by a BARO knob in the middle of the DC-550 controller. The BARO knob also functions as the STD button and allows a change to a baro setting of 29.92 in. Hg. (or 1013 millibars) by pressing it, "STD" will show when button is pressed. The baro correction setting display is located just below the altitude tape. The BARO knob will change the altitude correction by 0.01 in. Hg. per click.

An altitude trend vector is displayed on the left edge of the altitude tape and provides an indication of the rate of altitude change. The trend vector extends vertically from the apex of the current altitude display window. The vector extends up for positive vertical trends and down for negative values. The vector represents a prediction of what the altitude will be in six seconds if the current vertical speed is maintained.

Standby altitude indications are available from the standby flight display (standby airspeed/ altitude/ attitude indicator) which is discussed under Standby Flight Display below in this section.

TYPICAL ALTITUDE DISPLAY

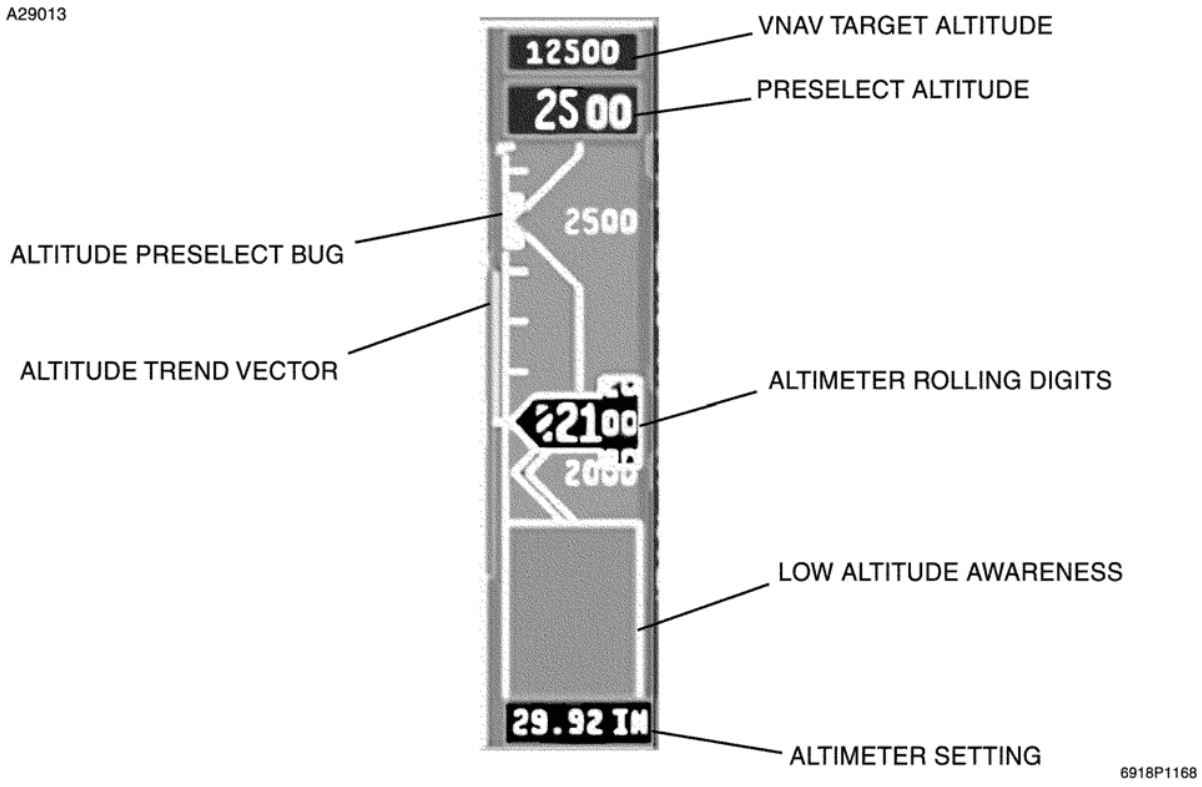


Figure 3-3

VERTICAL SPEED INDICATION

Vertical speed data is developed in the AZ-950 Micro Air Data Computers, which sense the rate-of-change of altitude from inputs of the static system. The computers convert the data into digital form and transmit it through the digital data bus system to the IC-615 Display Guidance Computers, which forward it to the DU-1080 Primary Flight Displays where it is generated into a visual display.

The vertical speed display is a fixed-scale, meter-movement type display; a pointer rotates about a point which is outside of the actual display. The range of the vertical speed indicator is 0 to ±6000 feet per minute. The scale is non-linear, which provides increased resolution between ±2000 feet per minute. A digital readout of the actual vertical speed is displayed above the scale when ascending and below the scale when descending. The digital readout has a resolution of 50 feet per minute. The digital readout does not appear for vertical speeds of ±300 feet per minute or less, leaving only the meter type display.

VERTICAL SPEED DISPLAY

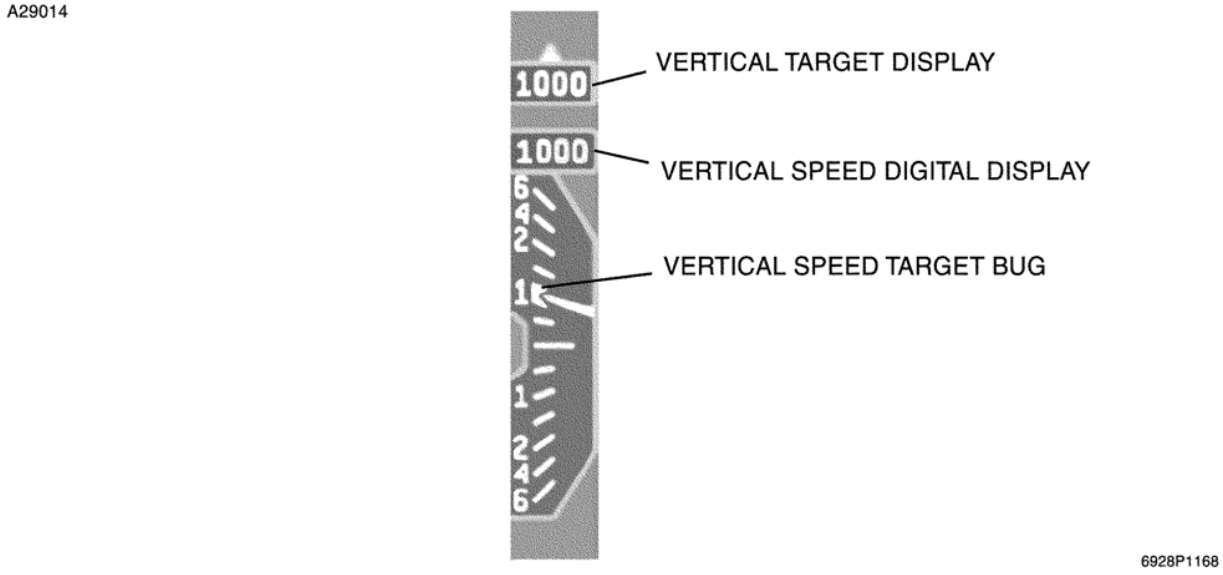


Figure 3-4

ROLL POINTER/SLIP SKID DISPLAY

The slip skid display is located at the top of the attitude display of the PFD and SFD. Coordinated flight is depicted as an alignment of the triangle with the associated rectangular block directly under the triangle.

MAGNETIC COMPASS

Magnetic heading is displayed on the SFD.

RAM AIR TEMPERATURE INDICATOR

Ram air temperature is displayed on the MFD and on the AMLCD.

TRUE AIRSPEED PROBE

A true airspeed probe is located below the windshield on the fuselage right side. This temperature reading is fed directly into the Air Data Computers for computation purposes only and does not provide a viewable readout.

STANDBY HORIZONTAL SITUATION INDICATOR (HSI)

The HSI-315B standby horizontal situation indicator is a three inch instrument located on the left side of the center instrument panel. It provides short range navigational guidance in case of PFD/flight director failure, or in case of primary electrical system failure. The HSI is “hard-wired” to the NAV 1 receiver and is powered by the emergency DC bus.

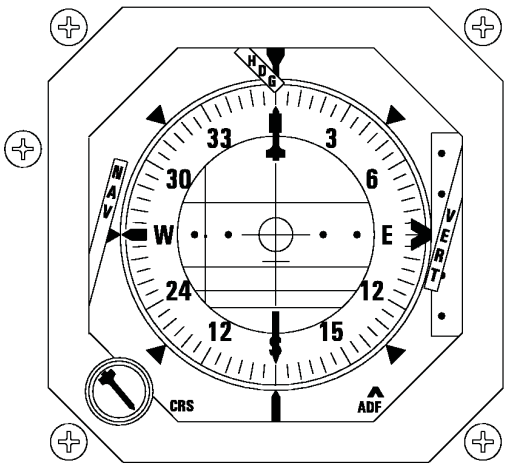
The standby HSI displays compass heading, glideslope and localizer deviation and airplane position relative to VOR radials. The compass card is graduated in 5° increments and a lubber line is fixed at the fore and aft positions. Azimuth markings are fixed at 45°, 135°, 225°, 270°, and 315° on the compass face. A fixed reference airplane is in the center of the HSI, aligned longitudinally with the lubber line markings.

The course cursor is set by a knob on the instrument. Once set, the cursor rotates in its set position with the compass card. The course deviation bar, which forms the inner segment of the course cursor, rotates with the course cursor.

A blue ADF needle, which displays ADF 1 bearings, rotates around the outer portion of the dial.

STANDBY (HSI)

A35153



6618T1166

Figure 3-5

A heading (HDG) flag will appear in the instrument when the compass system is OFF, the heading signal from the AHRS 2 becomes invalid, primary power to the indicator is lost, or the error between the displayed heading and the received signal becomes excessive.

The course deviation bar moves laterally in the HSI, in relation to the course cursor. Course deviation dots in the HSI act as a displacement reference for the course deviation bar. When tracking a VOR, the outer dot represents 10°, while on an ILS localizer it represents 2.5°. White TO-FROM flags point to or from a station along the VOR radial when operating on a VOR. A red warning flag comes into view when power is OFF, when NAV information is unreliable, or when signals from the NAV receiver are not valid. The standby HSI displays only NAV 1 information.

The glideslope deviation pointer is located to the right side of the display. When receiving glideslope information during an ILS approach, the green deviation pointer will be uncovered by the red VERT warning flag which will otherwise be in evidence. If an ILS frequency is not tuned and being received, or the ILS signal is unusable or unreliable, the deviation pointer will be covered by the red warning flag.

STANDBY FLIGHT DISPLAY

The GH-3000 ESIS (Electronic Standby Instrument System) standby flight display is located on the center instrument panel. This active-matrix liquid crystal display provides airplane attitude, slip/skid, airspeed, mach, heading, and altitude on a single display. Airplane attitude is provided by an internal 3-axis inertial sensor cluster. Airspeed and altitude are provided by a dedicated Air Data Unit. Heading reference is provided by a magnetometer mounted in the tailcone stinger.

Power to the system is controlled by a switch marked STBY PWR ON/OFF/TEST located on the lower right of the pilot's instrument panel. A separate 10.5 Ampere-hour sealed lead acid battery pack is located in the nose of the aircraft. When fully charged, the battery allows for at least 3.5 hours of operation in the event of total loss of airplane electrical power. The battery pack is constantly charged by the airplane's electrical system, and should therefore be fully charged in the event of an electrical power failure. The STBY PWR switch must be ON for automatic transfer of battery power to occur. An amber ON light next to the STBY PWR switch illuminates when the SFD is turned ON and the airplane's electrical system is not charging the emergency power supply battery. When the SFD switch is held to the spring loaded TEST position, a self-test of the battery and circuits is accomplished. The application of 28V DC power to the display system initiates the attitude initialization process, which is identified by the display of the message "attitude initializing" on the SFD. The duration of the initialization process is usually less than 180 seconds.

A light sensor is located on the bottom left side of the instrument case. It provides ambient light level data to the backlight control system to optimize display brightness.

STANDBY FLIGHT DISPLAY

Figure 3-6

The lighting level can still be manually controlled from the SET BRIGHTNESS OFFSET function by pressing the [M] menu access button and the adjustment knob for the sub-menu. Rotate the knob to adjust, then press the knob to finish setting the brightness offset. The brightness of the [M] menu access button is controlled from the center instrument panel light rheostat control.

SELF-TEST

The unit has a built-in test feature, which automatically detects any failure of the display at power up and during continuous operation. If a failure is detected, a message or flag will appear. Where it is not possible for the diagnostics feature to automatically correct a failure, the system will prompt the crew to intervene by resetting power.

NOTE

All power resets should only be accomplished while in straight and level, unaccelerated flight.

MENU FUNCTIONS

Pressing the MENU [M] button will bring the submenus into view. Select a submenu function by turning the adjustment knob to highlight the desired function. Enable that highlighted function by pressing the adjustment knob in. For an ILS, with the number one navigation radio tuned to and receiving an ILS frequency, highlight and select ILS. To use the ILS BC function, highlight and select ILS BC.

NOTE

- LOC and GS course deviation bars present raw data only. They are not flight director command bars.

- VOR, FMS, and TACAN information is not available on the XLS GH-3000 installation.

When on course and receiving reliable guidance information, the localizer and glideslope indicators will be displayed. The GH-3000 provides raw data guidance only. Marker beacons will annunciate in the upper right corner of the display.

Other menu functions configured on the XLS are:

- FAST ERECT
- SET BRIGHTNESS OFFSET
- SET HEADING (See NOTE)
- NAV [ON or OFF]
- ILS [BC or NORMAL]
- BARO TYPE

NOTE

SET HEADING menu function is available only during DG operations when no valid external heading data is available from the magnetometer.

ENGINE INSTRUMENTS

Each engine is equipped with the following instruments displayed on the center instrument panel:

- Fan RPM (N_1)
- Inter-Turbine Temperature (ITT)
- Turbine RPM (N_2)
- Oil Pressure
- Oil Temperature
- Fuel Flow

Also shown in addition to the engine instruments are:

- Ram Air Temperature (RAT)
- Fuel Temperature
- Fuel Quantity

The engine instruments are displayed on a two screen active matrix liquid crystal display (AMLCD). On the left screen, N_1, ITT, and Oil Pressure are shown with a vertical (tape) indicator format. Also shown are digital displays of N_1, ITT, and N_2. On the right screen, Oil Temperature and Fuel Quantity are shown with a vertical indicator format. Also shown are digital displays of Fuel Flow, RAT, Fuel Temperature, and Fuel Quantity.

A reversionary mode is available if a fault is detected. In the reversionary mode, one screen displays all of the parameters, while the opposite screen is blank. N_1 and ITT are shown with a digital and vertical indicator format, while all other parameters are shown in digital format only. The N_1 bugs and the IGN annunciators work the same as in the normal mode.

The reversionary mode is controlled by a rotary switch to the right of the engine instruments, labeled L-Auto-R. When this switch is in the AUTO position, the reversionary mode is automatically selected if a fault is detected. If the crew suspects a fault, the reversionary mode can be manually selected by placing the switch in the L or R position.

The left and right screens are powered through the LH ENG DISPLAY and RH ENG DISPLAY circuit breakers, on the respective left and right circuit breaker panels. The LH ENG DISPLAY circuit breaker is on the emergency bus, so when the batter switch is in the EMER position and the generators are offline, the left screen will change to the reversionary mode and the right screen would then be blank. Oil pressure and fuel quantity displays will be inoperative on the left screen, since they are powered through separate circuit breakers which are not on the emergency bus.

The fan RPM (N_1) and turbine RPM (N_2) are calibrated in percent from 0 - 115% (100% Fan RPM = 13034 RPM, 100% Turbine RPM = 32700 RPM). The fan and turbine RPM measurements come from monopoles (magnetic speed sensors) mounted on the applicable engine shaft. The vertical indicator and/or digits will turn red if 100% (redline) is exceeded. Two cyan N_1 bugs are displayed on both sides of the N_1 vertical indicators, and cyan digits above the vertical indicators show the N_1 bug setting. The bugs are set with a three position rotary switch to the left of the engine instruments labeled DEC - (off) - INC. At startup the N_1 bugs are set at 87.5%, and the cyan digits will flash until the switch is used to set the bugs to the correct N_1 target. Turn the switch to the DEC position to decrease the N_1 bug setting, and to the INC position to increase the N_1 bug setting.

AMLCD INDICATING INSTRUMENT

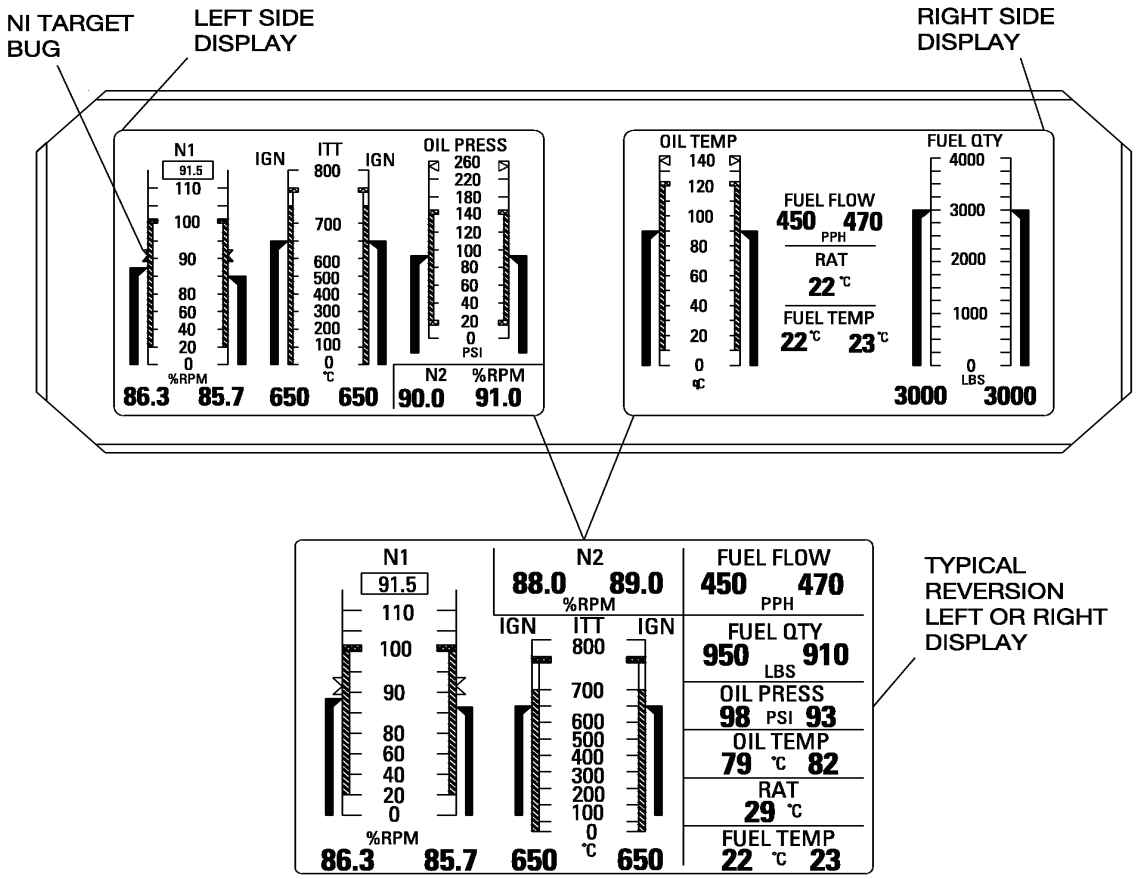


Figure 3-7*

The ITT gage is calibrated from 0 - 750°C. The temperature displayed is a synthetic interturbine temperature which is computed by measuring the exhaust gas temperature and adding to it three times the temperature rise across the bypass duct. During normal engine operation, if the 741°C redline is exceeded, the ITT vertical indicator will turn red and red digits will be displayed. During an engine start sequence, green ITT digits will be displayed and the vertical indicator and digits will only turn red if the start temperature redline (740°C) is exceeded. When the ignition system is on, IGN is annunciated in green letters above the ITT vertical indicator.

The oil pressure gage is calibrated from 0 - 260 psi. The vertical indicator (or digits in the reversionary mode) turn red or yellow if a redline is exceeded or the yellow band is entered. When the 160 psi redline is exceeded, the red color change is suppressed for 400 seconds. Exceeding the 250 psi redline is indicated in red immediately. During engine start and shutdown, the yellow range changes of the indicators or digits are suppressed, the red triangle is still active.

The oil temperature gage is calibrated from 0 - 140°C. The vertical indicator (or digits in the reversionary mode) turn red if the 121°C redline is exceeded.

The fuel flow gage displays fuel flow in pounds per hour. Readings are accurate at stabilized power settings.

Ram air temperature (RAT) gage is calibrated from -70 - +70°C. It displays outside air temperature uncorrected for ram rise.

The fuel temperature gage is calibrated from -60 - +70°C.

The fuel quantity gage is calibrated in pounds of fuel and accurately displays the fuel remaining in the left and right tanks.

FLIGHT HOUR METER

The quartz hour meter, on a panel next to the right circuit breaker panel, displays the total flight time on the airplane in hours and tenths. The landing gear squat switch activates the meter when the weight is off the gear. A small indicator on the face of the instrument rotates when the hour meter is in operation. It receives DC power from a circuit breaker (FLT HR METER) on the left circuit breaker panel.

DIGITAL CLOCK

The Honeywell Primus 1000 Control Display System uses an integrated digital clock. A section on the MFD and PFDs labeled CLOCK is located in the lower left hand side of the displays. The PFD/MFD clock will only display when FMS is in operation. The clock will show the time output from FMS in GMT.

One digital clock is mounted on the center instrument panel as a secondary clock. The clock can be made to display four time functions: local time, GMT, flight time and elapsed time. Two versions of the elapsed time function may be selected: count up or count down.

The clock has two control buttons: SEL (select) and CTL (control). The SEL button is used to select the desired function, and the CTL button to start and reset the selected mode.

For normal operation, either local time or Greenwich Mean Time (GMT) may be selected. GMT is displayed only in 24-hour format, and local time is 12-hour format. Pressing the SEL button sequentially displays GMT, local time, flight time and elapsed time. The displayed mode is annunciated GMT, LT, FT and ET, as applicable, under the time display window.

To set GMT or local time, select the desired function by pressing the SEL button. Simultaneously press both the SEL and the CTL buttons to enter the set mode. The hours digit will start flashing and may be changed by pressing the CTL button. The next digit is then selected by pressing the SEL button, and similarly set by means of the CTL button. When the last digit has been set, press the SEL button to exit the set mode. At that time the clock will start running and the lighted annunciator will resume flashing. When no airplane power is applied to the clock, the SEL and CTL buttons will not operate.

