

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The Saratoga SP is a single engine, low wing, retractable landing gear airplane. It is all metal, seats up to seven occupants, and has two separate one hundred pound capacity baggage compartments.

7.3 AIRFRAME

With the exception of the steel engine mount, parts of the landing gear, miscellaneous steel parts, the cowling, and the lightweight plastic extremities (tips of wings, tail fin and stabilator), the basic airframe is of aluminum alloy. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure. There is a front door on the right side and a rear door on the left. A cargo door is installed aft of the rear passenger door. When both rear doors are open, large pieces of cargo can be loaded through the extra-wide opening. A door on the right side of the nose section gives access to the nose baggage compartment.

The wing is of a semi-tapered design and employs a laminar flow NACA 65₂-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the center seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. Each wing contains two interconnected fuel tanks. Both tanks on one side are filled through a single filler neck located in the outboard tank.

A vertical stabilizer, an all-movable horizontal stabilator, and a rudder make up the empennage. The stabilator incorporates an anti-servo tab which provides longitudinal stability and longitudinal trim. This tab moves in the same direction as the stabilator, but with increased travel.

7.5 ENGINE AND PROPELLER

The Lycoming engine is rated at 300 horsepower at 2700 rpm. This engine has a compression ratio of 8.7 to 1 and requires 100 minimum grade fuel. The engine is equipped with a geared starter, a 60 ampere alternator, dual magnetos, vacuum pump drive, a diaphragm-type fuel pump, and fuel injection.

The exhaust system consists of individual exhaust pipes routed in pairs to three heavy gauge stainless steel mufflers. Exhaust gases are directed overboard at the underside of the engine cowling. The mufflers are surrounded by a shroud which provides heat for the cabin and for windshield defrosting.

The cowling is designed to cool the engine in all normal flight conditions, including protracted climb, without the use of cowl flaps or cooling flanges.

An induction scoop is located on the left side of the lower cowl. An intake air box is attached to the inside of the cowl adjacent to the air filter box. The air filter box is located at the aft end of the induction scoop. Access to the filter is gained through a detachable plate located on the outside of the lower cowl.

The intake air box incorporates a manually operated two-way valve designed to allow induction air either to pass through the filter or to bypass the filter and supply heated air directly to the engine. Alternate air selection insures induction air flow should the filter become blocked. Since the air is heated, the alternate air system offers protection against induction system blockage caused by snow or freezing rain, or by the freezing of moisture accumulated in the induction air filter. Alternate air is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. The primary (through the filter) induction source should always be used for takeoffs.

The fuel injection system consists of a servo regulator which meters fuel flow in proportion to airflow to the engine, giving the proper fuel-air mixture at all engine speeds, and a fuel flow divider which receives the metered fuel and accurately divides the fuel flow among the individual cylinder fuel nozzles.

A combination fuel flow indicator and manifold pressure gauge is installed in the left side of the instrument panel. The fuel flow indicator is connected to the fuel flow divider and monitors fuel pressure. The instrument converts fuel pressure to an indication of fuel flow in gallons per hour and percentage of cruise power.

The constant speed propeller is controlled by a governor mounted at the left forward side of the crankcase. Control from the engine control quadrant is provided by a push-pull control.

7.7 ENGINE CONTROLS

Engine controls consist of a throttle control, a propeller control and a mixture control lever. These controls are located on the control quadrant on the lower center of the instrument panel (Figure 7-1) where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

