INSTRUMENTATION

The Citation Model 525A is equipped with a Rockwell Collins Pro Line 21 Integrated Avionics System which includes display, flight director guidance, autopilot, yaw damper and pitch trim functions. The integrated avionics system is designed and intended for single pilot operations. The basic system is comprised of the following subsystems:

- Two (2) AFD-3010 Adaptive Flight Displays (Pilot's Primary Flight Display (PFD) and Multifunctional Display (MFD)
- Flight Control System (3 axis)
- Two AHC-3000 Attitude Heading Computers
- ADC-3000 Air Data Computer and associated temperature probe
- Integrated Avionics Processor System
- Radio Altimeter
- Angle-of-Attack Computer
- Weather Radar
- External Global Positioning System (GPS) and Flight Management System (FMS) - OPTIONAL

In the optional second PFD configuration, additional subsystems included are:

- Copilot's PFD
- Copilot's ADC-3000

The integrated avionics system includes the following displays and controls: Primary Flight Display (PFD), Multifunctional Display (MFD), Display Control Panel, Course Heading Panel, Autopilot Panel, and Mode Select Panel. In the optional second PFD configuration, the additional displays and controls installed on the copilot's side of the panel are: Primary Flight Display (PFD), Display Control Panel, Course Knob Panel, Mode Select Panel. A version of the APP-85 Autopilot Panel also includes an autopilot transfer button.

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The upper portion of the PFD displays the basic "T" flight instruments: an attitude director indicator (ADI), altitude scale, airspeed scale and vertical speed scale. In addition, Flight Control System mode information is displayed in the area above the ADI, and radio altitude data is shown on the attitude display. The lower portion of the PFD screen is used to display a rose, arc, or optional FMS MAP navigation format as selected by the pilot. Weather radar and lightning symbology can be overlayed on the ARC or MAP format. The area on either side of the rose, arc or map format is used to display a lateral navigation data field, a weather radar mode field, system messages and selected menu data. Normal control, reversion and warning annunciations also are displayed. The PFD can be pilot-configured as a combined PFD/MFD to serve as a backup in the event of multifunction (MFD) failure.

On the MFD, the upper portion of the screen displays the Engine Indication System. The lower portion displays a rose, arc, FMS map or FMS plan map format as selected by the pilot. The area on either side of the rose, arc or map format is used to display a lateral navigation data field, a weather radar mode field and selected menu fields. A data line is displayed along the bottom of the MFD display with groundspeed, true airspeed and temperature readouts. Normal control, reversion and warning annunciations also are displayed. Like the PFD, the MFD can be pilot-configured as a combined PFD/MFD to serve as a backup in the event of PFD failure.

Line select keys on both the PFD and MFD provide the primary pilot interface. Control of the basic display formats is via the bezel mounted line select keys located on each display. Control of the radar, navigation sources, bearing pointers, speed and altitude references is via the line select keys. Control of the course, selected heading and selected altitude is via the course/heading panel. In the optional second-PFD configuration, an autopilot transfer button is provided.