To use the clock as a stop watch to time approaches, etc., select ET with the SEL button and press the CTL button to start the timing. The clock will start counting elapsed time in minutes and seconds up to 59 minutes and 59 seconds. It will then switch to hours and minutes and continue up to 99 hours and 59 minutes. Pressing the CTL button will reset the elapsed time to zero.

To use the clock for an elapsed time "count down" display, select ET for display and enter set mode by pressing both buttons simultaneously. A maximum count down time of 59 minutes and 59 seconds can be set. The time from which it is desired to count is entered in the same manner as setting GMT or local time. When the last digit is set, press the SEL button to exit the set mode. Pressing the CTL button will start the countdown. The display will flash when the time reaches zero. After reaching zero, the ET counter will count up. Pressing the CTL button again resets ET to zero.

DIGITAL CLOCK

A4546

5685P6065

Figure 3-8

The flight time mode of the clock is enabled by a weight-on-wheels landing gear squat switch which causes the clock to operate any time the airplane weight is off the landing gear. The flight time may be reset to zero by selecting FT mode with the SEL button and holding down the CTL button for three seconds. Flight time is zeroed when the CTL button is released. A total of 99 hours and 59 minutes can be shown.

The flight time mode of the clock is enabled by a weight-on-wheels landing gear squat switch which causes the clock to operate any time the airplane weight is off the landing gear. The flight time may be reset to zero by selecting FT mode with the SEL button and holding down the CTL button for three seconds. Flight time is zeroed when the CTL button is released. A total of 99 hours and 59 minutes can be shown.

A flight time alarm mode is provided which will flash the clock display when the desired flight time is reached. To set the alarm function, select FT with the SEL button and enter the set mode by pressing both buttons simultaneously. Enter the desired alarm time in the identical manner that GMT or local time is set. When flight time equals the alarm time, the display will flash. If FT is not being displayed when the alarm time is reached, the clock will automatically select FT for display. Pressing either the SEL or CTL button will turn off the alarm and reset the alarm time to zero. Flight time is unchanged and continues counting.

The clock display may be tested when power is on the airplane by holding the SEL button down for three seconds. The display will show 88:88 and activate all four annunciators.

STALL WARNING AND ANGLE-OF-ATTACK SYSTEM

The angle-of-attack system is powered by 28 VDC from the left main DC bus through a circuit breaker on the left circuit breaker panel and incorporates an angle-of-airflow sensor, a signal summing unit, a vane heater monitor, an angle-of-attack indicator on each PFD and a stick shaker on each control column.

The vane type angle-of-airflow sensor, which is located on the forward right side of the fuselage, detects the angle of airflow and deflects accordingly. The wedge shaped vane streamlines with the relative airflow and causes a transducer to send signals to the signal summing unit (computer) located in the left nose avionics compartment. Signal inputs concerning flap position are also received by the signal summing unit. It then compensates for that variable and transmits the information to the angle-of-attack indicator. Indications are accurate throughout the weight and CG range of the airplane.

The full range type indicator is calibrated from 0.2 to 1.0, and marked with red, yellow and white arcs. Lift information is displayed on the indicator with 0.2 representing near zero lift and 1.0 representing stall. Lift being produced is displayed as a percentage and, with flap position information, is valid for all airplane configurations and weights. At 1.0 where full stall occurs, 100% of the available lift coefficient is being achieved. At the bottom of the scale (0.2) near zero lift is being produced.

ANGLE-OF-ATTACK INDICATOR AND INDEXER

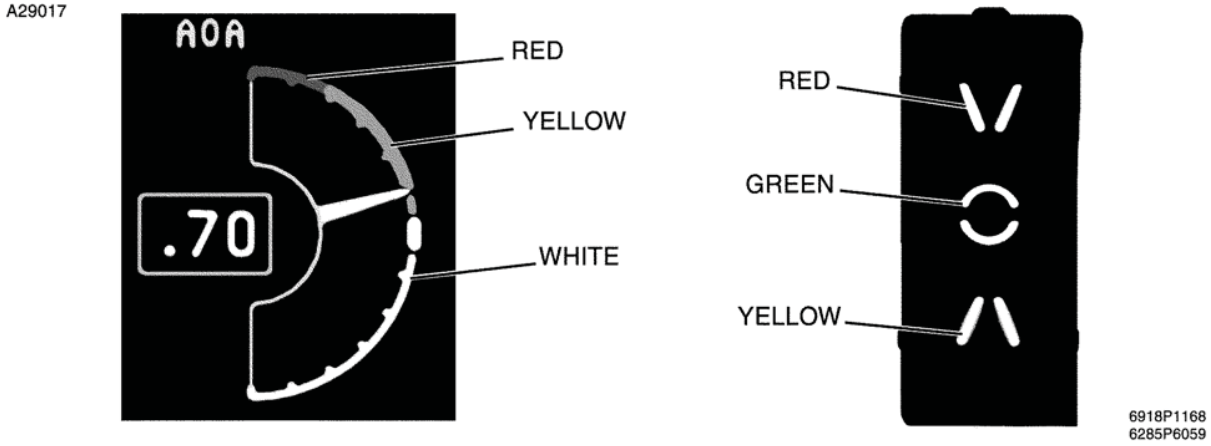


Figure 3-9

The area at the lower part of the scale (0.63 to 0.2) represents the normal operating range of the airplane, except for approach and landing. The narrow white arc (0.57 to 0.63) covers the approach and landing range and the middle of the white arc, 0.6, represents the optimum landing approach (VAPP or VREF). The yellow range (0.63 to 0.87) represents a caution area where the airplane is approaching a critical angle-of-attack. The red arc (0.87 to 1.0) is a warning zone that represents the area just prior to stick shaker activation and continuing to full stall. At an indication of approximately 0.79 to 0.88 (depending on flap setting and rate of deceleration) in the warning range, the stick shaker will activate.

If the angle-of-attack system loses power or becomes inoperative for other reasons the needle will deflect to the top of the scale and stow at a 1.0 indication. A red X will also appear at the ADI slow/fast indication. The airplane may not be flown if the stick shaker is found to be inoperative on the preflight check, or if the angle-of-attack system is otherwise inoperative.

A stick shaker is located on both the pilots' control columns, approximately 9 inches down from the control wheel and on the forward side. The stick shaker provides tactile warning of impending stall. The angle-of-attack transmitter causes the stick shaker to be powered when the proper threshold is reached.

WARNING

IF THE ANGLE-OF-ATTACK VANE HEATER FAILS AND THE VANE BECOMES ICED, THE STICK SHAKER MAY NOT OPERATE OR MAY ACTIVATE AT NORMAL APPROACH SPEEDS.

AVIONICS

The standard airplane avionics package for the Citation XLS is the Honeywell Primus 1000 Control Display System (CDS). In addition, standard equipment includes two audio control panels, dual VHF COMM transceivers, dual NAVs incorporating marker beacon receivers, dual DMEs with dual indicators, dual Mode S transponders, an ADF, a flight guidance system which includes dual attitude/heading reference systems (AHRS), electronic flight instrument system (EFIS, which is part of the flight guidance system), a Universal UNS-1Esp flight management system with GPS capability, color weather radar, a radio altimeter, a cockpit voice recorder, a standby flight display system (combination attitude indicator/altimeter/airspeed indicator) with approach capability, a standby horizontal situation indicator, a Primus 880 weather radar, and an emergency locator transmitter. Included as part of the flight guidance system is altitude preselect, altitude alerting, altitude reporting and vertical navigation. An Enhanced Ground Proximity Warning System (EGPWS or TAWS) is also installed, as is a Traffic Collision Avoidance System (TCAS II), an optional second ADF, provisions for a second Universal FMS, and provisions for an Allied Signal KHF-1050 high frequency radio.

A flight data recorder, A high frequency communications radio, airborne flight information system (AFIS), B & D cabin display, Magnastar, single or dual Universal or Honeywell FMS, and Aircell phones are also available as options.

VHF COMM TRANSCEIVERS

HONEYWELL PRIMUS II REMOTE RADIO SYSTEM

The RCZ-833 integrated communications unit normally operates in the frequency range of 118 to 136.975 (or 137) MHz. The RCZ-833 unit is the communications component of the SRZ-85X integrated radio system. The COM radios are controlled from the RM-855 radio management unit (RMU), two of which are mounted on the center instrument panel. TCAS, COM 1, NAV 1, ADF 1, etc. are controlled by the left RMU. TCAS, COM 2, NAV 2, and ADF 2 are controlled by the right RMU. The unit being controlled is annunciated on the control display unit of the RMU. The four radio functions: COM, NAV, ATC (Transponder), and ADF which are controlled by the RMU are all displayed on page one (main frequency select page) of the RMU. Tuning control for the desired function/parameter is obtained by pressing the line select key next to that function/parameter. The COM radio has a memory capacity for up to 12 frequencies to be selected and stored for later use.

CONTROLS AND INDICATORS

Control of the COMM radios is normally through the controls and display located in the upper left corner of the radio management unit (RMU). Any selectable parameter is changed by pressing the corresponding line key next to the displayed parameter which brings an yellow box (cursor) to surround that position, which allows it to be tuned by the concentric controller tuning knobs on the bottom of the RMU.

Tuning of the COM radios is accomplished by three methods. The first method, discussed below, also provides methods to store frequencies in the memory locations. This is considered the "normal" method. Storing of the frequencies while tuning is not required, however, and is discussed there only because it may be convenient to store the frequencies as they are used for possible later use. The second method is "direct tuning", and the third is remote tuning through the Standby COM 1/NAV 1 control display unit control head which may be used when only battery power is available or desired, or in case of emergency. Operation of the standby radio control (SRC) unit is discussed at the end of the VHF COM section.

Normal, or preselect tuning of the COM radios is accomplished in the following manner: Press the line key next to the second COM frequency line displayed on the RMU. The yellow box will move to that position if it is not already there; set the desired frequency by means of the concentric tuning knobs at the bottom of the RMU; press the upper left button on the RMU bezel (the one with vertical arrows), which will switch the pretuned frequency with the active frequency. When a frequency is preselected (set in the second line), it may result in the changing of a frequency which was identified by MEMORY, plus a number from 1 to 12, below the active frequency. The prior number has been stored in memory and the imposition of the second frequency over it is only temporary (which is identified TEMP) and will not result in the new frequency being stored in the memory unless the STO button is pressed before the frequency is transferred to the active location (top line). In this case, the word TEMP will be replaced by the word MEMORY plus the memory position number. The pilot may progress through all 12 of the memory locations by pressing the line key near the line identified by TEMP or MEMORY in the COM box (upper left hand corner), which will move the yellow box to surround that line. Turning either the large or small tuning knob will then select each memory space sequentially, showing the frequency stored there in blue on the line above the MEMORY annunciator line. Vacant memory locations will not appear. When the last occupied memory location is selected, the frequency shown on the second line, which was a temporary frequency in memory, will again be shown to occupy that space, plus the word TEMP, indicating that it is not stored in MEMORY.

When progressing through the stored memory locations, the frequency in the memory location being displayed can be transferred into the active position (tuned) simply by pressing the upper button (the one with the vertical arrows).

To view all of the stored frequencies at once, press the PGE (page) button at the bottom of the RMU and the active frequency, with a maximum of six stored frequencies, will be displayed along with the number of their memory location. Pressing the line key adjacent to the MORE annunciator will advance the page to show the remaining frequencies with their location numbers of 7 through 12. If it is desired to insert a frequency in any particular location on these pages, move the cursor to that location by pressing the line key next to the desired memory location and the tuning knob will control that selection. The memory locations must be filled sequentially, blanks cannot be left open. If memory location 11 is vacant, for instance, and an attempt is made to store a frequency in location 12, the word CAN’T will appear in yellow at the bottom of the page. It is not necessary to push STO to store the frequency. If deletion of a stored frequency is desired, press the line key adjacent to that memory location and press the line key adjacent to the DELETE ANNUNCIATOR. Higher memory locations will move down to fill the vacant space. If the pilot desires to place a frequency in a particular memory location, press the line key at that location to move the yellow box there; press the line key at the INSERT location. The frequencies at the selected location and at higher location numbers will move up one location. The frequency in the selected location may then be modified and it will be stored.

If all the memory locations on the first memory page are not filled, the second memory page cannot be accessed.

Direct tuning of the COM radio is accomplished by selecting the cursor (yellow box) to the COM preset location (second frequency line) and pressing the line key at that position for a minimum of three seconds. The preset frequency will disappear and the cursor will move and enclose the active frequency. Direct tuning is then available. Preset tuning may be restored by pressing the same button again.

An additional feature provided by the SRZ-85X integrated system is stuck microphone protection. The COM transmitter has a two minute timer which cuts off transmission after that time has elapsed if the MIC key has not be released. A short warning tone is sounded a few seconds before the automatic shutoff. When the microphone cutoff has been activated at the two minute limit, a MIC STK warning in red will be annunciated in the upper left corner of the RMU.

A TX annunciation at the top of the COM frequency window will annunciate whenever the transmitter is active.

When the second (first memory location) page of the display is selected, a "NARROW BANDWIDTH SELECT" annunciation will appear in the upper right corner of the display. Narrow bandwidth is the normal selection, however, a wider bandwidth may be selected for use in areas where slightly off-channel transmitters are used. Its selection will result in improved reception in such areas. The selection is made by pressing the double arrow selector next to the annunciation. Another press of the selector will return the selection to the original.

If any of the components of the radio system fail to respond to tuning or operating commands of the RMU, the frequency or operating command associated with that particular function will be dashed out. This alerts the crew to a failure or abnormal system operation.

"Cross-side" operation of the RMU is possible by pressing the 1/2 button on the bottom of the RMU. This allows the operator to tune the opposite side radio system from that RMU. The tuning will be followed on the other RMU and so indicated. The system banners will be indicated in magenta color to serve as a reminder of the cross tuning condition.

Each time the integrated radio system is powered up with the landing gear squat switches activated, a power on self-test (POST) will be activated. If any radio or bus fails any test parameter, an error message will be displayed on a test results page. If no errors are detected, the main tuning page will be displayed.

PRIMUS II RADIO MANAGEMENT UNIT

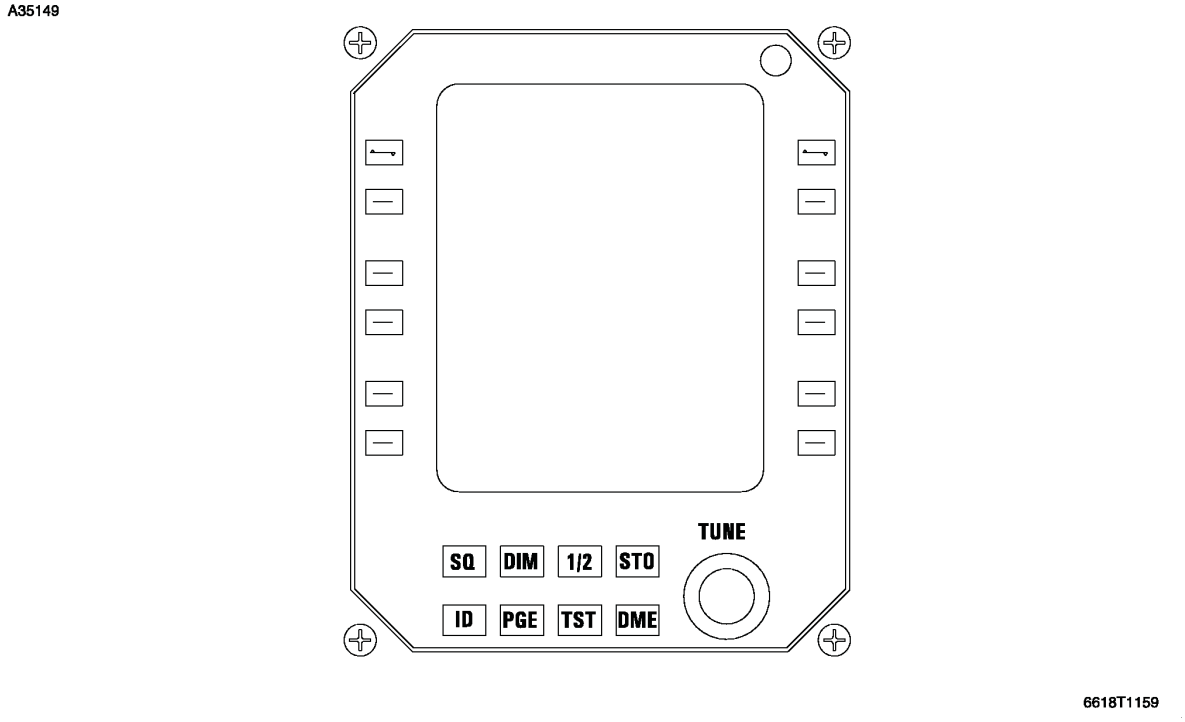


Figure 3-10

A pilot activated self-test (PAST) may be initiated by pressing the TST button on the RMU. A complete test will then be accomplished on the component represented by the window at which the yellow cursor is located. At the completion of the test, a legend will appear in the window for a short time to indicate successful completion. If the test is not successful, an error message will appear to indicate which circuit area has failed.

By pressing the DIM button on a bottom of the RMU, the tuning button may be used to dim the display. Exit from the dim mode is accomplished by pressing the DIM button again. Variations in ambient light will be automatically sensed, within limits, and automatically adjusted to maintain a desired setting.

STANDBY RADIO CONTROL UNIT

The CD-855 standby radio control (SRC) unit is located on the center instrument panel. It may be used in two modes: normal and emergency. The modes are selected by means of the mode switch on the SRC. The mode selections cycle as the switch is turned. In the emergency mode, EMRG is displayed vertically along the top right edge of the display. The SRC is powered from a circuit breaker (NAV1) on the emergency DC bus.

STANDBY RADIO CONTROL UNIT

A35150

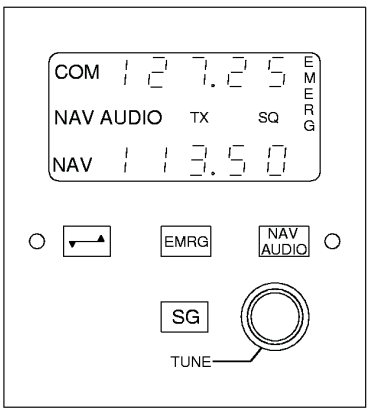


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Figure 3-11

In normal mode the SRC acts as an additional tuning source for the radio system. COM 1 and NAV 1 may be tuned by the SRC in this mode. The SRC verifies that the COM 1 RCZ-833 or the NAV 1 RNZ-850 (integrated COM and NAV units, respectively) are tuned to the correct frequency by checking the frequency echoed on the radio service bus (RSB). If the tuned frequency is incorrect, the frequency displayed on the SRC will be dashed out. If the appropriate RMU is illuminated, the frequency change will be seen to appear in the active display. In normal mode, the radios which are tunable by the SRC (COM 1 and NAV 1) may be also tuned from the applicable RMU. If tuned from the RMU, the frequency will also be tuned on the SRC.

In emergency mode, operation of the SRC is identical on the part of the operator. The internal tuning of the system differs in that it does not read and compare frequencies on the RSB. Frequencies that are set in the SRC are transmitted to the appropriate NAV or COM unit and that frequency is tuned.

When tuning the standby radio control, COM frequencies are displayed on the top line and NAV frequencies on the bottom. An arrow cursor, which appears to the left of the displayed frequencies may be toggled between the NAV and COM frequencies by pressing the double arrow (transfer) switch. The line on the which the arrow appears is then tunable by the tuning knobs on the SRC.

The SQ push button toggles the COM squelch open and closed. When the squelch is open, SQ is annunciated in the right center part of the display.

When the EMER button is selected on the audio panel, the NAV AUDIO push button toggles the NAV AUDIO off and on. When NAV AUDIO is on, it is summed in with the COM audio. NAV AUDIO will be annunciated at the center left of the display.

Any time the COM transmitter is being keyed, the TX annunciator in the center of the display will appear.

VHF NAVIGATION

The RNZ-850 integrated navigation unit operates in the frequency range of 108.00 to 117.95 MHz. The RNZ-8501 system encompasses the functions of VHF NAV, localizer and glideslope receiver, marker beacon receiver, and the additional functions of ADF and DME, which in conventional systems, are separate units. Operation of the marker beacon system is discussed under "Marker Beacon".

Glideslope paired frequencies are tuned with the published ILS frequencies as in standard VHF NAV practice. The RNZ-851 is the navigation component of the SRZ-85X integrated radio system. The two NAV integrated receivers are controlled and tuned in a similar manner to the RCZ-833 COM units discussed under VHF COMM, above.

The NAV frequency window on the main tuning (first) page has an additional function called the "DME Split Tuning Mode". This function involves "DME hold" plus some additional features, and is discussed under Distance Measuring Equipment in the Pulse Equipment part of this section.

NAV 1 can be tuned by the standby radio control unit (SRC) as well as by the RM-855. Tuning by means of the SRC is discussed under Standby Radio Control Unit, above.

Both NAV 1 and NAV 2 are selectable on the pilot’s and copilot’s DC-550 display controller to be displayed on either HSI (within the PFD). NAV 1 is displayed by the BRG "**O**" knob and NAV 2 is displayed by the BRG "♦" knob. Either NAV 1 or NAV 2 may be selected by the NAV pushbutton to provide guidance to the flight director system. The NAV 1 or NAV 2 selection switches with each press of the button. If NAV 1 or NAV 2 is selected on both sides (by pilot and copilot) the annunciation in the HSI will be in yellow instead of green.

Operation of the NAV displays on the standby horizontal situation indicator (HSI) and the electronic horizontal situation indicators (EHSI) is discussed under Standby Horizontal Situation Indicator and Electronic Horizontal Situation Indicators, in this section.

AUTOMATIC DIRECTION FINDER

The automatic direction finder (ADF) function of the Primus II integrated radio system is provided by the DF-850 ADF receiver module which is a component of the RNZ-850 integrated navigation unit. As discussed in the COM section above, the tuning of the complete system, which includes the ADF, is accomplished by means of the radio management unit (RMU), the RM-855.

The receiver has a frequency range of 100.00 to 1799.5 KHz in 0.5 KHz increments. A strap selectable option is available which allows tuning of marine emergency frequency of 2181 thru 2183 KHz.

Four modes of operation are available on the DF-850 ADF: ANT (Antenna), ADF (Automatic Direction Finder), BFO (Beat Frequency Oscillator), and VOICE. In ANT mode, the ADF receives only and does not compute bearing information. In ADF mode, the system receives signals and computes relative bearing to station. In BFO mode, a beat frequency oscillator is added to the signal for reception of CW signals. In VOICE mode, the reception bandwidth is widened for improved voice audio on the frequency. The VOICE mode is not used for navigation. Bearing information is available only in ADF and BFO modes. If ANT is used for tuning, random ADF needle searching is prevented. The modes are selected by pressing the lower line key adjacent to the ADF window. Progression is: ANT; ADF; BFO; and VOICE. The mode changes each time the line key is pressed. When the tuning cursor (yellow box) surrounds the lower ADF Line, the ANT, ADF, BFO, and VOICE Progression may also be selected by turning the tuning knob.

When the line select key adjacent to the frequency window of the ADF is pressed, the cursor will move to the ADF frequency window and the ADF may be tuned by the tuning knobs. Tuning will increment in steps of 0.5 KHz with the small knob and 10 KHz with the large knob. If the knobs are turned faster, larger increments are selected for each turn enabling large changes to be made in much less time. The rate of increased tuning speed is proportional to the rate the knobs are turned.

The ADF has a "scratch pad" memory which will store one frequency. This is accomplished by selecting the desired frequency and pressing the STO button for two seconds. To retrieve the frequency from memory, press the line select key adjacent to the ADF frequency window for two seconds.

The "**O**" bearing needle on the DC-550 display controller is dedicated to number one sources. ADF 1 bearing information may be selected on the "**O**" bearing needle of the pilot’s and copilot’s electronic horizontal situation indicators (EHSI). The "♦" bearing needle is dedicated to number two sources. The "♦" bearing pointer displays ADF 2 (if installed), when selected; if ADF 2 is not installed, ADF 1 will be displayed on both needles when selected. Selection is controlled by the BRG "**O**" knob and the BRG "♦" knob on the respective DC-550 controller.

On the radio magnetic indicators (RMI's), the single bar needle displays ADF 1 (when ADF is selected) and the double bar needle displays ADF 2.

TRANSPONDER

The ATC (transponder) function of the SRZ-85X Integrated Radio System is provided by the XS-850 transponder module, which is a sub-unit of the RCZ-833 Integrated Communication Unit. It functions as a 4096 code mode A transponder, as well as providing mode C (altitude) and mode S (collision avoidance) data link information.

General tuning information concerning the SRZ-85X system is discussed under PRIMUS II REMOTE RADIO SYSTEM - COM in this section. Specifically, tuning of the transponder is accomplished by pressing the line key adjacent to the desired ATC function of the left side of the main tuning page which is displayed on the RMU. The ATC window has two lines. The top line represents the tuneable transponder codes and the second line represents transponder modes. When the line key adjacent to the transponder code line is pressed, the yellow box (cursor) will surround the code digits, which are then tuneable by the tuning knobs. The large knob controls the left two digits and the small knob controls the right two digits.

Pressing the mode select line button moves the cursor box to the mode select annunciator which connects the tuning knobs to the window. Either knob may then be used to select modes in the following sequence:

Only one transponder is in operation at one time; the opposite one is held in STANDBY for instantaneous operation, if required. The system in operation is controlled by the mode select line key. Pressing the mode select line key (once the cursor is moved to that line) cycles the transponders as follows:

- STANDBY - Both units in STANDBY.
- SYSTEM No. 1 in operation.
- STANDBY - Both units in STANDBY.
- SYSTEM No. 2 in operation.
- STANDBY - (Sequence will repeat)

If S ONLY or S+ALT is selected and Mode S is not active at the ground station, the transponder will appear to the ground station to be inoperative. Make sure that Mode S capability exists at the ground station before selecting any Mode S function.

The system in operation is indicated by a "1" or "2" in front of the selected mode.

A transponder code may be stored in memory. To accomplish that, select the desired codes and press the STO button for two seconds. To retrieve the code from memory, press the line select button for two seconds.

The IDENT function of the transponder may be activated by pressing the ID button on the RMU or by pressing the ID button on the inboard side of either the pilot’s or copilot’s control wheel. Pressing any ID button will activate the ID mode for approximately 18 seconds. A yellow ID annunciation will appear along the top edge of the transponder window during ID mode activation.

DISTANCE MEASURING EQUIPMENT

The Primus II DME system is comprised of two RNZ-850 integrated navigation units, two NV-850 VHF NAV receivers and two DM-850 distance measuring modules. The DME transmitters of the DM-850s work in the L frequency band, and the receiver frequency range is from 962 to 1213 MHz. DME tuning normally follows the VHF NAV receiver tuning which selects the DME frequencies paired to the VHF VORTAC published frequencies.

The PRIMUS II has a special "hold" function which is annunciated by splitting the NAV window. While in hold, the actual DME can be tuned independent of the active VOR or ILS.

In normal VOR/ILS/DME operations, one of the six DME channels is paired with the active frequency and another with the preset frequency. Pressing the DME function key will split the NAV box on the main tuning page, allowing the active DME channel to be selected from the active VOR/ILS frequency. Cycling the DME select button sequences the NAV window from normal; to VOR/ILS, and DME split tuning; to VOR/ILS and TACAN channel split tuning; back to normal. When the NAV window is split, an amber H (hold) appears in the lower DME window and on EFIS. This H indicates that the distance display (DME or TACAN) is not paired with the VOR/ILS navigation data. When the H is displayed, the other aircraft systems HOLD annunciators will also illuminate. Display of the DME (or TACAN) channel being held provides a more positive identification of the navigation channel. In addition, the DME station identifier is also displayed. DME indicators are displayed on the MFD and PFD's when SRN is selected on HSI.

Each DME has the capability to scan six channels, simultaneously tracking four selected DME channels for distance, ground speed and time to station, as well as tracking two stations for identification (IDENT) functions. Of the four channels of which it can track three functions (DIST, GS and TTG), two are dedicated to the flight management system(s) (FMS).

Normally, one DME station will be tuned to an active VOR frequency, which is annunciated on the top line of the NAV tuning window of the radio management unit (RMU). Another (preset) VOR frequency may be selected in the preset frequency window. When a frequency is set in the preselect window, the system will already be tracking the preselected station so that there will be no delay when that frequency is transferred to active.

NAV tuning, which normally also selects the associated DME frequencies, is discussed under VHF NAV in this section. Special tuning procedures applicable to DME, which are in addition to the NAV tuning, are discussed below.

The DME has a "split tuning" mode which operates somewhat like conventional HOLD functions, but provides other options. Pressing the DME button on the bottom of the RMU will divide the NAV window into two windows. The top window will remain the active VOR frequency. H will be annunciated on the bottom line, indicating that the DME frequency is holding with the active frequency which is displayed on the top line. The bottom line will be labeled DME and will have in it the active frequency displayed in VHF (VOR) format. The DME may then be tuned by pressing the line select key and changing it to a new channel. Pressing the DME button again will cause the DME (lower) window to change to a TACAN channel presentation. TACAN channels, along with their related W, X, Y, and Z channelization nomenclature will then be tunable with the tuning knobs. The DME function of all 126 TACAN channels may be tuned. No azimuth information is received in this mode. A third press of the DME button causes the NAV window to return to its normal active/preset presentation and the DME will resume tuning with the active frequency.

DME information is selected for display on the pilot’s and copilot’s PFD's by using the PFD menu on the MFD.

AUDIO CONTROL PANELS

Two identical Honeywell Primus II digital audio control units are installed. Digital transmission of audio from remote units to the audio panels differs from conventional audio systems in that it requires one twisted pair of wires rather than many twisted pairs to achieve the same performance. The control units are mounted on the pilot’s switch panel and the copilot’s meter panel respectively.

AUDIO CONTROL PANEL

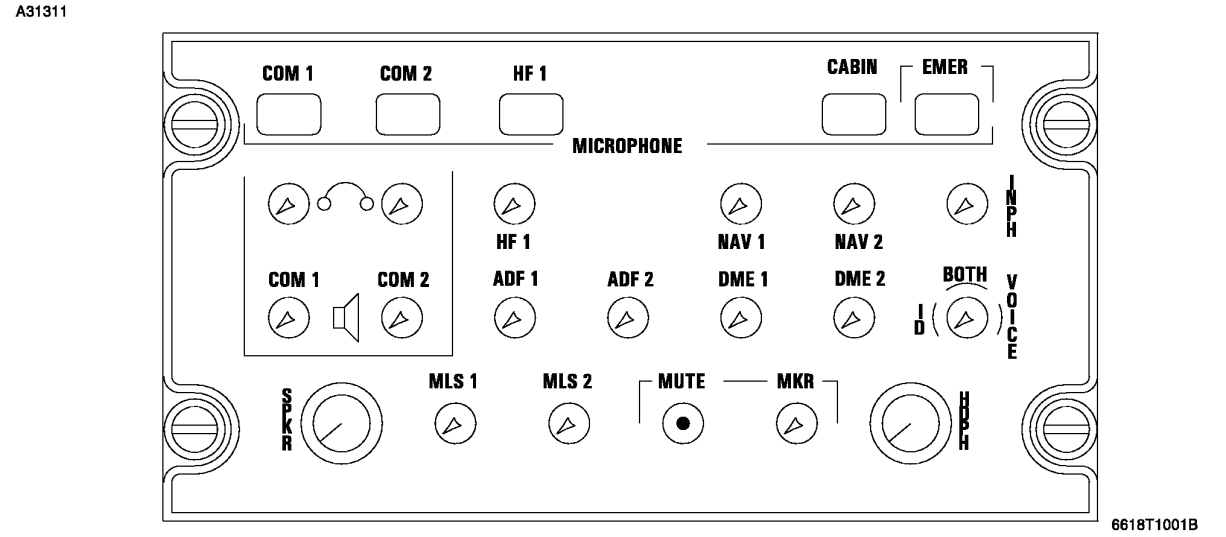

Figure 3-12

The panels have three rows of combination audio ON/OFF switches and volume controls. The small round knobs serve as audio on/off switches when pressed. When the switch is latched in, the audio for the particular receiver it serves will be off. When pressed again, the switch will move outward, turning the audio on. When the audio is on, the knob of the switch may be used as a volume control. Turning it clockwise will increase the volume; counterclockwise will decrease it.

Two larger knobs on the lower part of the control panel serve as volume controls for the speaker and headset respectively, of the pilot and copilot. These knobs are in series with the smaller individual volume controls allowing a volume selection to be made on the individual radio volume control. A final overall volume selection can be made by means of the speaker or headphone control, resulting in a more flexible individual control of all available audio signals.

A row of microphone selector buttons (push-push latching switches) is located across the top of the control panel. These buttons connect the pilot's or copilot's microphone to the selected transmitter. The receiver for the selected radio or interphone will also be selected regardless of the selection of the audio on/off switches. For night operation, a light above the microphone selector button is illuminated.

The emergency COM (EMER) microphone switch, located at the upper right corner of the audio panel, when depressed connects the COM 1 transceiver directly to the aircraft microphone and headphone. All electronic circuitry is eliminated and all other audio panel modes are disabled in this mode. NAV 1 audio will also be directed into the headset controlled by the panel on which EMER is activated if NAV AUDIO is selected on the SRC unit.

An ID/VOICE selector is located on the right center of the audio panel. It is not a latching switch, but is active whenever NAV 1 or 2 and/or ADF 1 or 2 (if installed) is selected. If BOTH is selected, both ID and voice will be heard; if ID is selected, voice signals will be filtered out and coded identification signals will be heard. If VOICE is selected, coded signals will be filtered out and voice will be heard.

The marker mute and marker aural on/off/volume control are located on the bottom row of switches on the panel. The marker mute is used to temporarily silence the marker beacon audio. Momentarily pressing the MUTE button will mute the beacon signal as long as it remains above a minimum threshold level. When it drops below that level, a time-out sequence will begin, which will mute it for a fixed period of time. The MKR button may be pressed in to disable the aural signal. When the button is out (pressed again) the marker beacon volume can be controlled with the knob, however, maximum counterclockwise rotation will not totally turn down the volume since a minimum signal is automatically retained in order not to miss the aural marker signal if it has been selected on.

COCKPIT VOICE RECORDER

The L3 FA2100 cockpit voice recorder system provides a continuous recording of the last 30 minutes of all voice communications and aural warnings originating in the cockpit, as well as sounds from warning horns and bells. The system is protected by a 5-ampere circuit breaker located on the left circuit breaker panel in the cockpit.

The sensitive cockpit microphone is located to the left of the fire tray. The recorder is energized any time the battery switch is in the BATT position. The control panel, located low on the right side of the copilot's instrument panel, contains a TEST button and an ERASE button. System operation is checked by pressing the TEST button. When the TEST button is held down for five seconds, illumination of the green light on the control panel indicates correct functioning of the voice recorder system. To erase the cockpit voice recorder the airplane must be on the ground with the landing gear squat switch compressed and the cabin door open. Pressing the ERASE button for approximately 2 seconds will cause the entire recording to be erased.

COCKPIT VOICE RECORDER

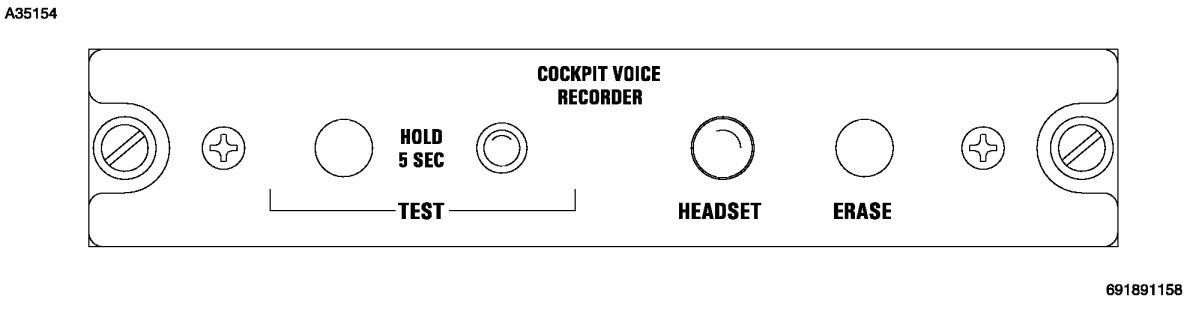

Figure 3-13

The installation is equipped with a five-G switch which will activate any time the airplane is subjected to a five-G force; this will disable the system's erasure mechanism until a reset button on the G-switch is pressed. The switch is located in the tailcone.

EMERGENCY LOCATOR TRANSMITTER

The Artex C406-2 emergency locator transmitter (ELT) system is an emergency transmitter designed to assist in locating a downed airplane. The system is comprised of a cockpit mounted remote switch (with indicator), a dorsal mounted transmitter/bracket assembly, and a fuselage mounted rod antenna.

The transmitter has a self-contained battery pack which must be changed every three years or after a cumulative total of one hour of operation. The system is activated automatically by an impact of 5.0 G, +2 or -0. The ELT can also be activated manually by the cockpit ON/ARM switch (located forward of the left circuit breaker panel). When activated, a modulated omni-directional signal is transmitted simultaneously on emergency frequencies 121.50 MHz, 243.00 MHz, and the satellite frequency of 406.00 MHz.

The dorsal mounted transmitter/bracket assembly can be accessed by removing access panel 340AR (this panel is located just forward of the horizontal stabilizer on the left side). The transmitter itself has an integral ON-OFF switch which is set to OFF (down) upon final inspection/installation. This switch setting will allow the system to transmit either by an impact (“G”) Switch or by the cockpit ON/ARM switch.

The transmitter may be turned off (reset) by placing the transmitter switch to ON (up) and back to ARM (down). This turns off the transmitter and resets (rearms) the unit.

NOTE

The transmitter must be correctly placed and properly secured in its bracket to function. The transmitter will not transmit if removed from its bracket.

The cockpit ON/ARM switch provides manual activation of the system (ON position) as well as a means of testing the system operation. In ARM (down) position, the system is armed for activation by the impact switch. In ON position, the impact switch is bypassed and the emergency signal is transmitted. Signal transmission is indicated by a blinking red light located directly above the cockpit switch.

The ELT system also incorporates a complete self analysis program with test routines transmitted at reduced power over the emergency frequencies. The test sequence checks the microprocessor, antennas, and transmitter. To test, perform the following sequence:

1. Turn on applicable airplane and avionics switches.
2. Tune radio to 121.5 MHz.
3. Place the ARM/ON switch to ON for three sweeps of the receiver (approximately one second) and then back to ARM. Make sure the indicator light comes on immediately and begins flashing.

NOTE

If the indicator light does not come on immediately, the unit has failed its test.

DIGITAL FLIGHT DATA RECORDER (Parts 91 and 135)

On airplanes which are equipped with more than 9 passenger seats and are operated under FAR Part 91 or FAR Part 135, a digital flight data recorder (FDR), which continuously records at least 17 parameters of airplane and systems operation, is required. A continuous recording of 8 hours is also required. The optional recorder installed in the Citation XLS records the information digitally by a solid state method. Recorder operation begins upon airplane power-up and continues until electrical power is shut off. Recorder operation requires no attention from crew members. An annunciator light (FDR FAIL) in the annunciator panel will illuminate if the flight data recorder malfunctions or if power to the system fails. The flight data recorder receives 28-volt DC power through a 5-ampere circuit breaker (FDR) on the right circuit breaker panel powered by the right avionics bus.

AIRCELL - ST 3100 IRIDIUM TELECOMMUNICATIONS SYSTEM

- Worldwide Iridium satellite voice and data communication.
- Air and ground service.
- Single-source provider for equipment, services, support.
- Access Rockwell Collins' Airshow Network.
- Access Universal Avionics' UniLink information in-flight.
- Access MedAire's MedLink in-flight medical emergency help.
- Corded or cordless handsets.

The AirCell ST 3100 telecommunication system is a compact, light-weight system that offers worldwide voice and data communication through the Iridium network of 66 low-earth orbiting (LEO) satellites. Making and receiving calls to any telephone can be made on the ground or in the air.

The built-in RS-232 support allows Internet dial-up connections to access e-mail and Web sites. AirCell service partners provide access to news, weather, financial, ATC information and messaging and MedAire's MedLink in-flight medical emergency help.

In addition to global coverage, the ST 3100 provides communications between the cabin and cockpit with audio intercom and conference calling features.

MAGNASTAR C-2000 DIGITAL AIRBORNE TELEPHONE

The MagnaStar C-2000 can be used to place and receive voice telephone calls, send data transmissions via modem, as well as to send and receive facsimile transmissions. A central processor on board each MagnaStar equipped airplane controls and coordinates the (s) for all voice calls, data and fax modem transmissions, and in-cabin intercom functions. The MagnaStar continually scans and monitors ground based radio cells for the clearest usable communications channel while in flight. The LCD on the handset indicates the availability of a channel and- the clearest usable communications channel while in flight. The system searches for the optimum channel when a call is initiated and connects the calling and receiving parties. The system allows for multiple handsets and two simultaneous calls may be placed (voice, fax, or data). Reliable and clear connections are ensured at all times through digital technology. Coverage is provided throughout North America above 17,000 feet (much of the United States is covered at lower altitudes) and additional coverage is available on the ground at many major domestic airports.

All operations are performed via the handset. The handset features adjustable volume and a telephone system numerical keypad. The two-button volume control is located on the side of the handset and should be used to adjust the volume to the users desired level. Two additional keys are also included: “+” and “END CALL”. The LCD on the handset displays information and “menu” style selections, reducing the need for separate instruction. A credit card reader is also provided in the handset, allowing optional billing to individual user accounts.

NOTE

The standard handset has a magnetically activated hook switch in the holder and therefore operates in a typical “on-hook” and “off-hook” manner. Additional (optional) handsets, custom mounted or portable (which plug into jacks), do not provide the hook switch. To place these handsets “off-hook”, depress the “+” key; to return the phone to “onhook”, depress the “+” key again.

While the handset is “on-hook”, available services will be displayed on the LCD. To place a call, remove the handset from its holder and select the type of call you wish to make (“1” for a voice call). In the case of a voice call to someone on the ground, the following would be keyed; “1” + “Area Code” + “Number”. To terminate any dialing sequence and return to the main menu, press “END CALL”.

Calls to the airplane may be made in three ways:

AIRPLANE AIRCALL NUMBER

The Aircraft Aircall number is permanently assigned to the aircraft and is stored by the C- 2000 upon registration. The Aircraft Aircall number will ring at all handset locations.

STATION AIRCALL NUMBERS

Station Aircall numbers are assigned to each handset and are permanently stored by the C- 2000 upon registration. The Station Aircall number will ring at the assigned handset location.

GTE AIRFONE CALLING CARD/“PERSONAL” NUMBERS

These numbers are encoded into GTE Airfone Calling cards and can be used on any MagnaStar or GenStar equipped aircraft, and must be registered on each flight. Up to nine GTE Airfone calling card numbers may be registered on a C-2000 equipped aircraft.

FLIGHT GUIDANCE

HONEYWELL PRIMUS 1000 CONTROL DISPLAY SYSTEM

The Honeywell Primus 1000 Control Display System is an autopilot/flight director and electronic flight instrument system (EFIS) which is integrated into one complete automatic flight control system. The primary component of the system is the IC-615 Integrated Avionics Computer (IAC) which contains the symbol generator, the flight director, and the autopilot computer (autopilot computer in pilot's IC-615 only). The entire system is comprised of the flight director, automatic pilot, pilot's and copilot's electronic attitude director indicators (ADIs) and electronic horizontal situation indicators (EHSI) located in one single primary flight display (PFD) for each pilot, dual air data computers with associated outputs, autopilot controller, altitude alert and altitude preselect, touch control steering, and the autopilot servos. The air data system provides pressure altitude, true airspeed and overspeed warning. The system may be flown manually or automatically.

The IC-615s are cooled by individual cooling fans. Failure of the fan(s) are annunciated in the upper left hand corner of the multi-function display (IC1 FAN or IC2 FAN). Continued operation of the IC-600s without a fan may produce even greater heat (especially on the ground or in hot ambient conditions). If temperature rises to between 110°C and 140°C, the message IC1 HOT or IC2 HOT will appear on the Primary Flight Display. If temperatures exceed 140°C, the respective IC-615(s) will shut down.

Specific procedures for dealing with fan failure and computer overheat conditions can be found in the AFM.

LCR-93 ATTITUDE AND HEADING REFERENCE SYSTEM (AHRS)

The dual AHRS is the primary source of attitude and heading information on the Citation XLS. The LCR-93 is a strapdown AHRS which uses fiber optic rate gyros and three micromechanical accelerometers to provide a composite source of pitch, roll and heading information for the Electronic Flight Information System (EFIS) and the Automatic Flight Control System (AFCS). Attitude data is also supplied to the weather radar antenna and heading data to the standby horizontal situation indicator (HSI). A flux valve provides long term heading references for the system. A digital computer mathematically integrates the rate data to obtain the heading, pitch and roll information. The micro air data computers provide true airspeed and barometric altitude inputs to the AHRS. The key component of the AHRS is the attitude and heading reference unit (AHRU). It comprises the inertial sensors and the computer boards for data processing and interfacing.