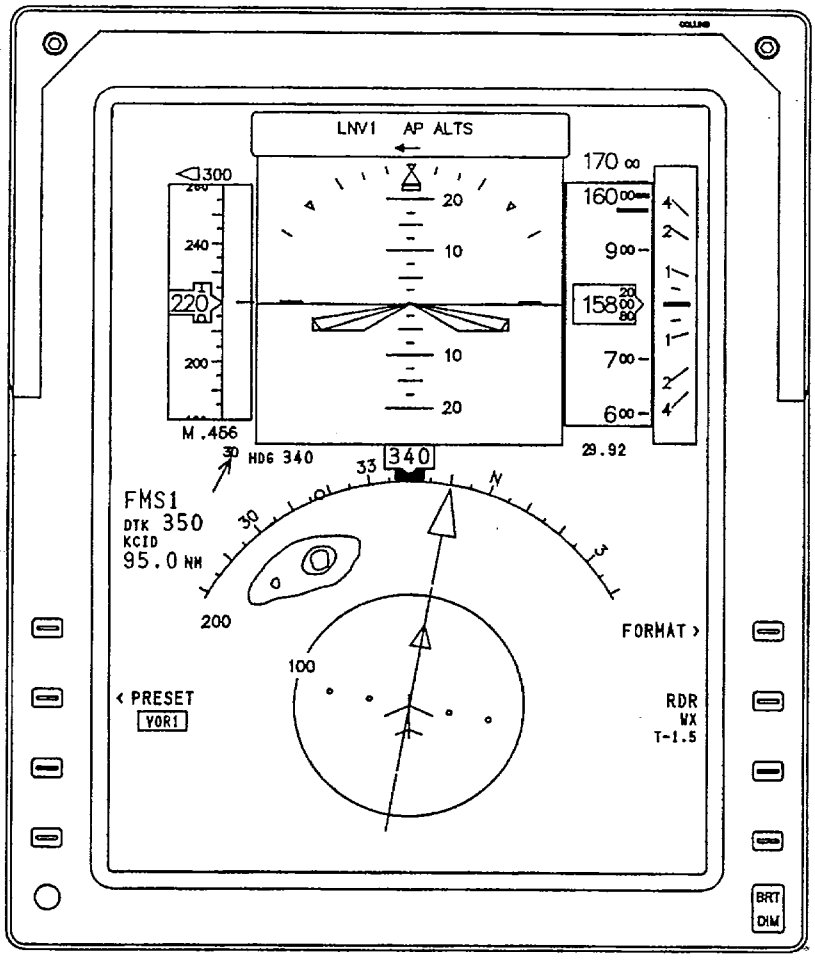

Figure 3-1. Primary Flight Display (PFD)

PITOT-STATIC

The Model 525A is equipped with separate pilot-static systems located on the left and right sides of the airplane. For the two display system, the left side pitot tube supplies pressure to the air data computer which, after converting the data into digital information, forwards the data through the system to the pilot's primary flight display The pitot tube on the right side of the airplane supplies pressure to the copilot's airspeed indicator. In the optional three display system, pitot pressure from the tube of the right side of the airplane serves the copilot's air data computer.

Two static ports are located on each side of the airplane providing a static source for the pilot's air data computer. The other port on each side provides a static source for the copilot's airspeed indicator, altimeter, instantaneous vertical speed indicator, and the cabin differential pressure gage. The gear warning airspeed system and the mach airspeed warning are provided by the Pro Line 21 Avionics System via the Air Data Computer.

AIRSPEED AND ALTIMETER INDICATIONS

Altitude and airspeed data to the primary flight displays (PFDs) is provided by information generated through the Rockwell Collins ADC-3000 Air Data Computer, which is transmitted in digital form to the PFDs. This information is then presented in color on the display in the PFDs. The ADC-3000 processess the following air data: pressure altitude (uncorrected), barometric corrected altitude, barometric pressure, total pressure, static pressure, vertical speed, airspeed (IAS/CAS), mach, maximum speed (V_{MO}/M_{MO}), true airspeed, total air temperature, static air temperature, and ISA delta temperature.

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, with the larger numbers at the top of the scale. The range of the airspeed scale is 40 to 450 knots with tick marks at 10 knot intervals.