MODES OF OPERATION

After the system is powered on and completes its alignment, it begins to provide system information from the Normal, Basic, Slaved, and DG modes. The attitude loop is controlled by the normal/basic modes, and the heading loop is controlled by the slaved/DG modes.

In normal mode the AHRS uses valid true airspeed (TAS) from the air data computers, to improve attitude accuracy. If the true airspeed data are not available or are invalid, the system will automatically revert to the basic mode to operate autonomously. If true airspeed becomes valid again during basic mode operation, the system will revert to normal mode. Transition between normal and basic modes is controlled by the availability and validity of true airspeed data, and the transition is performed automatically in both directions.

In slaved mode, the heading loop of the LCR-93 attitude and heading reference unit (AHRU) is supplied with magnetic heading data from the magnetic sensor unit (flux valve). The heading output is magnetic heading referenced to local magnetic north. The earth rate and gyro drift correction factors are updated continuously during slaved operation.

In DG (directional gyro) mode, the heading may be set as desired by the L SLEW and R SLEW (right) switch of either AHRS system, after DG is selected on the appropriate system switch (DG/SLAVE/TEST). In DG mode the system acts as a free gyro; there is no magnetic input, and no update of earth rate and gyro drift estimation will be performed.

The AHRS basic mode is annunciated in the upper left corner of the MFD (i.e., AHRS BASIC-1-2), in white, if the AHRS is not in a normal mode.

SYSTEM ALIGNMENT

When power is supplied to the AHRS system it automatically enters the alignment mode. Upon completion of the alignment the appropriate modes of slaved heading or DG, and Normal or Basic (depending upon switch selection and availability of data), will be entered. Alignment takes approximately 30 seconds; if no internal failures are detected during the alignment self-test and all values are within accuracy limits, heading, attitude, angular rates, and accelerations are output and system flags are withdrawn. A pilot initiated self-test is available by pressing the DG/SLAVE/TEST switch to the TEST position. While the system is testing, failure flags and invalid data annunciations (amber dashes) will be in evidence, and TEST will be annunciated in red at the top left of the attitude display and over HSI in the primary flight display (PFD). When the system is tested, the heading of the HSI will slew to 015°, the attitude sphere will show 45° of right bank, and 5° nose up attitude.

Wind buffeting, cargo loading, and movements caused by running engines will not affect the duration of alignment on the ground. In case of excessive movement of the airplane on the ground the alignment may take longer or alignment may not be completed. If alignment is not completed the warning flags will not be withdrawn and it may be necessary to restart alignment by removing power from the system by shutting down airplane system power or by pulling the affected AHRS circuit breakers (AHRS 1, AHRS 1 AUX or AHRS 2, AHRS 2 AUX). An AHRS battery supplies power to AHRS 1 AUX and AHRS 2 AUX circuit breakers when the STBY PWR switch is in the ON position. An in-flight power interruption is unlikely because a system battery will prevent an in-flight power interruption for periods of up to 30 minutes. However, if an in-flight power interruption is experienced or attitude and heading reference is lost during flight, an in-flight alignment can be performed. The same system circuit breakers must be pulled, as on a ground alignment (above), to ensure that all power has been removed from the system. By re-setting, the system will then start an in-flight alignment which normally takes 45 seconds to 2 minutes. An in-flight alignment requires that the airplane be flown straight and level for the duration of the alignment.

HDG REV and ATT REV

The opposite attitude source may be selected, if desired, by pressing the applicable ATT REV (attitude reversion) button on the pilot’s or copilot’s instrument panel. The opposite heading source may be selected by pressing the applicable HDG REV (heading reversion) button, also on the pilot’s or copilot’s panel. Pressing either of these buttons adds the opposite system to the desired source. If both systems are selected to the same source, or if a “cross-selection” has been made, it will be annunciated on the EFIS displays in amber.

Takeoff with one AHRS in BASIC and/or in DG mode is not recommended.

FLIGHT DIRECTOR MODE ANNUNCIATION

Flight director mode annunciations are integral to the primary flight displays. The vertical and lateral modes are annunciated along the top of the display. Armed vertical and lateral modes are annunciated in white and appear slightly to the outboard side of the captured vertical and lateral mode annunciations, which are presented in green. Lateral mode annunciations are located to the left of top center and vertical modes are annunciated to the right of top center. A white box appears around a capture or hold mode for five seconds after mode transition. Lateral and vertical mode annunciations and transitions are listed below:

VOR	A NAV mode (VOR) is armed or has been captured and is being tracked.
HDG	Heading select mode engaged.
LOC	Localizer has been armed or captured.
APR	VOR approach selected or course capture has occurred.
GS	Glideslope armed or captured.
ASEL	Altitude preselect armed.
ALT	Altitude hold mode engaged.
BC	Back course armed or captured.
VS	Vertical speed hold has been selected and captured.
IAS or MACH*	Indicated airspeed (or Mach) hold has been selected and captured.
LNAV	Long range NAV (FMS) mode has been selected.
VNAV	Vertical navigation mode has been either armed or captured.
GA	Go-around mode has been selected.
TEST	System is in test mode (annunciated in green) Annunciation is automatic immediately after power up.

*IAS or MACH will be annunciated automatically, depending upon airplane altitude and airspeed. Transition from IAS to Mach is automatic as the airplane climbs through 29,000 feet altitude or exceeds 0.620 Mach, and Mach to airspeed occurs automatically as the airplane descends through 28,800 and decreases below 0.610 Mach.

LATERAL TRANSITIONS

VOR arm to VOR cap
LOC arm to LOC cap
BC arm to BC cap
APR arm to APR cap

VERTICAL TRANSITIONS

ASEL arm to ALT
VNAV armed to VNAV cap
VNAV cap to ALT
ASEL arm to ASEL cap
ASEL cap to ALT
GS arm to GS cap

MISCELLANEOUS ANNUNCIATIONS

ATT1 (or ATT2)	Attitude Source (amber for "cross-selection").
MIN	Illuminates when the airplane reaches the preset minimum radio altitude. (Annunciated in amber letters on white background with black border in the upper left side of the ADI attitude sphere.) A white box is drawn around the indication when DH is reached. When the airplane reaches the selected minimums, MIN will flash for 10 seconds and then remain steady.
AP ENG	Illuminates when the autopilot is engaged.
GREEN ARROW	A green arrow will point either left or right, indicating to which flight director (pilot's or copilot's) the flight director is coupled.
TCS ENG	Illuminates in white to Indicate touch control steering is engaged.
TRN KNB	Illuminates in amber when the autopilot turn knob is out of center. The autopilot will not engage when the turn knob is out of center.
AP FAIL	Illuminates in amber to indicate autopilot failure.
MAG1 (MAG2)	Heading Source, in mid left-center of PFD. MAG annunciation if SLAVE is selected on the applicable AHRS DG/SLAVE/TEST switch.
DG1 (DG2)	Gyro slave switch; DG annunciation if DG is selected on the applicable AHRS DG/SLAVE/TEST switch. Annunciation is in amber. No annunciation if normal selections are made.
SG1 (SG2)	Amber, in upper left side of primary flight display (PFD) (annunciated only in case of reversion selection). Symbol generator 1 (or No. 2) is providing symbol generator for both PFD displays. Selection is made on the SG1/ NORM/SG2 switch on the RI-552. In SG1 position SG2 will be a duplicate of SG1; in SG2 position SG1 will be a duplicate of SG2.
ADC1 (ADC2)	Amber, in upper left side of PFD (annunciated only in case of reversion selection). ADC1 (ADC2) is the source of air data information for both displays, or a cross-selection of both systems (ADC2/ADC1) has been made. Selection is by the small ADC REV buttons on the bottom of the respective pilot's and copilot's instrument panels.
WPT	FMS waypoint annunciation (amber), (DR [dead reckoning] - amber, DGR [degrade] - amber, INTG [FMS integrity problem] - amber.)

AOA	Invalid angle-of-attack input - amber.
APP, HDG SEL	Typical FMS lateral submodes; indicated in magenta near center-left of display.
MAX (MIN) SPD	Maximum (Minimum) speed has been reached. Indicated to the left side of the attitude sphere.
CRS (DTRK) XXX (digits)	FMS course selected (desired track) digital display. Color depends upon FMS/NAV pilot/copilot selections.
WIND SHEAR	Annunciation of WINDSHEAR mode; caution - amber, warning - red. In boxed annunciator at upper right side of attitude sphere.
GND PROX	Ground proximity warning system mode annunciator; caution - amber.
MSG	FMS message flag (amber). Appears in order to indicate message is present on the FMS control display unit (CDU).
BELOW GLIDE	Amber message in box in upper right side of attitude sphere.
VNV	VNAV source annunciation. FMS (white); VNV (white). Annunciation located above vertical deviation scale.

FLIGHT DIRECTOR MODE SELECTOR

The flight director mode selector consists of eight push-on, push-off switches that select various flight director/autopilot modes of operation. The green mode activation light in the switch (button) will be illuminated if the corresponding mode is in the arm or capture state.

The status of the selected mode is displayed in white letters (annunciations) in the primary flight display (PFD) when armed, and in green when capture has occurred (or when selected on, for those modes where capture occurs immediately).

MS-560 MODE SELECTOR PANEL

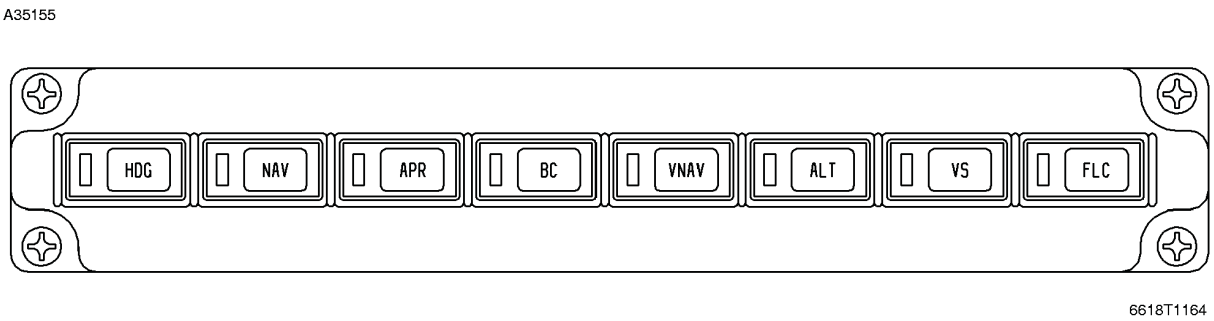

Figure 3-14

The flight director can be selected off by deselecting all of the modes on the MS-560 Flight Director Mode Selector. The command bars will bias out of view. If no modes are selected on the MS-560 mode selector the autopilot will engage in a basic heading hold/pitch hold mode which will be annunciated (PIT and ROL) in the primary flight display (PFD).

Operation of the various modes is explained under Primus 1000 System Operation below. The pilot and copilot may select either NAV 1 or NAV 2 for display on the course deviation indicator (CDI) of their respective primary flight display (PFD), by means of the NAV button on the DC-550 display controller. The respective NAV will be automatically selected upon power up; the sequence of selection will then be NAV2/NAV1/NAV2 etc. for the pilot and NAV1/NAV2/NAV1 etc. for the copilot. If both sides have been selected to the same source, the annunciation of VOR 1, etc., in the PFD will be in amber. The selection of NAV 1, NAV 2 or FMS is annunciated above and to the right of the HSI display in the PFD as VOR 1, VOR 2 and FMS respectively.

The selection of NAV 1, NAV 2 or FMS on the DC-550 display controller push-buttons controls the source of navigation information to the flight director, as well as selects the source of navigation information displayed on the EFIS course deviation indicator of the PFD. A switch (AP XFER FD1/AP XFER FD2) is installed (on the center instrument panel) to determine which flight director controls the autopilot. The position of this switch can be changed with the autopilot engaged or disengaged, however, the flight director modes will drop out. The autopilot will remain engaged, if it is already engaged, but will revert to basic autopilot modes of pitch and heading hold.

AUTOPILOT CONTROL PANEL

The autopilot control panel, mounted at the aft end of the pedestal, provides the means of engaging the autopilot and yaw damper, as well as manually controlling the autopilot through the turn knob and pitch wheel.

The autopilot (AP) engage switch is used to engage the autopilot and yaw damper. The yaw damper (YD) switch is used to engage and disengage the yaw damper without the autopilot. Use of the yaw damper while manually controlling the airplane aids in airplane stability and passenger comfort. The push-on push-off AP and YD switches are illuminated green when engaged. Pressing the AP switch when the autopilot is engaged will disengage the autopilot but leave the yaw damper engaged. Pressing the YD switch when both YD and AP are engaged will turn off both the yaw damper and the autopilot. The yaw damper and autopilot may also be disengaged with the red AP TRIM DISC button on the pilot's and copilot's control wheels. Pressing the go around (GA) button on either throttle will disconnect the autopilot and force the flight director into go around mode; the yaw damper will remain engaged. Additionally, the stick shaker will disengage the autopilot and yaw damper.

The pitch wheel allows manual pitch control of the airplane proportional to the rotation of the wheel and in the direction of wheel movement. Movement of the wheel also cancels any other previously selected vertical mode. The turn knob allows manual bank control of the airplane proportional to and in the direction of knob movement. Turns with a maximum bank angle of 30° can be performed with the turn knob. The turn knob must be in the center detent position before the autopilot can be engaged. Rotation of the turn knob out of detent cancels any other previously selected lateral mode.

AUTOPILOT CONTROL PANEL

A35156

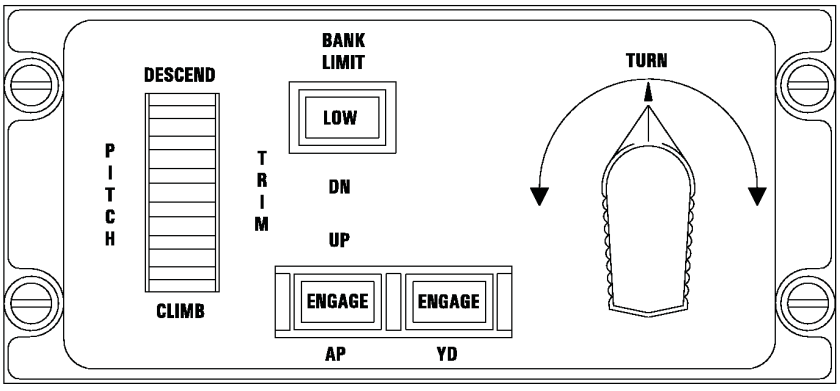

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Figure 3-15

When a sustained trim input is being applied to the elevator servo, the elevator trim indicator shows an out of trim condition in the direction indicated by illumination of UP or DN in the TRIM annunciator. The indicator should be OFF before engaging the autopilot. If the TRIM annunciator is illuminated and the autopilot must be disengaged, the pilot must be prepared for an out-of-trim condition in the annunciated direction.

A separate additional AP PITCH MISTRIM/AP ROLL MISTRIM annunciator is located on the annunciator panel where it is more readily visible to the pilots. The AP PITCH MISTRIM annunciator is a repeat of the TRIM annunciator on the autopilot control panel. The AP ROLL MISTRIM annunciator indicates to the pilot that a sufficient level of roll mistrim is present and that the pilot must be prepared for an out-of-trim roll condition if the autopilot is disconnected. The bank limit (LOW) mode may be selected if it is desired to limit the maximum bank angle during autopilot operation. The mode is limited to use in conjunction with heading (HDG) mode only. When the bank limit mode is engaged, the autopilot maximum bank angle is limited to 14°. When the mode is engaged, LOW will annunciate in the pushbutton. Low bank mode will be automatically selected when climbing through 34,000 feet altitude, and automatically cancelled when descending through 33,750 feet. If heading mode is selected and then deselected while low bank is engaged low bank mode will be disengaged and the engage light will extinguish during the time heading mode is disengaged. Low bank mode will reengage and the LOW annunciator will re-illuminate when heading mode is reengaged. When low bank mode is engaged, a green low bank limit mark will appear on each side of the vertical index at the top of the attitude sphere.

The autopilot is normally disengaged in one of three ways: (1) depressing the AP/TRIM DISC switch on either yoke, (2) electrically trimming the elevator trim system, or (3) depressing the go-around button on either throttle. Actuation of the touch control steering button on the yoke will interrupt the pitch and roll servos until the switch is released; the yaw damper will remain engaged. If the autopilot is disengaged by any of the above three ways, a warning tone will sound for one second and the amber AUTOPILOT OFF light will illuminate for one second. Any other disconnect will cause the warning tone to sound for one second and the amber AUTOPILOT OFF light to stay illuminated. The amber light can be turned off by holding the AP/TRIM DISC switch for two seconds, or by pressing the electric trim switch or the go-around (GA) button on either throttle. The autopilot will also disengage if an overriding force (sustained torque) is applied to the vertical or horizontal axis for a minimum preset time. Disconnect will be annunciated by the one-second disconnect tone and illumination of the autopilot disconnect light, until the light is extinguished by one of the above methods.

ALTITUDE ALERTING SYSTEM

An altitude alerting system provides a visual indication of when the airplane is within 1000 feet of a preselected altitude and normalizes when the airplane is within 200 feet of the preselected altitude. After capture, the system will reactivate if the airplane departs more than 200 feet from the selected altitude. As the airplane approaches within 1000 feet of the preselected altitude, the color of the altitude display will change to amber and the altitude alert warning tone will sound for one second. As the airplane approaches to within 200 feet of the selected altitude, the display will change back to blue. If the airplane again deviates from the selected altitude by more than 200 feet, the altitude display will change to amber and the altitude alert tone will sound for one second. The display will remain amber until the airplane returns to within 200 feet of the altitude, or until the altitude selection is reset. The altitude selection is set into the upper right corner of the primary flight display (PFD) by means of the ALT SEL knob on the lower right side of the multi-function display (MFD). The selected altitude setting is also visible, in the same color codes, above the ALT SET knob on the MFD.

The altitude alert function works in conjunction with altitude preselect (ASEL) mode, which is described below. The only difference in operation of altitude alert function alone is that the flight director and/or autopilot need not be engaged for altitude alert to function. The altitude alert annunciations are controlled by the pertinent flight director, which is selected by the autopilot couple switch (AP XFER FD1/AP XFER FD2), and are therefore based on the barometrically corrected altitude displayed on the same side of the cockpit. If the altitude set knob is moved or the glide slope capture mode is active, the annunciations of altitude alert will be cancelled.

PRIMUS 1000 SYSTEM OPERATION

The Primus 1000 system incorporates a wide variety of capabilities that produces one of the most precise, flexible and easy to use systems in airplanes today. The flight director (FD) and autopilot (AP) can be used independently or together. The airplane may be flown manually, using the guidance provided by the modes selected on the flight director, or when the autopilot is engaged and coupled to the flight director it will control the airplane using the commands generated by the flight director computer. Disengagement of the autopilot will have no effect on the FD modes in operation at the moment of disengagement, except when using the go-around button, in which case a wings level 10° nose up attitude will be commanded and all other FD modes will be reset. When the autopilot is engaged without any mode selected, manual pitch and roll commands may be made by means of the turn knob and pitch wheel on the autopilot controller. Touch control steering (TCS) can be used to maneuver the airplane or to modify the commands to the FD and AP. If the autopilot is not engaged, the TCS button can be used to synchronize the command bars to the airplane attitude. If HDG mode has been selected, BANK LIMIT mode may be engaged and the maximum bank angle will be limited to approximately 14°.

The Primus 1000 system in the Citation XLS operates through displays of the pilot's (or copilot's) electronic flight instrument system (EFIS). The systems of autopilot and EFIS are integrated, and unnecessary system redundancy has thereby been eliminated. The result is an overall simplification over previous systems, and greatly simplified interface requirements for the flight director function. If a particular EFIS unit is operational, the flight director will also be operational, and conversely if the EFIS has failed, the flight director will also be failed. The display is available as a single-cue or a double-cue (cross-pointer) presentation, the selection of which is made by means of a menu. The presentation upon power-up is configurable. Glideslope information is presented on the right side of the electronic attitude direction indicator (ADI) section of the primary flight display (PFD).

The autopilot may be switched to the pilot's flight director (FD 1) or the copilot's flight director (FD 2) by means of an illuminated selector switch (FD/AP PFD1 / FD/AP PFD2) located on the center instrument panel. This switch determines only which flight director system provides guidance to the autopilot.

BASIC AUTOPILOT

The basic autopilot, without any inputs from the flight director system, can be used for pitch, roll and heading hold. The autopilot will hold the pitch attitude existing at the moment of AP engagement and the pitch attitude existing at the moment of disengagement of a vertical mode. PIT and ROL will be annunciated for the basic modes.

The autopilot can be engaged in any reasonable attitude; however, unless touch control steering (TCS) is used in conjunction with autopilot engagement, the autopilot will roll wings level if engaged while in a bank. If the bank is less than 6° at engagement, the autopilot will hold the heading indicated when the autopilot is engaged. If the bank is over 6° at engagement, it will hold the heading indicated when the airplane rolls through 6° of bank on the way to wings level. If a lateral mode is disengaged, the autopilot will hold the heading existing at the moment of disengagement. If the turn controller is out of the center detent position, the autopilot will not engage.

ALTITUDE ALERTING SYSTEM

The altitude alerting system is automatically engaged in conjunction with the altitude preselect mode (ASEL). The desired altitude is set into the system for use of the ASEL mode. The altitude is set into the lower right corner of the MFD and on top of the PFD altitude tape scales with the ALT Sel knob. The desired flight director mode which is to be used to reach the designated altitude is then selected on the flight director/autopilot mode control panel. Refer to Altitude Hold and Altitude Preselect, below. If the pilot does not desire to select a flight director mode, the airplane can be flown manually and the altitude alerting system will still provide the appropriate annunciations.

TOUCH CONTROL STEERING

Touch control steering (TCS) enables the airplane to be maneuvered manually during autopilot operation without cancellation of any selected flight director modes. To use touch control steering, press the TCS button, maneuver the airplane and release the TCS button. TCS is operable with all autopilot modes. During TCS operation the yaw damper will remain engaged.

If the autopilot is engaged in a bank and it is desired to hold the bank, press the TCS button, engage the autopilot and release the TCS button. The bank will be maintained if it is in excess of 6°. The airplane may be rolled level with the turn knob. The memory function holding the autopilot in a bank will be canceled when the turn knob is moved out of detent.

In the case of Flight Level Change (FLC) (IAS or MACH annunciated) mode, vertical speed (VS) mode or altitude hold (ALT) mode, the TCS button may be depressed and the airplane maneuvered to a new reference. When the TCS button is released, the flight director/autopilot will maintain the new reference.

HEADING MODE (HDG)

The heading mode (HDG - annunciated in green letters in the top left of the ADI) can be used with the flight director (FD) only, or in conjunction with the autopilot. When the heading (HDG) mode is selected on the MS-560 Mode Selector, the command bars will come into view and display a steering command that is controlled by the HDG cursor (bug) on the HSI. The heading bug is set by means of the RI-553 Remote Instrument Controller located on the pilot’s pedestal. The command bars will synchronize vertically to the pitch attitude at the time of HDG selection. Heading mode will be engaged automatically if another lateral mode is selected and the airplane is outside the capture parameters of that mode. In this case, HDG mode will remain ON until the airplane arrives at a point where capture can occur. The selected mode will then capture and be annunciated in the mode selector and in green letters at the top left side of the HSI, and HDG will cancel. If the autopilot is also engaged, the autopilot will receive steering commands according to the selected mode(s). NAV and APR modes can be armed with the HDG mode ON. When intercepting a VOR radial or localizer course with the NAV or APR modes selected, the system will switch from ARM to CAP when within the capture limits and the armed mode will be captured.

RI-553 REMOTE INSTRUMENT CONTROLLER

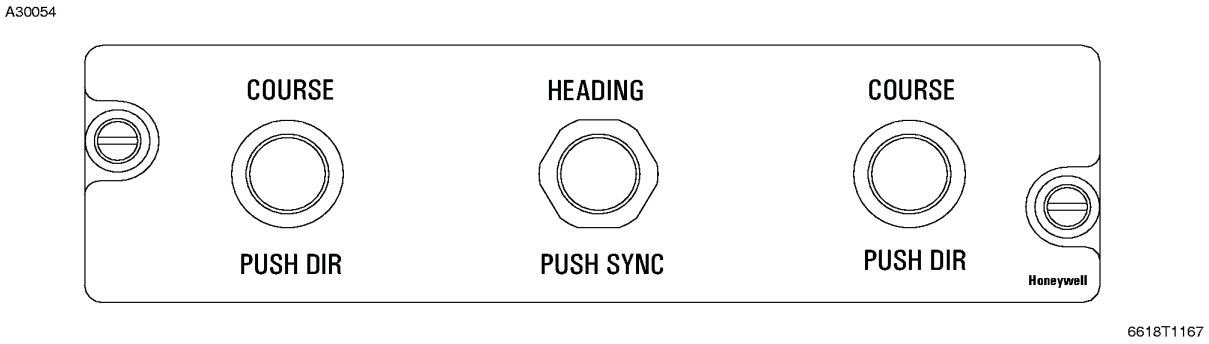

Figure 3-16

NAV (VOR) AND NAV APR (APR) MODES

Two different modes of capture and tracking a VOR signal are used in the Primus 1000 system. One method is used for normal enroute navigation (VOR) and the other for a VOR approach (APR).

For enroute navigation, the desired VOR frequency is selected on a NAV receiver, the course bearing set on the HSI, and NAV mode is selected on the MS-560 Flight Director Mode Selector. The small green light in the mode selector will illuminate, and if the airplane is outside the NAV capture limits, VOR will be annunciated in white at the top left of the ADI and HDG will be annunciated in green also at the top left of the ADI. As the airplane is maneuvered within the capture limits, HDG will extinguish and VOR will illuminate in the green at the top left of the ADI. When the mode is transitioning to capture, a white box will be drawn around the mode for five seconds.

For a VOR approach (APR mode), the desired VOR frequency is selected on the NAV receiver, the course bearing set on the HSI, and the APR mode is selected on the flight director mode selector. The green light will illuminate in the APR button and, if outside the capture limits, APR will illuminate in white on the top left side of the ADI. HDG will annunciate in green also in the top left side of the ADI. When the airplane maneuvers into capture range, HDG mode will cancel and APR will annunciate in green in the top left side of the ADI. A white box will be drawn around the capturing mode for five seconds.

In both NAV and APP modes, a station passage feature is provided that incorporates bank angle limits and a course hold (plus wind drift) mode. The station passage mode for enroute tracking (NAV mode) is of long enough duration to provide smooth transition of a VOR station at any altitude. The station passage mode for APP mode is of short duration to provide approach accuracy. This does not provide the degree of ride smoothing that is present in the enroute case.

With a localizer frequency selected in a NAV receiver, operation is similar to capturing and tracking a VOR radial. Selecting APR on the mode control panel with a localizer frequency tuned, arms both the LOC and GS modes and engages HDG, if not previously selected and the airplane is outside the capture parameters of the mode. HDG will be displayed in green at the top left of the ADI and the green light in the APR button of the mode selector will illuminate; LOC and GS will be illuminated in white on the upper left and right, respectively, of the ADI. When inside the LOC capture limits, LOC will illuminate in green at the top left of the ADI and HDG will extinguish. At glideslope capture (approximately 1/2 dot), GS will illuminate in green on the ADI. During transition to both the LOC and GS capture modes a white box will be drawn around the respective mode annunciations. During ILS approaches, the FD gain is progressively adjusted during the approach using GS deviation, radio altitude, and middle marker passage for gain programming. If the radio altimeter is not operational, this function is performed as a function of glideslope capture and middle marker passage.

The capture limits for VOR and LOC captures are variable depending on DME distance, speed and intercept angle. Glideslope capture is locked out until localizer capture occurs. If the localizer mode becomes invalid for any reason, the glideslope mode will also be cancelled.

The glide slope indicator, located on the right side of the ADI presentation, is green unless there is a cross-side selection, in which case it will be yellow.

BACK COURSE LOCALIZER APPROACH (BC)

A back course localizer approach capability is provided using either flight director or autopilot or both. With a localizer frequency set in the selected NAV, selecting BC on the mode selector arms the system for a back course localizer approach. The front course of the ILS must be set into the HSI to give proper indications on the course deviation bar and for the flight director computer to compute correct back course corrections during the approach. If the back course is set on the HSI the command bars and autopilot will be given incorrect steering commands. When BC is selected on the mode selector, the green light in the button will illuminate and BC will be annunciated in white on the top left side of the HSI. HDG may illuminate in the top right side of the ADI if the airplane is outside of capture parameters for the mode and heading select mode engages in order to effect capture. When the back course is captured, BC will be illuminated in green on the top left side of the ADI and HDG will extinguish if heading mode was engaged to accomplish intercept.

ALTITUDE HOLD (ALT) AND ALTITUDE PRESELECT (ASEL)

Selecting altitude hold (ALT) provides steering commands to maintain the altitude at the moment of engagement. An altitude preselect (ASEL) mode is also incorporated which provides a preprogramming capability. To use altitude preselect, the desired altitude is set into the ALT window in the lower right side of the MFD (and at the upper right corner of the primary flight display [PFD] at the same time) by means of the ALT SEL knob. ASEL will illuminate in white in the top right side of the ADI to indicate that the altitude preselect mode is armed. The airplane may be maneuvered toward the desired altitude using any of several methods: the autopilot pitch wheel, touch control steering, FD pitch synchronizer, speed hold, or vertical speed hold.

If the airplane is flown manually, the flight director will guide the pilot onto the selected altitude. As the airplane approaches the desired altitude, the altitude preselect will capture at an altitude corresponding to approximately 1/5 the rate-of-climb/descent. For example, at a 2000 feet/minute climb rate, the system will capture approximately 400 feet prior to the selected altitude.

At capture, the mode ASEL will illuminate in green on the ADI. The flight director will perform a smooth level-off at the selected altitude. At level-off altitude, ALT mode will be automatically selected and displayed in green on the ADI. Once altitude hold is captured, the touch control steering (TCS) button on the control wheel can be used to change or trim the selected altitude. TCS operates in conjunction with the flight director or the autopilot or both. Once ALT mode is engaged, resetting the BARO setting on the pilot's altimeter will cause the airplane to climb or descend to recapture the same indicated altitude. Moving the autopilot pitch wheel will cause ALT or ASEL CAP modes to be canceled if either is selected.

Selection of a vertical mode without a lateral mode will provide autopilot tracking of the mode but the FD command bars will not be in view.

FLIGHT LEVEL CHANGE HOLD AND VERTICAL SPEED HOLD

Flight Level Change (FLC) Hold (IAS or MACH - mode selectable depends upon altitude) and vertical speed (VS) hold are selected by pressing the appropriate mode button (FLC or VS) on the MS-560 Flight Director Mode Control Selector. The flight director, autopilot, or both will hold the airspeed, (Mach if appropriate), or vertical speed indicated at the moment of engagement. The green light in the respective mode selector button will illuminate and VS or IAS (or Mach), as appropriate, will illuminate in green on the ADI. When initially selecting speed mode, the speed target will synchronize to the existing indicated airspeed for altitudes below 29,000 feet or at speeds less than 0.560 Mach, and will synchronize to the existing Mach number for altitudes above 29,000 feet or at speeds greater than 0.620 Mach. The target will automatically switch from indicated airspeed to the equivalent Mach number as the airplane climbs through 29,000 feet or exceeds 0.620 Mach. It will automatically switch from Mach number to the equivalent indicated airspeed as the airplane descends through 28,800 feet and decreases below 0.610 Mach. Upon initially selecting vertical speed hold mode, the vertical speed will synchronize to the existing vertical speed. Once the vertical speed mode is selected with the autopilot engaged, the pilot can select a different vertical speed with the pitch wheel on the autopilot controller (within the minimum/maximum limits). If the autopilot is engaged after VS mode is selected, the vertical speed must be re-synchronized.

The autopilot pitch wheel may be used to change the reference speeds for both the speed mode and the vertical speed mode. The touch control steering (TCS) button may also be used to temporarily release the autopilot clutches and maneuver the airplane to a new reference. The airspeed, Mach, or vertical speed established when the (TCS) button is released will become the new reference.

A predetermined lower limit has been established, below which the FLC mode will not engage. At the opposite end of the speed spectrum, V_{MO} or M_{MO}, as appropriate, will not be exceeded. If an upper limiting speed is attained the system will maintain the limiting speed, thus speed hold mode can be used to fly V_{MO} or M_{MO} descents.

Selection of the flight level change mode will cancel all other vertical modes except altitude preselect arm (ASEL - green annunciation) and glide slope arm (GS - green annunciation).

GO-AROUND MODE

A go-around mode (GA) is available through buttons on the left and right throttles. Depressing one of the buttons will cancel all other FD modes and disconnect the autopilot except for the yaw damper. The FD command bars will command a wings level and a 10° nose up climb attitude. GA will illuminate in green on the ADI. After go-around has been selected, the selection of any lateral mode will cancel the wings level roll command but the pitch-up command will remain. The go-around mode is canceled by selecting and entering a vertical mode, pressing the TCS button, transitioning to altitude preselect capture mode, engaging the autopilot, or by changing the autopilot flight director coupling status (only the side that becomes the new flight director master will cancel the go-around mode).

PITCH SYNCHRONIZATION

When flying the airplane manually and using the flight director, the command bars may be matched to the existing pitch attitude, or if a vertical mode has been selected the mode reference may be changed, by pressing the touch control steering (TCS) button. When the TCS button is released, the command bars will synchronize to the airplane attitude existing at the moment of release. If a vertical mode is selected (ALT, VS, FLC), the flight director/autopilot will hold the vertical reference existing at the time of release.

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The electronic flight instrument system (EFIS) is an integral part of the Primus 1000 Control Display System. The EFIS system consists of two DU-1080 electronic Primary Flight Displays (PFD), the center instrument panel mounted DU-1080 Multi-function Display (MFD), a DC-550 Display Controller for each pilot, dual MS-560 Mode Selectors, an MC-800 Multi-function Display Controller, and an RI-553 Remote Instrument Controller. An AZ-950 micro air data computer in each system also provides inputs which are used and displayed by the EFIS system; cross selection, or reversion, (ADC1/ADC2 annunciation) of micro air data computers is possible, which provides system redundancy. The heart of each pilot's system is two IC-615 Integrated Avionics Computers. It contains the flight director computer; the pilot's IC-615 also contains the autopilot computer. The symbol generator receives and processes airplane sensor inputs and transmits the data to the electronic primary flight displays (PFD) or multi-function display (MFD) in its system. In case of malfunction of a symbol generator, which is located in each IC-615, reversion is possible through a selection on the three-position SG REV selector (SG1/NORM/SG2) located on the multi-function display controller located on the center instrument panel.

Other parts of the system are discussed under different headings, since some of the sub-systems must be covered individually, and components of the EFIS system also comprise parts of those systems. The dual LCR-93 attitude and heading reference system (AHRS) for example, is also an important part of the integrated system, however, it is discussed under its own heading.

The bottom third of the roll attitude pointer in the attitude director indicator (ADI) portion of the PFD acts as slip-skid indicator. For zero lateral acceleration the bottom section of the triangular pointer aligns with the top part and forms a complete triangle. When lateral acceleration is detected, to the right for instance, the bottom part of the triangle moves to the left, as the ball in the conventional inclinometer will move. For left lateral acceleration the bottom of the triangle will move right. Both primary flight displays and the multi-function display can be dimmed manually by means of knobs on the respective controllers and the relative brightness will then be maintained photoelectrically.

Selections for navigation sources and bearing needle presentations are controlled by means of buttons and knobs on the DC-550 display controller (DC). The selected sources are annunciated on the primary flight displays. Each pilot may choose full or arc mode for compass display, (pressing the HSI button on the display controller cycles the display), single cue or cross pointer flight director display, and elapsed time (ET). NAV 1 or NAV 2, or FMS may be selected for navigation display and control of the flight director. These functions are explained under Display Controller below. Additional knobs which select various navigation equipment for display (only) on the EFIS are also discussed below.

Operation of the EFIS is similar to a standard flight director system except for the presentation of additional information on the small format of two electronic display units. More information is available in a more compact arrangement and the format is variable as desired. Presentations that are not necessary or desired can be removed and replaced with more appropriate data for the existing flight conditions. Control of the system is discussed below.

EFIS DISPLAY CONTROLLER

The display controller, located near the respective PFD on the pilot's and copilot's instrument panels, allows selection of the different display formats and provides for selection of required navigation sources and bearing data.

EFIS DISPLAY CONTROLLER

A30055

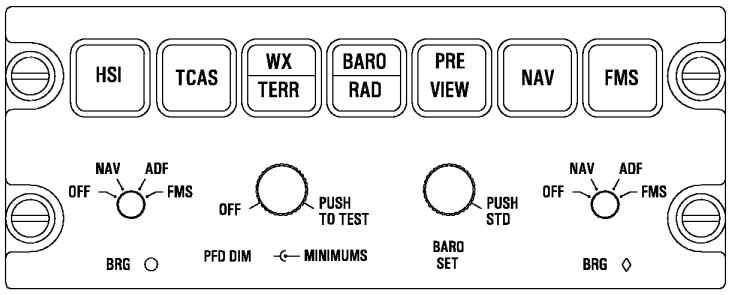

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Figure 3-17

The individual controls are:

HSI Button	Controls FULL or ARC (partial compass display). Displays 360° in FULL mode and 90° in ARC mode. Successive pushes change the mode back and forth.
TCAS	Toggles the PFD to overlay TCAS display on the compass in either arc or map mode. If the display is in full compass mode, selection of TCAS for display will set the compass to arc mode.
WX/TERR	Toggles the PFD HSI between compass mode (power-up/default display), arc wx, arc EGPWS and arc (no WX/TERR), or between map mode, map wx, and map EGPWS.

BARO/RAD	Toggles the Barometric Altitude Minimums Display between dashes (---) at power-up, baro min display, rad min display and off (blank).
PREVIEW	When FMS is the displayed navigation source on the PFD, VOR/ILS course deviation and vertical deviation may be previewed on the compass card formats.
NAV Button	Pressing the NAV button selects the VOR for display on the HSI course deviation indicator (CDI). Pressing the button alternately selects NAV 1 and NAV 2 (annunciated VOR 1 and VOR 2 on the center right side of the HSI; ILS 1 and ILS 2, if ILS frequency is tuned in NAV). The flight director interfaces with the NAV that is selected and displayed on the HSI.
FMS Button	Selects flight management system (FMS) for display on the HSI; the flight director will interface with the FMS. The HSI course needle represents FMS course information on the bearing pointer. If two FMS's are installed, the switch will toggle between the two.
Bearing " **O** "	This knob has four positions. The OFF position removes the bearing pointer from the display. In NAV 1 position, VOR 1 bearing information is displayed. In ADF 1 position, ADF 1 bearing is displayed. Selecting FMS displays FMS information. If two FMSs installed, selects FMS 1.
PFD DIM (Outer Concentric)	The DIM knob sets the overall brightness of the PFD. When a reference level is set, photoelectric sensors will maintain the relative brightness level in various lighting conditions. Full counterclockwise OFF position blanks the PFD and the PFD information is displayed on the MFD.
Radio Altitude	Rotation of the DH inner concentric knob adjusts the radio altitude decision height display on the ADI. Rotating the inner knob fully counterclockwise removes decision height information from the display.
Test Function (TEST)	Pressing and holding the TEST button causes the displays to enter the test mode. Flags, cautions, and all flight director and mode annunciations are tested and presented on the display. As the test button is held down an autopilot (left display only) and flight director system checks will be accomplished. Satisfactory or unsatisfactory test results will be annunciated on the display. The test will also result in a self-test of the radio altimeter system; 50 feet will be indicated in green at the bottom of the ADI display. The TEST button is wired through a squat switch and is completely active only when the airplane is on the ground. The Primus 1000 test is not active in flight, but a self-test of the radio altimeter system may be made in flight if the APR mode is not selected. The EFIS system will also automatically self-test when it is powered up. If the test is not satisfactory it will be so annunciated.
Bearing "♦ "	This knob has four positions. The OFF position removes the bearing pointer from the display. In NAV 2, NAV 2 bearing is displayed. In ADF 2 position (if installed), ADF 2 bearing is displayed. In FMS position, FMS is displayed. Decal will be OFF/NAV/ADF/FMS, if FMS 2 is installed.

HEADING REVERSION SWITCH (HDG REV)

The heading reversion switch is an auxiliary push button switch (HDG REV) on the respective pilot's and copilot’s instrument panels which allows selection of the opposite side attitude and heading reference system (AHRS) as an alternate (reversion) heading source for the pilot's or copilot’s flight director. MAG 2 (MAG 1) or DG 2 (DG 1) will be annunciated in amber in the center-left of the PFD. The annunciation of MAG or DG will be controlled by the position of the respective AHRS DG/SLAVE/TEST switch on the pilot’s or copilot’s instrument panel. If there is no reversion selection and both systems are selected to their own respective sources, there will be no annunciation. If there is a cross-selection (reversion) on both sides, the annunciation will be in white. If the same AHRS is selected as a heading source on both sides, the heading source annunciation will be in amber, to apprise the pilots that both indicators are selected to the same heading source.

ATTITUDE REVERSION SWITCH (ATT REV)

The attitude reversion switch (ATT REV) is an auxiliary push button switch on the respective pilot's and copilot’s instrument panels which allows selection of the opposite side attitude and heading reference system (AHRS) as an alternate (reversion) attitude source for the pilot's or copilot’s attitude direction indicator (ADI) in their respective PFD. ATT 2 or ATT 1 will be annunciated in amber in the upper left of the PFD. If the same AHRS is selected as an attitude source for the attitude indicators on both sides, the attitude source annunciation will be in amber; if both systems are selected to their respective sources there will be no annunciation. In case of a reversion selection, the annunciation is in amber to apprise the pilots that both indicators are selected to the same attitude source.

RADOME COOLING FAN

An avionics cooling fan is mounted well forward in the right side of the nose compartment to provide circulation of cooling air to the radar set and other nose mounted avionics while on the ground. An amber RADOME FAN annunciator on the annunciator panel monitors the condition of the cooling fan. If the RADOME FAN annunciator illuminates, indicating failure of the fan, procedures in Abnormal Procedures of the AFM should be followed. In flight, no abnormal conditions should be experienced, however, ground operation is time limited.

EFIS BACKUP MODES

In case of a symbol generator (SG) failure, the side having the failure may be selected to the opposite side SG by means of the SG REV selector (SG 1/NORM/SG 2) on the RI-552 controller. If SG1 is selected it means that the symbol generator in the pilot’s IC-615 is driving both PFDs. SG2 means the symbol generator in the copilot’s IC-615 is driving both PFD displays. In these cases both PFD displays will have the same format. The annunciation (SG 1 or SG 2) will be amber.

AUXILIARY EFIS ANNUNCIATORS

Various amber annunciators, located on the airplane annunciator panel and in the upper left corner of the multi-function display (MFD), are used to monitor the condition of the various components of the EFIS system. Procedures in the Abnormal Procedures section of the AFM must be followed in the event of illumination of one or more of the annunciators. Their function is to warn of overtemperature and failure conditions in the respective primary flight displays or other EFIS components as follows:

IC-1 HOT	Indicates Pilot IC-615 Integrated Avionics Computer Overtemperature Condition.
IC-2 HOT	Indicates Copilot IC-615 Integrated Avionics Computer Overtemperature Condition.
IC-1-2 HOT	Indicates Overtemperature Condition of Both IC-615 Integrated Avionics Computers.
IC-1 FAN	Indicates Failure of Pilot's IC-615 Cooling Fan.
IC-2 FAN	Indicates Failure of Copilot's IC-615 Cooling Fan.
IC-1-2 FAN	Indicates Failure of Both Pilot's and Copilot's IC-615 Cooling Fans.
DU 1-2-3 FAN	Indicates Failure of the PFD or MFD cooling fan.
DU 1-2-3 HOT	Indicates overtemperature of the PFD or MFD most likely caused by failure of the cooling fan.
CHK PFD1	IC-615 Display Guidance Computer Detects a Wraparound Failure in PFD 1. This annunciator appears in the MFD and is also found on the annunciator panel.
CHK PFD2	IC-615 Display Guidance Computer Detects a Wraparound Failure in PFD 2. This annunciator appears in the MFD and is also found on the annunciator panel.
CHK PFD1-2	IC-615 Display Guidance Computer Detects a Wraparound Failure in Both PFDs.
AHRS BASIC-1	Indicates AHRS 1 is in basic mode. AHRS 1 has lost TAS/GS input.
AHRS BASIC-2	Indicates AHRS 2 is in basic mode. AHRS 2 has lost TAS/GS input.
AHRS BASIC-1-2	Indicates that both AHRS are in basic mode.
PWR-1-2	Indicates AHRS 1 or 2 has transferred to the auxiliary battery due to loss of DC power.

ATTITUDE DIRECTOR INDICATOR (ADI)

CM 1-2 FAIL	Indicates pilot or copilot Config Fail Flags are set to FAILED.
CM MISMATCH	Indicates the System Configuration Comparison Monitor Flag is FAILED and the on-side and cross-side Config Fail Flags indicate NOT FAILED.