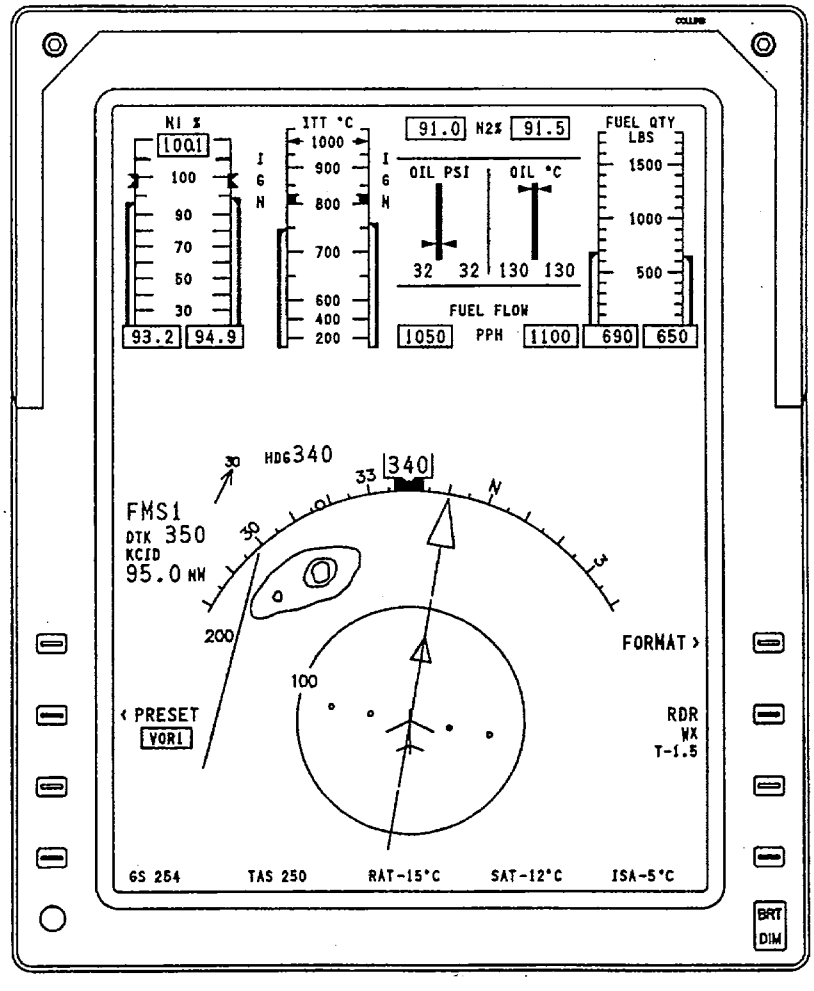

Figure 3-2. Multifunction Flight Display (MFD)

The copilot's instantaneous vertical speed indicator indicates vertical velocity from 0 to 6000 feet per minute, either up or down. Operation of the flight instrument differs from conventional VSIs in that there is less time lag between airplane displacement and instrument indication. Accelerometers sense any change in normal acceleration and displace the needle before an actual pressure change occurs.

ENGINE INSTRUMENTS

The engine operating parameters of fan RPM, inter-turbine temperature (ITT), turbine RPM, fuel flow, oil temperature, and oil pressure are monitored by the Engine Indicating System (EIS) through a color display on the upper screen segment of the center MFD. The EIS consists of four identical data concentration units. Of the four units, two are configured as data concentrator units , receiving analog and discrete data inputs from the engines and other airplane systems. The left and right data concentrator units output engine data to the respective EFIS displays.

Engine data from the EIS is shown in either normal or compressed format at the top of the MFD. The fan (N_1) display consists of the N_1 legend, N_1 pointers, N_1 scale and N_1 readouts. Two N_1 pointers (analog) are used with the N_1 scale to show the current fan speeds for the left and right engines. These pointers are white vertical bars that extend from the bottom of the scale to the current N_1 value. The N_1 digital readouts show the current fan speeds as numerical values (100 percent fan RPM = 17,245). The two N_1 readout values are green for valid data less than or equal to 104.4 percent, yellow for valid data from 104.5 to 105.3 percent for less than 20 seconds, and red for valid data (1) from 104.5 to 105.3 percent for 20 seconds or more, or (2) equal to or more than 105.4 percent. The N_2 display consists of the N_2 legend and the N_2 digital readouts. The two N_2 readouts are green for valid data less than or equal to 99.3 percent and red for valid data equal to or more than 99.4 percent (100 percent = 41,200 RPM).

The ITT display shows the interstage turbine temperature for each engine in degrees Centigrade on a scale range from 100 to 1050 degrees C. The display consists of the ITT legend, ITT pointers, ITT scale, and ITT start limit bugs. The scale values (starting engine) are green if from 100 to 1000 degrees C. and red if from 1002 to 1050 degrees C. The scale values (engine running) are green if from 100 to 796 degrees C., yellow if from 798 to 820 degrees C. for less than 5 minutes and red if (1) from 798 to 820 degrees C. for 5 minutes or more, or (2) from 822 to 1050 degrees C.