Certain displays form a permanent part of the attitude direction indicator (ADI) portion of the Primary Flight Display (PFD). The displays are: the blue and brown sphere, the pitch and roll attitude reference marks, the airplane symbol, the conventional inclinometer which is fixed to the lower part of the PFD, and the electronic slip-skid indicator. Some annunciations which are presented in the ADI display are annunciations for other systems which are discussed under the headings of those systems, since they are not associated with ADI information. The flight director command bars will be in view on power up unless there is no lateral mode selected. The single-cue flight director presentation is the power-up mode.

Other displays are present when selected or during certain phases of a flight. When not in use, the displays are removed from view. The displays are:

Decision Height (Radio Alt) Minimums	The radio altitude minimums readout is a three-digit display identified RA (white) located below and right of the attitude sphere. The value of the decision height is identified in cyan numbers. It is set by rotating the DH set knob on the display controller. Full counterclockwise rotation removes the display from view. A decision height annunciation (MIN in amber inside a black box with white background) appears in the upper left of the attitude sphere at radio altitudes less than or equal to the decision height setting and flashes for ten seconds. Decision height will not be annunciated until it is armed. Arming occurs when the “weight on wheels” switch senses “in air” and a radio altitude of 100 feet greater than the selected decision height exists for at least five seconds.
Flight Director Mode Annunciators	Armed mode annunciations appear in white at the top left (lateral modes) and the top right (vertical modes) of the ADI presentation. Captured mode annunciations appear in green. When a mode is not selected, the annunciation is not present. As a mode transitions from armed to captured, a white box is drawn around the annunciation for five seconds.
Marker Beacon	Marker beacon information appears below the glideslope indicator when ILS is tuned. A white box, in which the appropriate letter will flash when a marker beacon is passed, will be located in that position. Outer marker is identified with a cyan "O", middle marker by an amber "M" and inner marker by a white "I".
Comparison Monitors	Amber attitude comparison monitor warnings (ROL, PIT, ATT), and localizer and glideslope comparison monitor warning (LOC, GS and ILS) are located at the lower left side of the attitude sphere. Parameters for the illumination of comparator warnings are discussed under Comparison Monitor, below in this section.

Flight Director Couple Arrow	The green flight director couple arrow is positioned at the top center of the PFD. The arrow is left pointing or right pointing to indicate which flight director the autopilot is coupled to. (This display is always present.)
Low Altitude Awareness	A “Low altitude awareness” indication of a solid brown raster band will appear on the altitude tape as the radio altitude drops below 550 feet. When the airplane is on the ground the brown band will cover the lower half of the altitude tape. A yellow line will be drawn at the intersection of the brown and grey band of the altitude tape, until radio altitude drops below 60 feet. There will be no written information displayed in the brown raster tape.
Glideslope	When an ILS frequency is tuned, glideslope information will appear. Indication is conventional in appearance. Green color of the vertical scale pointer identifies the information as glide slope information (pilot tuned to ILS 1 and copilot to ILS 2) (yellow if same NAV is selected on both sides or “cross-selected”.) When tuned to other than an ILS frequency, the glideslope disappears.

NOTE

When the back course (BC) mode is selected on the flight director the glide slope indication will not be present.

Flight Director Command Cue	The magenta flight director command cues can be selected in single cue or cross pointer format be pressing the menu button on the DC-550 Display Controller. In the single cue format, if a lateral mode is not selected, the command bars will remain biased out of view. Power up default selection is single cue.
Radio Altitude	When at an altitude within operational range of the radio altimeter, the radio altitude display appears in green in the lower section of the ADI sphere.
Source Annunciations	Source annunciations (ADC1 and ADC2, ATT1 and ATT2, SG1 and SG2) will be displayed to indicate the sources of air data, attitude and symbol generator information, respectively. If the pilot and copilot are using their normal sources, there is no source annunciated. “Cross-selections” will be annunciated in white, and when both displays are selected to the same source the annunciation will be in amber, to remind the pilots of the single source selection. Annunciation is in the upper left section of the ADI display.

PRIMARY FLIGHT DISPLAY

Figure 3-18

ADI CAUTION OR FAILURE ANNUNCIATIONS

Flight Director Failure	If the flight director fails, the flight director command bars disappear and an amber FD warning appears in the top left center of the display. All FD mode annunciators will be removed.
Internal Failures	A large red X will cover the face of the primary flight display.
Radio Altimeter Failure	If the radio altimeter fails, the radio altitude readout will be replaced by an amber -RAD-. If the low altitude awareness indication is present, it will be removed.
Pointer/Scale Failures (Glide Slope [Vertical Deviation], Altitude, Airspeed, and Vertical Speed)	Failure of pointers/scales is indicated by: Replacing the digital readouts with dashes, drawing a red X through the scale (IAS, ALT, GS only), and removing the pointer (GS and VS only). The digital readout inside the vertical speed scale will be removed.
Attitude Failure	Attitude failure is annunciated by appearance of ATT FAIL in red in the middle of the attitude sphere. The sphere will change to solid blue, and the pitch scale and roll pointer will disappear.

EXCESSIVE ATTITUDE DECLUTTER

When roll or pitch attitude becomes excessive, certain symbology is removed from the PFD in order to declutter the display. A roll attitude of greater than 65° in either direction, a pitch attitude of greater than 30° nose up or 20° nose down will trigger the declutter mode. Many of the digital readouts, failure flags, comparison monitor annunciations, and mode annunciations are removed from the ADI display.

When the roll attitude becomes less the 63°, the nose up pitch attitude less than 28°, and the nose down attitude less than 18°, the removed symbology will be restored.

HORIZONTAL SITUATION INDICATOR (HSI)

The displays in the HSI portion of the PFD are discussed below in three categories: FULL TIME which are always present, PART TIME which are sometimes present, and the arc mode.

FULL TIME DISPLAYS

Certain displays are always present on the HSI or are always present when certain navigation equipment is in operation. The airplane symbol is always present and provides a quick visual cue of airplane position relative to a selected course or heading.

The other full time displays are discussed below. The angular presentations are all similar to those seen on a mechanical HSI.

Heading Dial and Digital Heading Readout	Heading information is presented on standard type compass dial format and digital heading readout is shown above the heading dial when in the ARC mode.
Heading Select Bug and Heading Select Readout	The heading bug is positioned around a compass dial with HDG knob on the remote instrument controller. The bug then retains its position in relation to the dial. A digital heading select readout is provided at the lower left of the display (cyan digits, white HDG label). The heading bug provides a heading error signal to the flight director.
Course Deviation Indicator	Navigation or localizer course. Course deviation and airplane position relationships are depicted as on a mechanical HSI instrument. The course deviation indicator also operates in conjunction with the long range NAV system. Refer to Part Time Displays (below) for Desired Track information. The CDI is positioned by the course knob on the remote instrument controller. The course knob is not functional when FMS mode is selected. The CDI is magenta when FMS course information is displayed, green when on-side NAV information is being displayed, and yellow when off-side NAV information is being displayed.
TO/FROM Annunciator	Indicator points along selected course depicting whether the course will generally take the airplane to or from the selected station or waypoint. Indicator does not appear during localizer operation.
Distance Display	Indicates nautical miles to selected station or waypoint. Distance display is 0-512 NM for selection of short range navigation equipment and 0-4095 NM for long range equipment. DME HOLD is indicated by an amber H next to the readout.
Navigation Source Annunciators	NAV source annunciations are displayed in the upper right corner of the HSI presentation. Long range sources are in magenta and short range sources are in green or yellow. A yellow indication means an “offside” selection or that both sources are the same. The label identification will always be white. A yellow annunciation of FMS indicates that both pilots are selected to the FMS.

PART TIME DISPLAYS

Part time displays are present when selected on the display controller or the flight director mode selector panel. The mode and bearing pointers available depend upon optional equipment installed and may not be present in all installations. Some annunciations are also related to other systems, which will be discussed under headings pertaining to those systems.

Bearing Pointer and Source Annunciation	The bearing pointers indicate relative bearing to the selected navaid and can be selected as desired on the display controller. Bearing pointers appear on the compass rose when they are selected by means of the knobs on the display controller, and the bearing pointer source annunciations are in the lower left of the HSI display. If NAV source is invalid or LOC frequency is tuned, the NAV bearing pointer and the annunciation will disappear. The "**O**" bearing displays NAV 1, ADF 1, or FMS. The "◇" bearing pointer displays NAV 2, ADF 2 (if installed), or FMS. In dual FMS installations the "**O**" bearing pointer displays FMS 1 and the "◇" bearing pointer displays FMS 2. In standard single ADF installations, ADF can be selected on either bearing pointer.
Elapsed Time Annunciation	Shows elapsed time in hours and minutes or minutes and seconds. Selection is made on display controller. Display is green with white label.
Time-to-Go and Ground Speed	Pressing the GS/TTG button on the display controller alternates time-to-go (to next waypoint or navaid) and ground speed displays. Display is in color determined by navaid selection/cross selection; label is white.
Desired Track	When long range navigation is selected, the course pointer becomes a desired track pointer. The long range nav system will position the desired track pointer. A desired track (DTRK) digital display will appear in the upper left corner of the HSI display. When FMS is selected, the course selection knob on the remote instrument controller is inactive. Color of the course deviation indicator (CDI) and digits will depend upon combination of short range and long range navigation sources selected.
NAV Source Annunciation	Appears in the upper right side on the HSI presentation when a NAV (NAV), ILS (ILS), or FMS (FMS) source is selected as a navigation source. Distance to next waypoint or to selected VORTAC appears below the annunciation. Source will be annunciated by the color code of the annunciations and HSI course deviation indicator (CDI). Yellow means "same side" or "cross side" selection of both sources, and green means normal "on side" selection. Labels will be white.
Wind Display	The wind display (magenta direction and arrow) is located at the lower left-center of the display when FMS is selected for navigation. In single FMS installations, the wind display will be in magenta unless both sides are selected to FMS, in which case the display will be yellow.

ARC MODE (PARTIAL COMPASS FORMAT)

During operation in the arc mode, 90° of arc presentation is visible on the HSI. Pressing the HSI button on the display controller toggles the display between the full and partial compass display.

Range Rings	Display of the range rings aids in the use of radar returns when WX mode is selected. Center half-range ring represents half the value of the selected radar range. Range is controlled by the weather radar controller. Power up default is 50 nautical range.
Weather	Weather radar returns are displayed on the HSI when WX mode (HSI Button pressed) is selected on the display controller. WX mode forces the PFD into arc display if it was not already selected. Radar mode annunciations are presented on the left side of the HSI presentation and on the lower left side of the multi-function display (MFD).

HSI CAUTION OR FAILURE ANNUNCIATIONS

Amber caution annunciations will appear to indicate the following situations:

DME Hold	When the DME is selected to HOLD, an amber H will appear to the left of the DME readout on the HSI.
FMS Alert Messages	Waypoint (WPT), dead reckoning (DR), GPS Integrity (INTG), or Degrade (DGR) messages appear in amber at the upper center-left of the HSI presentation to indicate, respectively, that a waypoint is being passed, the FMS is in dead reckoning, the GPS has an invalid receiver condition, or the FMS navigation has become degraded for any of various reasons. Amber MSG annunciated (flashing) in amber at the top center-right of the HSI display indicates that the FMS has a message on the FMS CDU.
Digital Display Cautions	When DME, ground speed (GSPD), time-to-go (TTG), or elapsed time (ET), digital readouts fail, the digital display will be replaced by amber dashes.
Target Alerts	An amber TGT on WX window indicates weather radar target alert. A green TGT annunciation indicates that target mode has been selected (enabled) on the weather radar. An amber annunciation means that a level three weather return has been detected in the forward 15° of the forward antenna scan.
Digital Readouts	Failure of the course or heading select signals will cause these displays to be replaced by amber dashes. They are also dashed when the heading display is invalid.
Heading Source and Navigation Source	When the pilot and copilot select to the same heading source or NAV source, the source annunciators will be amber. If the NAV or heading sources are cross-switched, i.e., pilot to copilot and vice versa, the annunciation will also be in amber. Normal selections are not annunciated.

Heading Comparator Warning	HDG is annunciated in amber at the top left center of the HSI display to indicate that the comparator system has detected an excessive difference between the two heading indicators.

Red failure annunciations will appear in the following instances and locations:

Heading Failure	A heading failure will result in the following indications: heading and bearing annunciations and bearing pointers will disappear; HDG FAIL appears at top of heading dial. HDG, CRS SEL, and DTRK will dash.
Deviation Indicator Failures	A failure in the vertical deviation or glideslope system will result in removal of the applicable pointer and a red **X** being drawn through the scale.
Vertical Speed Display	A failure in the vertical speed indicator or invalid information to the indicator will result in the needle being removed from the display. The digital information will be removed. For an invalid vertical speed target display, the target bug shall be removed from the display and the vertical speed digital display shall be removed from the display.
Navigation Indicator Failures	A red **X** will be drawn through the lateral deviation scale and the bearing pointer shall be removed from the display.

COMPARISON MONITOR

Selected pilot and copilot input data are compared in the symbol generator. If the difference between the data exceeds predetermined levels, the out-of-tolerance symbol will be displayed in amber. A list of the compared signals and the displayed cautionary symbols is given below. When the compared pitch and roll attitude or glideslope and localizer signals are out of tolerance, a combined level (ATT or ILS) will be displayed.

Compared Parameter	Annunciation	Triggering Difference
1. Pitch Attitude	“PIT”	5°
2. Roll Attitude	“ROL”	6°
3. Heading	“HDG”*	6°
4. Localizer	“LOC”**	Approximately dot
5. Glideslope	“GS”**	Approximately dot
6. Pitch and Roll Attitude	“ATT”	5° & 6° respectively
7. Localizer and Glideslope	“ILS”**	& dot respectively
8. Indicated Airspeed	“IAS”***	5 Knots
9. Altitude	“ALT”***	200 Feet

* If the compared heading sources are not the same (both MAG or TRU) the comparison monitor is disabled. 12° triggering difference if roll attitude is greater than 6°.

** These comparisons are only active during flight director, localizer, and glideslope capture with both NAV receivers tuned to a LOC frequency.

*** Airspeed and altitude displays will flash for ten seconds and then go steady.

EFIS EQUIPMENT FAILURE CHECKLIST

Failure of equipment feeding information to EFIS will be annunciated by flags or dashes. Failure effects of EFIS equipment are listed.

For detailed information related to the operation of the Primus 1000 system, consult the Primus 1000 Control Display System Pilot's Manual for the Citation XLS. For detailed emergency/abnormal procedures refer to the Emergency and Abnormal Procedures of the basic FAA Approved Airplane Flight Manual.

FAILURE	ANNUNCIATION	FLIGHT DIRECTOR	PILOT ACTION
Symbol Generator Failure	Red **X** on PFD or display blank	All modes cancel	Select opposite symbol generator on RI-552 SG1/NORM/SG2 switch, to drive all displays.
Display Controller Failure	Display cannot be changed	N/A	Select opposite symbol generator on RI-552 SG1/NORM/SG2 switch, to drive all displays.
Display Failure	Display goes blank	None	Rotate dim knob - to turn display off. Opposite pilot flies airplane, or fly from standby instruments.
Heading Failure	Red HDG FAIL on HSI, map, bearing pointers etc. removed	Command Bars out of view	Select opposite heading AHRS source by pressing appropriate HDG REV button.
Attitude Failure	ATT FAIL annunciation; No pitch scale or roll pointer, sphere all blue	None	Select opposite vertical AHRS source by pressing appropriate ATT REV button.
Flight Director Failure	FD FAIL on PFD in upper left of ADI display	FD Cues and Mode Annunciations Removed	Select opposite flight director on AP XFER FD1/AP XFER FD2 Switch and select opposite SG on instrument panel SG1/NORM/SG2 switch. Mode and display selections must be made on opposite Mode Selector and Display Controller respectively.

MULTI-FUNCTION DISPLAY SYSTEM

The Multi-function Display (MFD), the center DU-1080 liquid crystal display, serves as the weather radar indicator. It can be used to display the horizontal navigation situation, or long range (FMS), and to display electronic checklists. It also provides backup capability to the EFIS systems, with a major sub-function. If a symbol generator on one side fails the pilot can, through the SG1/NORM/SG2 control on the RI-552, select the opposite side symbol generator to take over the failed display, and operation of the EFIS in that position will continue as before, with the selected symbol generator powering all three displays.

The multi-function display system expands on the navigation mapping capability of the EFIS, especially in conjunction with the flight management system (FMS). The MFD display may be used independently for navigation and mapping information without disturbing the HSI's, which may be then used without additional displays which would result in more "clutter" on the PFD HSI. The weather radar display may be selected independently (by selecting off all of the navigation functions) or overlaid on the navigation display provided by the flight management system, in order to show the airplane route with respect to the displayed weather returns.

MULTI-FUNCTION DISPLAY CONTROLLER (MC-800)

The EFIS multifunction display (MFD) controller, located on the center instrument panel, allows mode selections, and display control. In addition to its navigation, terrain, reversion, and checklist functions, the MFD control also provides for control of the display of the Traffic Collision Avoidance System (TCAS).

MULTI-FUNCTION DISPLAY CONTROLLER

A30057

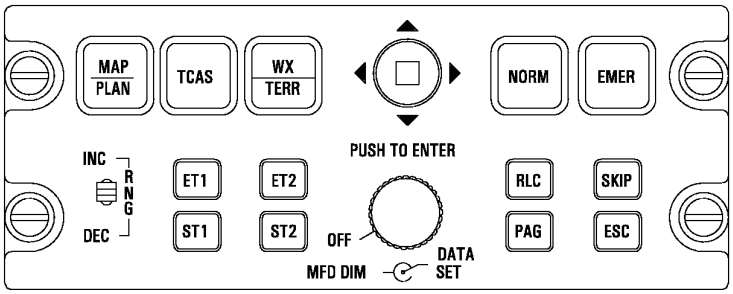

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Figure 3-19

MFD MODES OF OPERATION

The different modes of operation available to the multi-function display system are discussed below. The modes are: MAP/PLAN, WX, TCAS, Terrain, Checklist, with Normal and Emergency Procedures, and backup symbol generator modes for either of the primary flight displays (PFDs). The enhanced ground proximity warning system (EGPWS) and the Traffic Collision Avoidance System (TCAS) also operate through displays presented on the multi-function display.

MAP MODE

The MAP function is a partial arc airplane heading up display which is selected by the alternate action MAP/PLAN push button. The MFD display cycles from MAP to PLAN as the MAP/PLAN button is pressed. The MAP format allows total independent use of the MFD display for navigation mapping and allows increasing the maximum range, beyond normal radar range, on the display which normally serves as the radar indicator. Power up mode is the MAP mode. To add weather to the display, press the WX button on the RI-552. The MAP format is always oriented to the airplane heading and the airplane symbol is located at the center of the display. The MFD can only show information from the FMS. The NAV route, with up to ten waypoints, can be displayed to the range limit. When weather returns are selected, range control defaults to the WC-880 Weather Radar Controller.

PLAN MODE

In PLAN mode the top of the display is oriented to North; a three-inch range ring is displayed and centered horizontally on the display area. An aircraft symbol is plotted at present position (if present position is on the display) and is oriented with respect to heading. The PLAN mode display encompasses 360°. Weather radar returns, TCAS, Terrain, and Lightning cannot be presented in the PLAN mode.

TRAFFIC COLLISION AVOIDANCE SYSTEM (TCAS II)

The TCAS mode allows the TCAS window to be displayed. TCAS resolution advisories (on PFD), traffic advisories (on MFD and PFD), general TCAS operating modes, and failure annunciations will be displayed on the respective display. The TCAS display is selected by the TCAS button found to the right of the MAP/PLAN button on the display controller. The TCAS zoom window is the same field that is used for the checklist display. The TCAS window will display a 2-mile ring made up of twelve small circles, and an outer ring up to a 20-mile range display, at which time the 2-mile ring will be replaced with a half-arc ring. TCAS mode annunciations are displayed in the TCAS window. Traffic advisory (TA) and resolution advisory (RA) annunciations will be identified in the upper right corner of the TCAS window.

WEATHER (WX) MODE

The WX mode allows the MFD display to be used as a weather radar indicator. In WX mode, weather data is presented on the MFD and is superimposed upon the normal navigation display. Weather radar can only be selected for display on the MFD if MAP mode is selected. If the MFD is in PLAN mode, selection of WX mode will force the display into MAP mode. Range selection is controlled by the weather radar control on the center pedestal (arrow up and arrow down). When the WX button toggles between off, WX, terrain, back to off. Annunciation of weather mode, warnings, and antenna tilt angle are provided in the WX window. Annunciations are color coded in magenta, green, and amber according to the importance of the display. Operation of the weather radar with the weather radar control is discussed in this section. The MFD has a dedicated box in the lower left corner of the display, with four lines of display which include related WX mode annunciations plus antenna tilt angle and stabilization annunciation.

EFIS BACKUP MODES

In case of a symbol generator (SG) failure, the side having the failure may be selected to the opposite side SG. If SG1 is selected, it means that the pilot’s symbol generator in his IC-615 is driving all three displays. SG2 means the symbol generator in the copilot's IC-615 is driving all three PFD displays. In these cases the MFD will be normal and both PFD displays will have the same format. The MFD operates from IC-615 number one or number two.

CHECKLIST MODE

The NORM button on the MC-800 provides entry into the normal checklist display function. The normal checklists are arranged in the order of standard flight operations. Button actuations cause presentation of the normal checklist index page that contains the lowest order incomplete and unskipped checklist with the active selection at that checklist.

The RCL, SKP, PAG, and ENT buttons and the joystick on the MC-800 provide control of this function and are discussed under "MFD Controls" below.

The EMER button on the MC-800 provides entry into the emergency checklist display function. Actuation of EMER results in the presentation of the first page of the emergency checklist index with the active selection at the first checklist. The RCL, SKP, PAG, and ENT buttons and the joystick provide control of this function and are described in "MFD Controls" below. These controls perform as described for NORM with the exception of the action taken upon completion of the checklist. All checklist items are removed from the page and "EMERGENCY PROCEDURE COMPLETE" is written below the amber checklist title. This will be cleared when the index is selected. The SKP, PAG and ENT buttons will be inoperative.

WAYPOINT LISTING MODE

The waypoint listing mode is a display showing the user the airplane’s current position, the FROM waypoint, the TO waypoint, and any additional FMS waypoints on the flight plan up to a maximum of eight. If the waypoint listing is selected from the normal index mode, the display system will display data for the FROM waypoint, TO waypoint, present position, and up to eight additional waypoints from the current flight plan.

Information provided on the waypoint page will be the waypoint identifier, the latitude and longitude information, and the FMS distance.