The fuel flow display shows the fuel flow in pounds per hour or kilograms per hour for each engine. The fuel quantity display shows the fuel quantity remaining for each in engine in pounds or kilograms. This consists of the fuel quantity legend, the fuel quantity pointers, the fuel quantity scale, fuel quantity readouts, and fuel quantity units. The oil pressure display shows the current oil pressure for each engine in pounds per square inch, while oil temperature is displayed on a scale from 0 to 140 degrees C.

The fuel temperature readouts display the temperature in their respective wing tanks in degrees Centigrade only. Each fuel temperature readout consists of up to two digits with a leading negative sign, when appropriate.

MAGNETIC COMPASS

A standard liquid-filled magnetic compass is mounted above the glareshield.

FLIGHT HOUR METER

The meter, located on the copilot's meter 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.

STANDBY ATTITUDE INDICATOR

In both the two- and three-PFD instrument panel configurations, the standby attitude indicator is located on the upper right side of the center panel. The gyro normally operates on 29 volts direct current (VDC) power from the number one main bus. It is powered through a five-ampere circuit breaker marked STDBY GYRO on the left circuit breaker panel. Power to the gyro is controlled by a switch marked STDBY GYRO/OFF/TEST located on the pilot's switch panel. The gyro has an emergency source of power from an emergency battery pack located in the nose avionics compartment of the airplane. If the airplane bus voltage falls below a minimum amount, gyro power will be supplied from the battery pack. The battery pack also provides emergency instrument lighting for the standby gyro.

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 gyro power switch must be ON for automatic transfer to battery power to occur. The standby gyro will operate for a minimum of 30 minutes on battery power. An amber POWER ON light next to the STDBY GYRO switch illuminates when the gyro is turned ON and the airplane's electrical system is not charging the emergency power supply batteries. When the STDBY GYRO switch is held to the spring-loaded TEST position, a self-test of the battery and circuits is accomplished. The green GYRO TEST light, also next to the STDBY GYRO switch, will illuminate if the test is satisfactory and the battery is sufficiently charged. The gyro is caged by pulling the PULL TO CAGE knob.

ANGLE-OF-ATTACK SYSTEM

The angle-of-attack system is powered by 29 volts direct current (DC) through a five-ampere circuit breaker on the left main DC bus. It incorporates a signal summing unit (computer), an angle-of-airflow sensing vane, a flap position sensor, an angle-of-attack indicator and an optional indexer. The angle-of-attack system activates a stick shaker, located on the pilot's control column, at a predetermined angle of attack. The stick shaker provides tactile warning of impending stall. The system is calibrated to provide a higher margin of stall warning at altitudes above 35,000 feet.

The vane type angle-of-airflow sensor, including associated transducer, is mounted on the right forward fuselage of the airplane. The swept airfoil-shaped vane streamlines with the relative airflow and the transducer sends a signal to the computer located in the right console. The flap position sensor provides a signal to the computer, allowing compensation for any flap position selected. The computer then provides a signal to drive the AOA indicator (and EADI LAA display and optional indexer) which is accurate throughout the weight and CG range of the airplane.

The AOA indicator is a full range type, calibrated from 0.1 to 1.0 and marked with red, yellow and white arcs. The 0 represents a very low angle-of-attack, whereas the 1.0 indicates the airplane has exceeded the critical angle-of-attack and has stalled. The area from 0.1 to 0.57 represents the normal operating range of the airplane, except for approach and landing. The white arc (0.57 to 0.63) covers the approach and landing range with the middle of the arc. For each flap configuration 0.60 is calibrated to represent 1.3 V_{S1}; this equates to V_{APP} for 15° flaps and V_{REF} for 35° flaps.

The yellow range (0.63 TO 0.85) represents a caution area, indicating the airplane is approaching the critical angle-of-attack. The red arc (0.85 to 1.0) is a warning zone that represents the beginning of low speed buffet followed by full stall. Stick shaker activation for the Model 525A begins at a point between 0.80 and 0.95 on the angle-of-attack indicator, depending on flap setting. 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 default LAA setting will also be displayed if the angle of attack system loses power.