MFD CONTROLS

Dim / Off	This concentric knob controls overall MFD LCD dimming in addition to the automatic dimming feature. Counterclockwise dims display. Full CCW is off and reverts the PFD menu to PFD.
Joystick	The function of the joystick depends upon the type of MFD display.
MAP or PLAN	In MAP mode it moves the designator in the directions shown. In PLAN mode movement of the designator causes the flight plan to move while the designator remains fixed in the center of the PLAN circle.
TEXT	a. Vertical movement of the joystick act as a cursor control by changing the active line. This provides an additional means of skipping lines or returning to a previously skipped line. b. Horizontal movement of the joystick controls paging. Actuation to the right increases the page number, and actuation to the left decreases the page number.
MAP/PLAN	Pressing the MAP/PLAN button selects the MAP MFD display mode. Pressing it again selects North-up PLAN mode.
WX	Weather radar data may be displayed with the MAP mode. The toggling sequence of this button is WX on WX off. If PLAN mode is selected, selection of MAP mode will be forced when WX mode is selected. The WX and the MAP/PLAN buttons interact, the selection becoming PLAN, MAP with WX, or MAP without weather, depending upon which button was pressed last.
VOR	This button is used to display the four closest VOR's, that are not on the active flight plan list, on the MFD, MAP, and PLAN displays. The first push of the button inserts the VOR's with identifications. The second push removes the identification, and the third push removes the VOR's from the display.
APT	The APT button is used to display the four closest airports, that are not on the active flight plan list, on the MFD, MAP, and PLAN displays. The first push of the APT button adds the airports with their identifiers. The next push of the button removes the airport identifiers. A third push of the button removes the airports from the MFD display.
DAT	This button is used to add long range NAV information to the MFD, MAP, and PLAN displays. The first push adds waypoint identifications and the second push removes them.

TYPICAL MULTIFUNCTION DISPLAY

FLIGHT PLAN W/TCAS OVERLAY

A30058

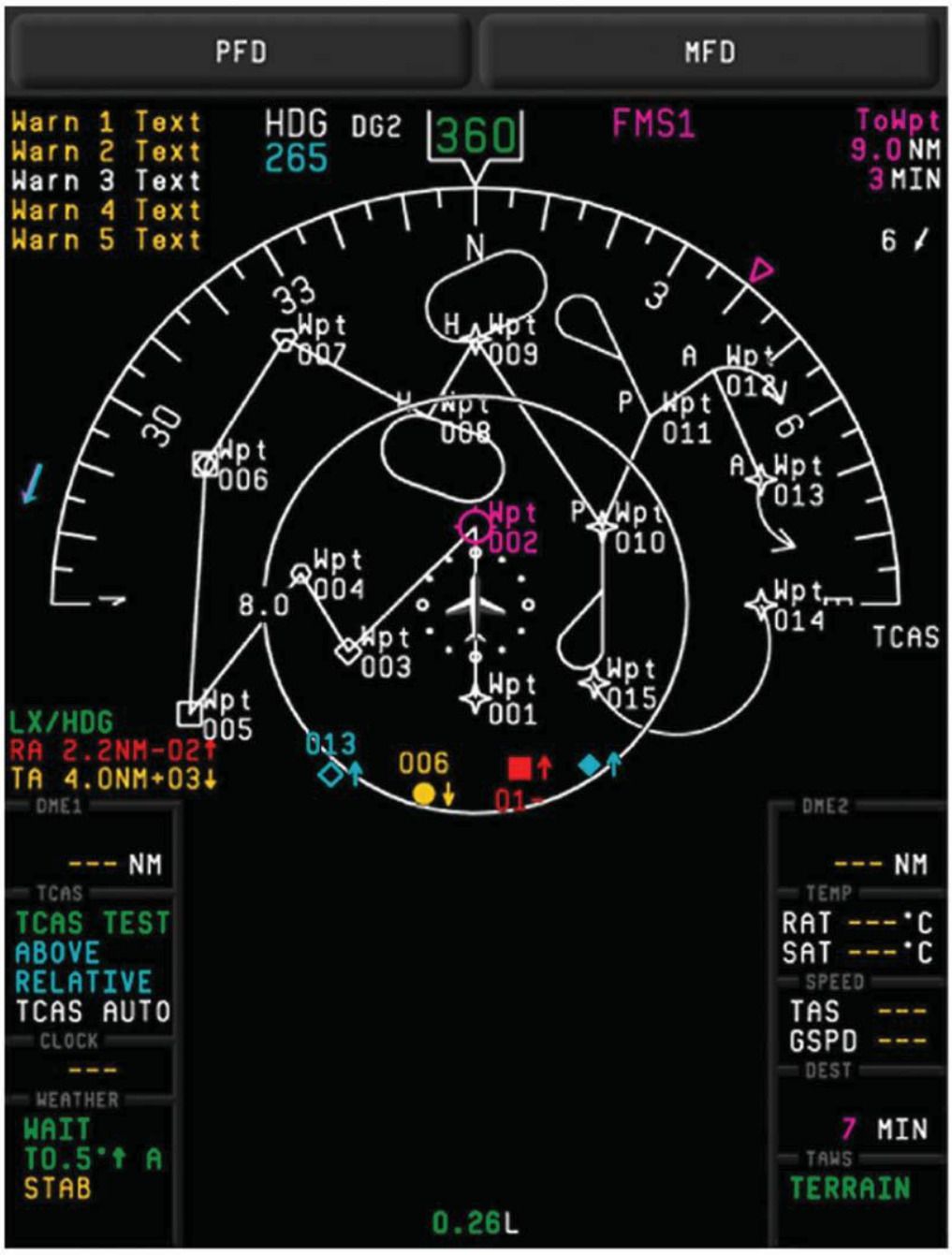

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Figure 3-20

Range Controls	The MFD range controls are active only when WX is not selected for display.
(INC and DEC)	Selectable ranges (in the MAP mode) are 2.5, 5, 12.5, 25, 50, 100, 150, 300, and 600 NM. The switch position labeled INC increases the selected range, and DEC decreases the selected range. In PLAN mode the ranges are 5, 10, 25, 100, 200, 300, 600, and 1200 nautical miles. In WX mode this selector is inactive. Default mode is 100- nautical mile range with MAP selected.
NORM	When this button is pressed, the MFD will display the index page containing the lowest numbered uncompleted or unskipped normal checklist with the active line at that checklist. While operating in this mode, as a checklist is completed, the system will automatically step to the next uncompleted procedure of the index.
EMER	Actuation results in the display of the first page of the emergency checklist index.
RCL	The function of this button depends upon the type of MFD display.
MAP or PLAN	Recalls the designator to its home position, or if the designator is at its home position, moves it to present position.
TEXT	Recalls the lowest numbered skipped line in a checklist by changing the active page and/or line.
SKP	The function of this button depends upon the type of MFD display.
MAP or PLAN	Skips the designator to the next waypoint. If the designator is not at the home position, the displacement line will be moved to the next waypoint.
TEXT	Actuation skips the active line in a checklist or index and advances the active selection to the subsequent line. If the line skipped is the last line, the active selection will revert to the lowest numbered skipped line.
PAG	Actuation advances the page count and places the active line selection at the first line of the page. Actuation with the last page displayed will result in display of the lowest numbered page containing a skipped line with the active line selection at the lowest numbered skipped line.
ENT	The function of this button depends upon the type of MFD display.
MAP or PLAN	With the designator moved from its home position, actuation of these buttons will enter the designator LAT/LON as a waypoint in place of the TO waypoint.
TEXT	Actuation checks off a line in a checklist or selects an index line item for display.

ENHANCED GROUND PROXIMITY WARNING SYSTEM

The Enhanced Ground Proximity Warning System monitors the airplane's flight path with respect to the terrain at radio altitudes from 50 to 2450 feet above ground level (AGL). If projected flight paths could result in impact with the terrain, unique aural and visual warnings are issued to the flight crew. The system is powered whenever power is applied to the airplane and it operates automatically in any one of six flight modes. If the airplane flies into an envelope which is protected by the warning system, the warning advisory will begin and will continue over the earphones and speakers until it is cleared by a positive pull up or the airplane flight path is no longer in the danger zone.

The EGPWS warning computer utilizes airspeed, altitude, and vertical speed signals from the micro air data computers as well as signals from the radio altimeter, glideslope indicators, landing gear position, flap position, angle-of-attack system, attitude AHRS, a world wide terrain elevation data base, and the selected radio altitude decision height to output the various aural and visual warnings.

There are four switch-annunciators in the system, (TERR NORM/TERR INHIB, TAWS FLAP NORM/ TAWS FLAP OVRD, TAWS G/S//CANCELLED, and TAWS TEST). The normal selection for the flap norm/override switch is for TAWS FLAP OVRD not to be illuminated. If it is desired to make approaches or landings with no flaps, nuisance warnings may be avoided by placing the switch to the TAWS FLAP OVRD position.

The warnings for the different system flight modes are listed and described below:

Mode 1 - Excessive Descent Rate (SINK RATE Envelope)

The sink rate is measured barometrically and registers in a flight envelope beginning at approximately 4500 feet-per-minute at 2450 feet above ground level, decreasing progressively as the absolute altitude decreases. If the EGPWS computer calculates that ground impact will occur in less than thirty seconds the red PULL UP light will illuminate and "SINK RATE" will be announced every three seconds. If the airplane enters a situation in which ground impact will occur within ten seconds or less, the red PULL UP light will illuminate and an aural warning PULL UP will be announced continually until the airplane is recovered by a positive pull up from the danger area.

Mode 2A - Excessive Closure Rate to Terrain

This mode protects the airplane from rising terrain after takeoff. The EGPWS uses radio altitude, airspeed, and vertical speed to compute an excessive closure rate. At less than 2,000 feet AGL if the radio altitude begins to decrease rapidly and there is no excessive rate of descent, then the terrain must be rising rapidly beneath the airplane. The EGPWS compares the airplane parameters to a programmed curve that varies with altitude AGL, terrain closure, and airspeed. In most cases, if ground impact is within 15 seconds the aural warning "TERRAIN - TERRAIN" will be heard once and the red PULL UP box in the PFD attitude sphere will illuminate. This is followed almost immediately by the continuous warning PULL UP until the airplane has exited the warning envelope. The red PULL UP box in the PFD attitude sphere will remain illuminated until the airplane has climbed approximately 300 feet above the last pull up message. If the flaps are in the landing configuration (out of the up position) or the flap override switch (TAWS FLAP OVRD ON) has been activated, the warnings will not occur.

Mode 2B - Excessive Closure Rate to Terrain During Landing

The warning envelope for this mode is much smaller, in order to allow flight paths closer to terrain without nuisance warnings. During an approach to a landing, this mode is armed when the flaps are in the landing configuration or the flap override mode has been selected, and the airplane is on a glide slope not more than 1.3 dots below the glide slope and the G/S CANCEL function has not been selected. Terrain closure rates between 2,500 and 10,000 feet per minute at less than 750 feet AGL will result in a red PULL UP light and the message "TERRAIN - TERRAIN" followed by a continuous "PULL UP" warning. If this mode is entered with the landing gear extended and the flaps in landing position, the red PULL UP light will illuminate and the message "TERRAIN - TERRAIN" will be heard. There will be no PULL UP warning.

Mode 3 - Descent after Takeoff

After takeoff or go around from an altitude below 245 feet AGL, a negative rate-of- climb for a specific altitude loss will trigger an aural warning of "DON'T SINK". The mode becomes active when the airplane leaves the ground or begins a go-around and the EGPWS senses the airspeed increasing, no weight on wheels, the radio altitude increasing, and the landing gear and flaps retracted. Above an altitude of 50 feet AGL the EGPWS monitors both radio and barometric altitudes.

If the airplane begins to descend toward terrain, a comparison of radio altitude gained to that point is made with the barometric altitude being lost in the descent. When the barometric altitude loss becomes approximately 10% of the radio altitude gained, the red PULL UP light will illuminate and the alert message "DON’T SINK" will be announced every three seconds. Once a positive rate of climb is re-established, the alert message will cease and the red PULL UP light will extinguish. In order to reduce nuisance warnings above 700 feet AGL, the alert envelope is shifted by five feet per second to allow greater loss of altitude before the alert is activated.

Mode 4A - Proximity to Terrain with the Landing Gear Retracted

This mode is intended to give protection against flying into terrain in cruise configuration. If an airplane has slowly descended toward relatively flat terrain or the terrain has risen slowly under the airplane, there will be no excessive descent rate warning as in Modes 1 or 2. This mode will also guard against making a gear up landing.

With the landing gear and flaps in the retracted position, the EGPWS monitors the radio altitude and airspeed. At speeds greater than 178 knots indicated airspeed (IAS), the EGPWS will illuminate the red PULL UP light and provide the aural warning "TOO LOW, TERRAIN" every three seconds between 750 and 500 feet AGL. The purpose of this warning is to alert the pilot of proximity to terrain at high airspeed. By climbing above the altitude at which the alert began, a safe terrain clearance will be re-established and the warnings will be canceled.

At airspeeds less than 178 knots IAS, the EGPWS monitors the aircraft configuration, since at lower airspeeds the crew is more likely to be preparing the airplane for landing. If the gear are not extended before the airplane is less than 500 feet altitude AGL, the warning "TOO LOW GEAR" will be repeated every three seconds and the red PULL UP light will illuminate. Extending the landing gear or climbing above 500 feet AGL will silence the warning. No warning will be heard if the landing gear is extended before the airplane descends through 500 feet altitude AGL.

Mode 4B -Proximity to Terrain with Flaps Up

Modes 4A and 4B are similar, however, mode 4B becomes active when the landing gear has been extended. At airspeeds greater than 250 knots IAS, if the flaps are not extended, the EGPWS will illuminate the red PULL UP light and announce "TOO LOW, TERRAIN" every three seconds between 750 and 170 feet AGL. Below 170 feet AGL the warning message changes to "TOO LOW, FLAPS". Extending the flaps to the landing configuration will cancel this warning.

In case specific conditions require a flaps retracted landing, or the pilot wishes to practice flaps retracted landings, mode 4B warnings can be eliminated by pressing the amber TAWS FLAP OVRD switch on the instrument panel. The switch may be engaged any time the altitude is at least 50 feet AGL. The yellow TAWS FLAP OVRD ON will illuminate, this will prevent flap warnings or will cancel flap warnings which have occurred. Illumination of the amber TAWS FLAP OVRD ON portion of the switch/annunciator indicates that the warning has been disabled.

The flaps override function may be selected off by pressing the switch/annunciator again or by descending below 50 feet AGL upon landing, when it is automatically reset.

Mode 4C - Proximity to Terrain after Takeoff

This mode alerts pilots to the fact that the terrain is rising at a steeper gradient than the airplane is climbing. It does this by monitoring and noting a decreasing radio altitude even if the barometric altitude is increasing. A “minimum terrain clearance floor” is created by the TAWS when a takeoff is made, or when a go around is made from below 200 feet altitude AGL. This floor is generated starting at 100 feet AGL during a takeoff and 200 feet AGL during a go around. As the airplane climbs, the EGPWS monitors the radio altimeter and records the highest point reached above ground level. If the radio altitude decreases to 75% of that maximum, the red PULL UP light will illuminate and TOO LOW, TERRAIN will be repeated every three seconds until the airplane climbs above the altitude at which the alert started.

Above 750 feet AGL the mode becomes inactive until the system detects another takeoff, or a go around from below 200 feet AGL.

Mode 5 - Descent Below Glide slope

Excessive descent below glide slope on an ILS approach will result in an alert from this mode. For the mode to become active the following conditions must be met:

1. A valid glide slope signal must be in reception from the NAV receiver selected for the approach.
2. The landing gear must be down.
3. The airplane must be below 925 feet AGL.
4. The glide slope cancelled function (BELOW G/S//G/S CANCELED) must not have been selected.

If the above conditions have been met, the voice message "GLIDE SLOPE" will be heard between 925 and 300 feet AGL when the airplane is greater than 1.3 dots below the glide slope. The initial warning will be at a reduced volume, which is referred to as a “soft warning”. Repetition of the voice warning varies with radio. As the radio decreases, the warning will be repeated more and more frequently.

If the airplane deviates more than 2.0 dots below the glide slope, or passes through 300 feet AGL, the aural warning will increase to the normal warning message level. This is referred to as the “hard warning”. All of the alerts cancel when the airplane returns to less than 1.0 dots below the glide slope.

If the pilot wishes to intentionally descend below the glide slope, the mode 5 warning can be cancelled by pressing the G/S CANCELLED button on the instrument panel The amber G/S CANCELLED light will illuminate to indicate this condition. The mode will be cancelled and reset when the airplane descends below 50 feet AGL, climbs above 1900 feet AGL, or when a VOR frequency is tuned on the selected NAV radio.

Mode 6 - Callouts and Excessive Bank Angle

This mode is designed to enhance the pilot’s situational awareness. During or bank angle warnings, no annunciators are illuminated. When the airplane descends through 500 feet AGL on an approach to landing, the system will announce "FIVE HUNDRED". This will only occur if the airplane is not on an ILS approach or is more than 2.0 dots below the glide slope. This warning will be silent if the airplane is near the glide slope on a properly executed ILS precision approach.

The electronic flight instrument system (EFIS) makes one input to the EGPWS. As the airplane descends through the decision height selected on the DC-550 display controller (using the RA knob) "MINIMUMS - MINIMUMS" will be announced. This announcement will be made only once per approach. If the decision height is set at 200 feet AGL, the minimums warning will be heard instead of the 200 FEET warning. The minimums warning can be disabled by setting the decision height to less than 50 feet.

The EGPWS monitors the bank angle of the airplane and compares it to the airplane’s current. The bank angle inputs are received from the pilot's and copilot's AHRS units. At ground level a bank angle of 15° will produce a BANK ANGLE warning every three seconds. As altitude increases the alert is shifted to progressively steeper angles of bank up to 50° of bank at 150 feet AGL and remains at that maximum point as the altitude increases. When the bank angle is reduced below the warning point the warning will cease.

Self-Test

The system is self-tested by placing the rotary test switch on the center pedestal to the ANNUN position or by selecting EGPWS TEST on the switch/annunciator on the center instrument panel, and holding it down for the duration of the test - approximately seven seconds. During system self-test by selecting EGPWS TEST, MK V warnings will be evidenced by the voice message "PULL UP" followed by "GLIDE SLOPE" and at least two more "PULL UP" MESSAGES.

When the EGPWS system is tested by placing the rotary test switch to the ANNUN position, the following EGPWS annunciations will occur:

1. EGPWS TEST, TAWS G/S//CANCELLED, TAWS FLAP NORM/TAWS FLAP OVRD, and TERR NORM/TERR INHIB will come on immediately.

When the EGPWS system is tested by selecting GPWS TEST, the following EGPWS annunciations will occur:

1. GPWS FAIL and GPWS/WSHR FAIL annunciations on PFDs.
2. Glide slope callout.
3. GND PROX annunciation on PFD.
4. PULL UP annunciation on PFD.
5. WIND SHEAR annunciation on PFD.
6. Wind shear callout.
7. Terrain inop callout (with FMS off).

TRAFFIC COLLISION AND AVOIDANCE SYSTEM II (TCAS II) TCAS 2000 (Optional)

The TCAS II system visually presents traffic advisories on the multi-function display to the flight crew. The system interrogates every transponder equipped airplane within the selected range for bearing and data. It uses this data to establish a track for collision avoidance predictions.

The TCAS computer performs functions that determine range, bearing, and of intruder aircraft based on information computed from or contained in the reply messages. Bearing can only be determined for intruder replies received on the system directional antenna. can only be determined if the intruder is reporting in its transponder reply message.

Based on the information that can be extracted from or computed from the reply, the TCAS computer evaluates the threat potential of the intruder by calculating intruder closing rate and position relative to own aircraft. Based on this evaluation the TCAS computer categorizes the intruder as a non-threat, proximity or traffic advisory.

For traffic advisory category aircraft, the TCAS computer outputs traffic advisory symbol position and alert data to the EFIS. The TCAS computer also outputs traffic advisory alert voice messages to the cockpit audio system.

For proximity and non-threat aircraft, the TCAS computer outputs proximity or non-threat traffic symbol position data to the EFIS. Voice alerts are not generated for proximity or non-threat category aircraft. Intruders which are not reporting are also detected and tracked. By using the interrogation reply, the TCAS can accomplish the following:

1. Compute range between own airplane and an intruder.
2. Compute relative bearing to the intruder.
3. Compute and vertical speed of an intruder (if reporting).
4. Compute closing rate between an intruder and own airplane.
5. Issue a traffic advisory (TA) when the closing traffic is in the vicinity.
6. Issue a resolution advisory (RA) in order to maintain safe vertical separation.
7. Track 45 aircraft at once, displaying up to 30, and can coordinate a resolution advisory for up to three intruders at once.

Certain functions of the traffic and collision avoidance system (TCAS) are tuned through the radio management unit (RMU). Other selections are made with controls on the multi-function display (MFD). For information on the MFD, refer to Flight Guidance System. The ATC/TCAS control page display provides displays and controls for the TCAS modes. To access the page, the page (PGE) button is pressed, and the ATC/TCAS line key is then pressed.

On the ATC/TCAS control page the additional selections which follow may be made. System selection (INTRUDER) is possible between two modes; relative altitude or absolute altitude modes. In relative (REL) (green) mode, the difference between the intruder airplane's altitude and own airplane altitude is displayed. In absolute altitude mode (FL), the flight level (cyan) of the intruder airplane is displayed. If FL is selected on the Honeywell system, the selection will return to REL in 20 seconds.

A TCAS selection may be made to display only traffic that constitutes a potential threat or all traffic. The TA DISPLAY line key is used to select AUTO, whereupon traffic will be displayed on the multi-function display (MFD) only if it is a TA (traffic advisory) or RA (resolution advisory) target. MANUAL on the same key selects an MFD display in which all TCAS traffic within the viewing airspace will be shown.

In the STANDBY (green) mode the TCAS computer shows no traffic displays and does not reply to other airplane interrogations. The standby mode is selected by pressing the STANDBY line key on the main tuning page, thereby causing the transponder not to transmit and disabling the TCAS system.

The primary TCAS selection is displayed in the lower left window of the RMU main tuning page. Control of those displayed functions is possible by means of the line keys and/or the tuning knobs, once the tuning box is moved to the desired function with the line key. Range and altitude bands are selectable. The following are included:

1. Altitude band select - With the NORMAL band selected (green) the altitude display encompasses a range of ±2700 feet; with ABOVE (cyan) selected the altitude display changes to a range of -2700 feet to +7000 feet from own airplane altitude. If BELOW (cyan) is selected, the range becomes from, -7000 feet to +2700 feet from own airplane altitude.
2. Range (green) - Selectable at ranges of 6, 12, 20, and 40 NM. Selection is made by pressing the RANGE line key or by turning the tuning knobs once the tuning box is transferred to the RANGE function by pressing the line key.
3. TCAS Display 1/2 - This is the annunciation of which (pilot or copilot) TCAS display features the RMU is controlling. When the cursor is in the window, the 1/2 button is used for the selection. At power down the selections store.