An optional approach indexer, mounted on the pilot's glareshield, provides a "heads up" display of deviation from the approach reference. The display is in the form of three lighted (red-green-yellow) symbols which are used to indicate the airplane angle-of-attack. High angle-of-attack is analogous to low airspeed; low angle-of-attack is analogous to high airspeed. Illumination of the symbols is progressive as the airplane angle-of-attack changes. When the airplane speed is on reference the center circle will be illuminated. As the speed decreases from reference (.6) the circle illumination will dim and the top chevron illumination will increase until the top chevron is fully illuminated and the circle is extinguished. As the angle-of-attack becomes high the top chevron will begin to flash.

When the airplane is accelerating from the on-speed reference the illumination of the circle will dim and illumination of the bottom chevron will increase until the circle is extinguished and only the bottom chevron is illuminated.

The top chevron points down, indicating that the angle-of-attack must be decreased to eliminate the deviation. The bottom chevron points up to indicate that the angle-of-attack must be increased to eliminate the deviation.

The optional indexer is active any time the nose gear is down and locked.

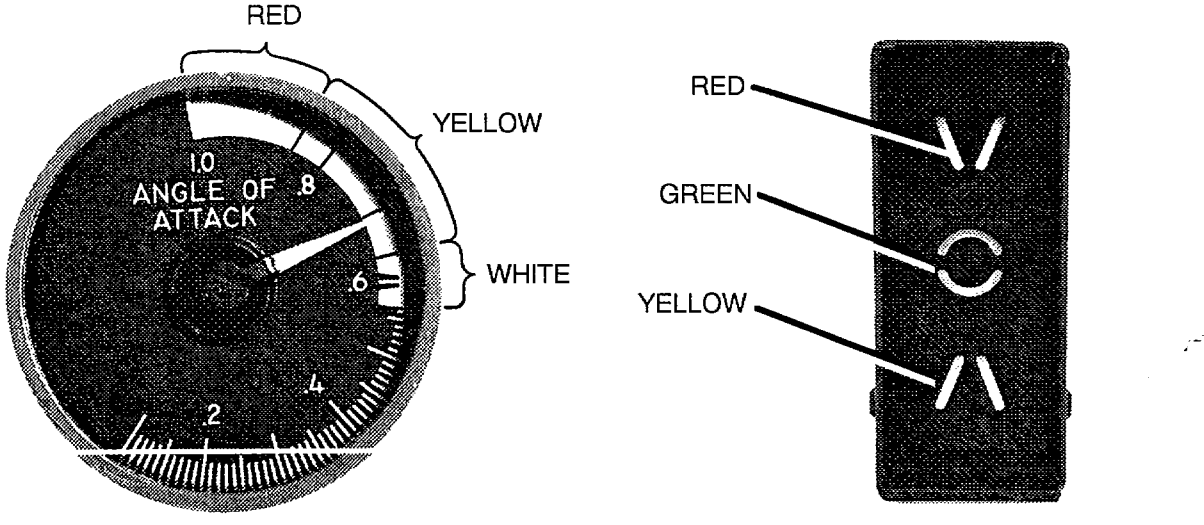

Figure 3-3. Angle-of-Attack Indicator and Indexer

DIGITAL CLOCK

The model M877 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 tens of hours digit will start flashing and may be incremented 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.

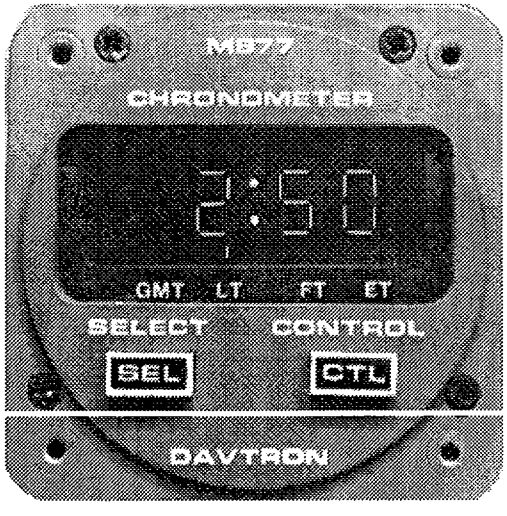

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Figure 3-4. Digital Clock

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.

The flight time mode of the clock is enabled by a ground-in-air 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.