Flight ID is a mode S coding which reflects the current flight's call sign. The outer tuning knob moves the character position designator and the inner tuning knob selects the desired alphanumeric character.

The flight level 1/2 selection on the ATC/TCAS control page displays the transponder's encoded and the air data source (digital air data computer 1 or 2) for that (i.e., DADC 1 and DADC 2).

The TCAS system has a self-test which may be activated when the yellow cursor is in the ATC/TCAS window and the TST key is pressed on the RMU control. “TEST” will be displayed when the test is active. During the test the TCAS traffic displays will show test pattern traffic symbols, red and green resolution advisories, during the test sequence. The sequence takes approximately ten seconds. If the test is completed successfully the system will return to the set operating modes and aurally annunciate "TCAS SYSTEM TEST OK" on the cockpit audio system. For a failure in the TCAS system “TCAS FAIL” will be displayed in yellow on the TCAS display and the audio system aurally annunciates "TCAS SYSTEM FAIL. TEST" and will operate either on the ground or airborne.

The TCAS system requires an operating mode S transponder with encoded altitude data included in the interrogation replies. When the transponder is set to STBY, the receiver transmitter may automatically change to standby mode or turn itself off.

DISPLAY INFORMATION

Messages concerning bearing information are displayed on two lines of text in the upper right side of the TCAS window whenever the system encounters an RA or TA target that has range but no bearing information for display. The color of each line is based on the intruder type. The first line contains the message RA NO BRG in red for an RA without bearing and the second line contains the message TA NO BRG in amber for a TA without bearing information.

The TCAS range ring boundary is a white full arc shown at the limits of the display window. The distance between the arc and the aircraft symbol is displayed in NM to the right of the arc.

The range ring is proportional to the selected range on the MFD, since the MC-800 MFD controller controls the map/plan mode range.

TCAS uses four color-coded symbols to map traffic and to locate aircraft which present a potential threat on the MFD. These symbols are a red solid square, an amber solid circle, a cyan solid diamond, and a hollow cyan diamond. These symbols represent traffic which has been identified and determined to pose a level of threat respectively as, resolution advisory (RA), traffic advisory (TA), proximate traffic, and other traffic.

Red represents an immediate threat to TCAS equipped aircraft, and prompt action is necessary to maneuver for avoidance. Red color is used only in conjunction with a resolution advisory (RA). Amber represents a moderate threat (traffic advisory or TA) to TCAS equipped aircraft and a visual search is recommended to prepare for avoidance of the intruder. Amber is only used in conjunction with traffic advisory (TA) traffic. Other traffic is represented by cyan color.

RADIO ALTIMETER

Honeywell AA-300

The Honeywell AA-300 radio altimeter displays radio altitude at all times up to an absolute altitude of 2500 feet. The system becomes operational when the airplane electrical system is powered up and it remains operational throughout the flight. Radio altitude is displayed in green digits located in the bottom center of the attitude sphere in the ADI displays.

The altitude display in the ADIs operates from -20 to 2500 feet. Between 200 and 2500 feet, the display is in ten feet increments. Below 200 feet, it is in 5-foot increments. Above 2500 feet, the display will disappear.

The radio altitude minimums (RA) selection is displayed digitally in the lower right side of the ADI display. It is selected by means of the DH/TST knob on the DC-550 display controller. The ADI radio altitude decision height range is from 200 to 999 feet in 10-foot increments and in 5-foot increments from 5 to 200 feet. Full counterclockwise rotation of the DH/TST knob on the DC-550 display controller removes the radio altitude DH display. A decision height warning tone will sound when the airplane reaches the decision height set on the pilot's ADI.

The decision height warning tone is controlled only by the DH setting in the pilot’s ADI. The copilot's attitude sphere decision height selection has no effect on the sounding of the DH warning horn.

When the airplane descends below an altitude of 100 feet above the selected radio altitude decision height, a black box with a white background appears in the upper left side of the ADI. When the decision height is reached, an amber MIN appears inside the box. The display flashes for ten seconds and then goes steady.

A “low altitude awareness display”, which is a brown strip along the right side of the DU-1080 primary flight display, is used as a visual annunciation of the airplane’s nearness to the ground. The low altitude awareness display is inside the bottom part of the altitude display and begins to appear when a radio altitude of less than 550 feet is reached. At touchdown, the low altitude awareness display reaches the horizon line. The yellow line, which divides the brown area from the rest of the display will disappear at a radio altitude below 60 feet.

If radio altimeter information is invalid, the radio display will be amber dashes, and the low awareness display will not appear.

Functional testing of the radio altimeter system and the ADI display digital readout is accomplished on the ground by depressing the TEST button on the DC-550 Display Controller. The following displays will occur: a radio altitude of 50, +5, -5 feet will be indicated until the button is released, at which time the actual altitude will be displayed. The radio altitude decision height display shows dashes when the TEST button is held down, and then displays the current set altitude for the remainder of the test. The radio altimeter TEST cannot be accomplished when APR CAP function of the flight director is selected. The radio altitude decision height tone check will depend on the radio altitude selection (RA) set on the pilot's ADI display. Testing the radio altimeter system with the TEST button on the DC-550 display controller will also test the EFIS failure flags and annunciators (lamps) in the MS-560 Flight Director Mode Selector.

NOTE

The test function activated by the TEST button is disabled after the glideslope has been captured during an ILS approach using the autopilot or flight director.

While taxiing over ice or snow, the radio altimeter may fluctuate by as much as fifty feet. Outputs from the radio altimeter system are used to desensitize the flight director and autopilot as the airplane passes 1100 feet AGL with the glideslope engaged during an ILS approach. If the radio altitude is invalid, gain programming becomes a function of glideslope capture, time, and airspeed.

PULSE EQUIPMENT

PRIMUS 880 WEATHER RADAR

WARNING

THE AREA WITHIN THE SCAN AREA AND WITHIN 15 FEET OF AN OPERATING WEATHER RADAR SYSTEM CONSTITUTES A HAZARDOUS AREA. DO NOT OPERATE THE RADAR SYSTEM WITHIN 15 FEET OF PERSONNEL OR FLAMMABLE OR EXPLOSIVE MATERIAL OR DURING FUELING OPERATIONS. FOR GROUND OPERATION OF A RADAR SYSTEM, POSITION THE AIRPLANE FACING AWAY FROM BUILDINGS OR LARGE METAL STRUCTURES THAT ARE LIKELY TO REFLECT RADAR ENERGY BACK TO THE AIRPLANE.

The Primus 880 Weather Radar System is an X-band alphanumeric digital radar with display designed for weather location and analysis and for ground mapping. The radar system can also be operated in conjunction with Electronic Flight Instrument Systems (EFIS) and the MFD to provide radar video to the EFIS HSI display and the MFD. The MFD serves as the primary indicator for the weather radar display, which is controlled by the WC-880 Remote Radar Controller. The system detects storms along the flight path and gives the pilot a visual indication, in color, of storm intensity. Storm intensity is displayed at five color video levels with black representing weak or no returns and green, yellow, red and magenta showing progressively stronger returns. In ground mapping mode, video levels of increasing reflectivity are displayed as black, cyan, yellow and magenta.

WARNING

THE SYSTEM PERFORMS ONLY THE FUNCTIONS OF WEATHER DETECTION AND GROUND MAPPING. IT SHOULD NOT BE USED OR RELIED UPON FOR PROXIMITY WARNING, ANTI-COLLISION OR TERRAIN AVOIDANCE.

The system consists of a receiver, transmitter, antenna, and a remote operating control panel mounted on the center pedestal.

The MFD controller (MC-800) is installed in the center instrument panel. Some functions of the MFD interface with the radar, these are also discussed under Electronic Flight Instrument System.

CONTROLS

TILT	Rotary control used to select tilt angle of antenna beam with relation to earth plane. Tilt range is 15° upward to 15° downward.
WX/TERR	On DC-550 EFIS display controller. WX/TERR button selects weather or map display on either primary flight display (PFD). WX selects arc mode as well as adds weather to the display.
WX/TERR	On MC-800 multi-function display controller. Selects radar weather mode for display on the multi-function display (MFD). If the MFD is in PLAN mode, selecting WX mode will force the display into the MAP mode for weather display.

MODE SWITCH Six-Position Rotary Switch

OFF	Removes power from the system.
SBY	Standby. System will warm up but antenna is stowed and transmitter is disabled.
WX	Places system in the operational mode selected by HSI switch on the DC-550 EFIS display controller.
GMAP	Places system in ground mapping mode. Ground targets are enhanced. Do not use GMAP for weather detection, because weather type targets are not calibrated in GMAP mode.

MULTI-FUNCTION DISPLAY / PRIMUS 880 WEATHER RADAR

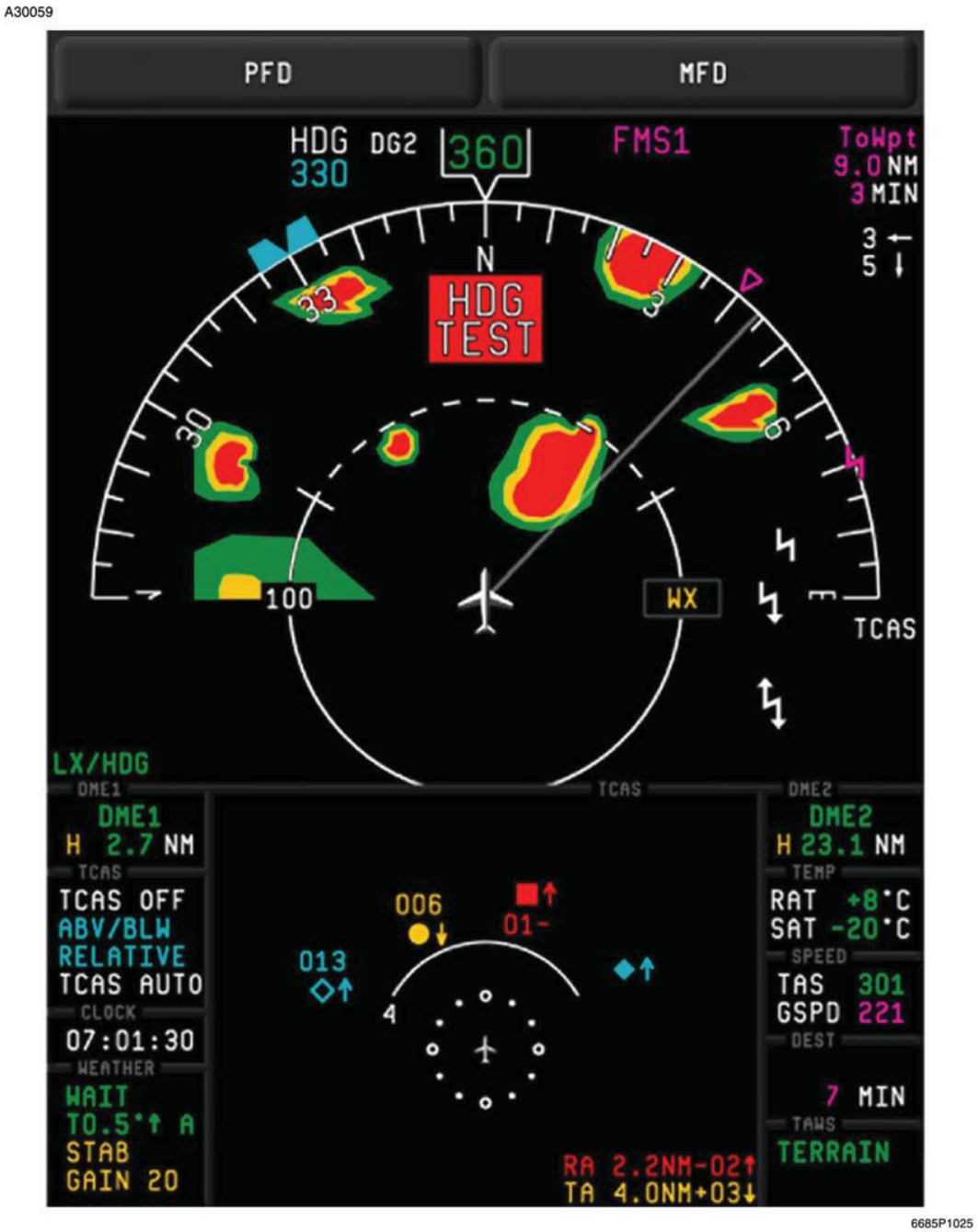

Figure 3-21

PRIMUS 880 RADAR CONTROLLER

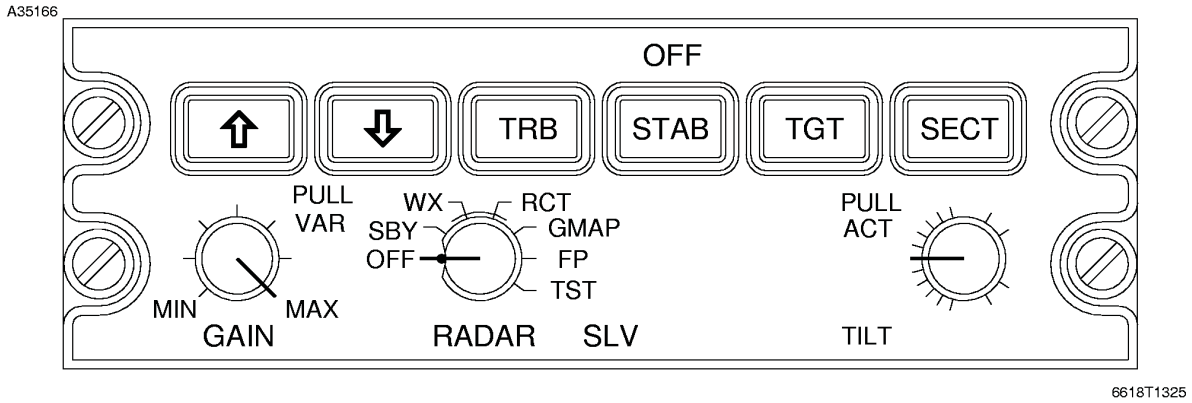

Figure 3-22

FP — Flight Plan. Provides extended range display of navigational data. No radar data is presented, the system is put into standby mode.

TST — Activates the self-test mode and displays a test pattern. Transmitter is on and radiating.

TRB — Momentary alternate-action push button which enables and disables the Turbulence Detection mode of operation. TRB mode can only be selected when WX mode is selected and the selected range is 50 nautical miles or less. Areas of moderate or greater turbulence are shown in soft white (grey-white). WX/T is annunciated in the mode field. The radar cannot detect clear air turbulence. Undetected turbulence may exist within any storm cell. Selecting the 100, 200, or 300-mile range turns off the turbulence detection. The“/T” is deleted from the mode annunciation and variable gain is engaged if it was previously selected. Subsequent selection of ranges of 50 miles or less will re-engage the turbulence detection.

GAIN — Rotary control used to adjust sensitivity of radar receiver. Receiver gain is fixed and calibrated in the PRESET position. Selection of REACT (RCT) overrides the gain control setting causing the receiver gain to be fixed and calibrated.

RANGE — A two-pushbutton range selection system permits range selection from 5 to 300 nautical miles full scale in the WX mode, or 5 to 1200 nautical miles in the Flight Plan mode. The UP arrow button selects increasing ranges while the DOWN arrow selects decreasing ranges. 100- nautical mile range is presented when system is initially turned on. The last range selected will be remembered when switching between WX and FP. WX range overrides the RNG/INC/DEC switch on the MC-800 MFD controller when WX mode is selected on that controller.

TGT — Alternate action pushbutton enables the target alert function.

SECT — Alternate action pushbutton selects either full azimuth scan angle (120°) or sector scan (60°). Fourteen looks per minute versus 28 looks per minute.

DISPLAY ANNUNCIATIONS

The different mode annunciations shown below are annunciated in the mode field. The mode field is on the lower left side of the PFD display. Below the mode field is the antenna tilt angle display which is preceded by a blank for positive values and a “-” for negative values. Directly below the tilt display are the target mode annunciation or the variable gain indicator. When target mode is selected, a green TGT annunciation appears on this line. When the receiver/transmitter (R/T) detects an alert condition the TGT turns to amber as long as the alert condition persists. Variable gain indication is annunciated by an amber VAR in the same field as the target alert, however, target mode/alert has the higher priority. When full compass mode and WX are turned on, a magenta TX will be displayed in the mode field. Also, if WX is failed and in test mode, an amber FAIL will be displayed in the mode field, and a failure code in the tilt field. If more than one code is associated with the failure, the numbers toggle between different fault codes.

PFD WX RADAR OPERATING MODE ANNUNCIATIONS

OPERATING MODE	FEATURE SELECTED	DISPLAY	
		MODE ANNUNCIATION	“TGT” AREA
WAIT	ANY SELECTION	WAIT (Green)	---
STANDBY	---	STBY (Green)	---
FORCED STANDBY	---	FSBY (Green)	---
TEST	---	TEST (Green) or FAIL (Amber)	---
WX	NONE VAR TGT RCT RCT/TGT	WX (Green) WX (Green) WX (Green) RCT (Green) RCT (Green)	--- VAR (Amber) TGT --- TGT
FLIGHT PLAN	NONE FPLN/TGT	FPLN (Green) FPLN (Green)	--- ---
GMAP	NONE VAR	GMAP (Green) GMAP (Green)	--- VAR (Amber)

AREA NAVIGATION

UNIVERSAL UNS-1Esp FLIGHT MANAGEMENT SYSTEM

The Universal UNS-1Esp is a fully integrated navigation management system designed to provide the pilot with centralized control for the airplanes navigation sensors, computer based flight planning, and fuel management. The FMS accepts primary position information from short and long-range navigation sensors. The primary position data received from the sensors is filtered within the FMS to derive "Best Computed Position" (BCP). It accomplishes these computations and advises the flight crew of components or systems requiring attention, as well as other irregularities, such as loss of enough sensors to compute a valid position. In the latter situation, if sensor loss endures over a set length of time, the system will enter Dead Reckoning (DR) mode and so inform the pilot through a message on the control display unit (CDU).

The UNS-1Esp provides lateral steering information to the pilot through the flight director and primary flight display (PFD). When connected to the autopilot, it provides roll steering commands. The VNAV function provides vertical steering information via the vertical deviation needle. VNAV guidance is not provided to the flight director or autopilot when in the APR button on the MS-560 is pushed, but the UNS FMS does provide the VNAV submode VAPP. The NAV computer additionally computes fuel flow information, providing a current fuel status and airplane gross weight throughout the flight if the fuel and gross weight are updated prior to takeoff.

In the dual installation of the Universal UNS-1Esp, the system may be configured as independent or with crossfill capability.

The system provides best computed position from the scanning DME, VOR, and long range navigation sensors. This position is used for navigating the airplane along the programmed flight plan and during approved instrument approach procedures.

The UNS-1Esp provides advisory VNAV information for up to nine waypoints on the flight plan. Vertical guidance is displayed on the EFIS.

NOTE

Selecting HSI or SG reversion returns the navigation display to basic NAV mode. FMS may be reselected.

The UNS-1Esp database incorporates SIDs, STARs, and approaches including GPS approaches. These procedures may be flown coupled to the autopilot or flight director.

NOTE

- The MFD map display may be incorrect for the procedures described above. The pilot should refer to the appropriate published SID, STAR or approach procedure for correct navigational guidance. For SIDs and STARs containing floating waypoints (heading to altitude and/or course to intercept), the CDI needle will be set to the correct sensing for the first active non floating waypoint on that procedure. This waypoint will always be annunciated on the HSI and appear as the magenta colored waypoint on the MFD map. If LNAV is selected as the lateral mode, the flight director will command headings and course to intercept per the published procedure but these will not appear on the MFD or HSI map, nor will the CDI give any guidance to these floating waypoints.

- Curved flight path portions of the search pattern may not display on the MFD or may display as straight line segments. The center point of the orbit pattern may also not display on the MFD. CDI steering information will be accurately displayed.

SINGLE DME OPERATION

If one DME is inoperative and the crew elects to tune both NAVs to the ILS frequency during approach they should be aware that the VPU may go into DR. This does not affect the accuracy of other Universal UNS-1Esp sensors. This situation should not occur unless the remaining operational DME roving channel is unable to receive at least two valid DME signals.

OPERATOR'S MANUAL

For detailed operating information, consult the Universal UNS-1Esp Pilot's Operating Manual, latest revision.

UNIVERSAL UNS-1ESP FLIGHT MANAGEMENT SYSTEM

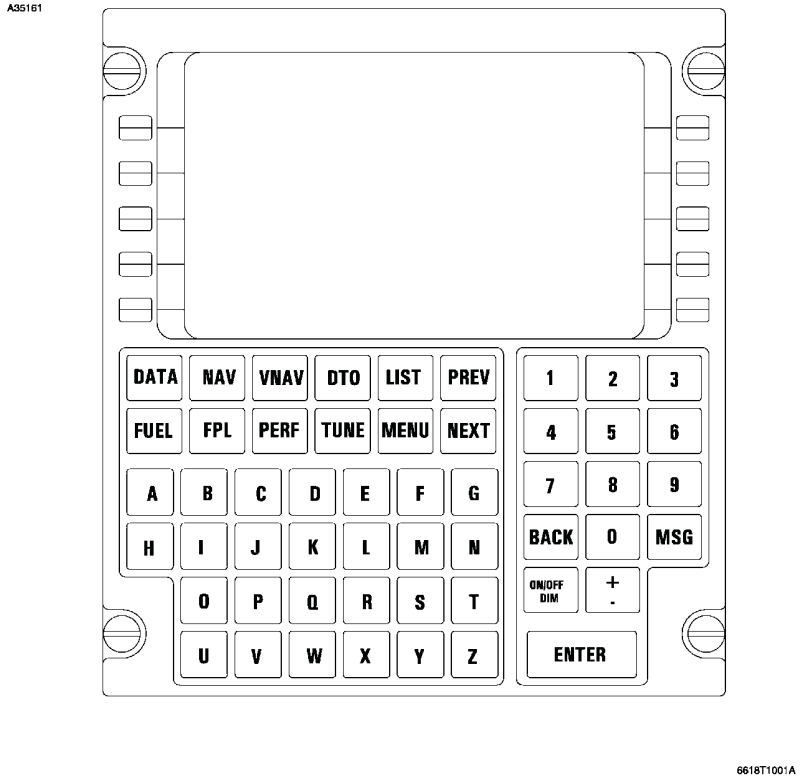

Figure 3-23