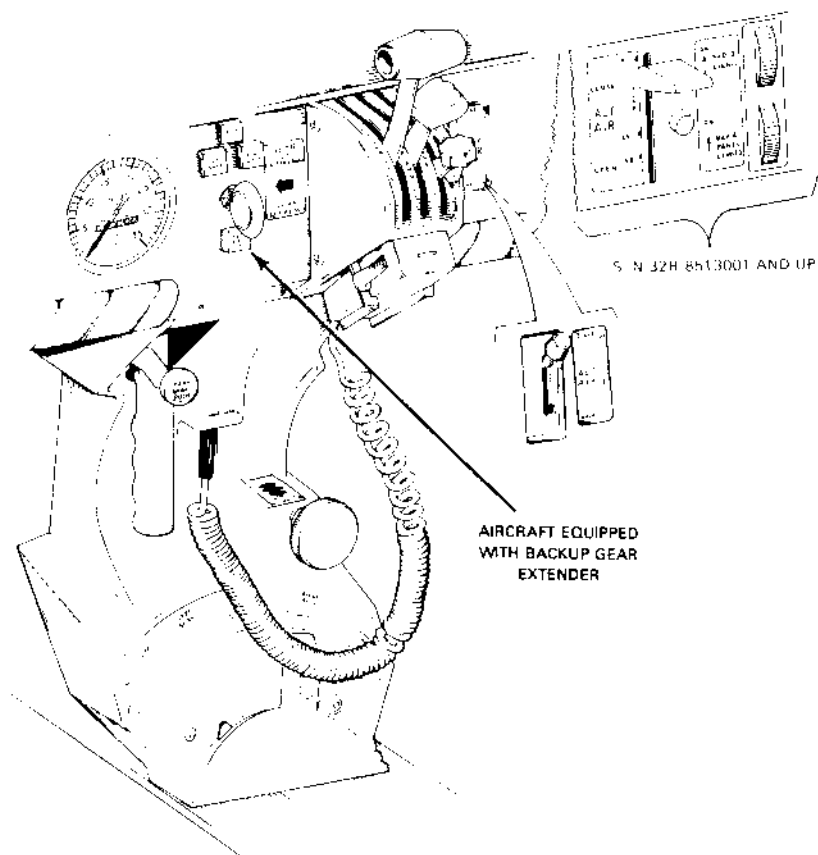
The throttle lever is used to adjust the manifold pressure. It incorporates a gear up warning horn switch which is activated during the last portion of travel of the throttle lever to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a feature to prevent an inadvertent gear up landing.

The propeller control lever is used to adjust the propeller speed from high RPM to low RPM.

The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture control lever in the full lean position. In addition, the mixture control has a lock to prevent activation of the mixture control instead of the pitch control. For information on the leaning procedure, see the Avco-Lycoming Operator's Manual and the leaning procedure in Section 4 of this handbook.

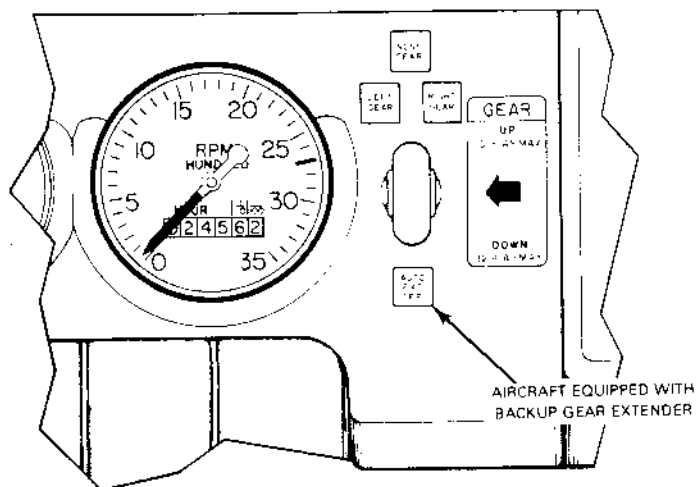
The friction adjustment lever on the right side of the control quadrant may be adjusted to increase or decrease the friction holding the throttle, propeller, and mixture controls or to lock the controls in a selected position.

The alternate air control is located to the right of the control quadrant. When the alternate air lever is in the up, or closed, position the engine is operating on filtered air; when the lever is in the down, or open, position the engine is operating on unfiltered, heated air. The control is operated by pressing the knob to the left to clear the retaining gate and then moved in the desired direction (refer to Figure 7-1).



CONTROL QUADRANT AND CONSOLE

Figure 7-1



LANDING GEAR SELECTOR

Figure 7-3

7.9 LANDING GEAR

The airplane is equipped with a retractable tricycle landing gear, which is hydraulically actuated by an electrically powered reversible pump. The pump is controlled by a selector switch on the instrument panel to the left of the control quadrant (Figure 7-3). The landing gear is retracted or extended in about seven seconds.

Some aircraft also incorporate a pressure sensing device in the system which lowers the gear regardless of gear selector position, depending upon airspeed and engine power (propeller slipstream). The gear is designed to extend at airspeeds below approximately 103 KIAS with power off even if the selector is in the up position.

The extension speeds will vary from approximately 81 KTS to approximately 103 KIAS depending on power settings and altitude. The device also prevents the gear from retracting at airspeeds below approximately 81 KTS with full power, though the selector switch may be in the up position. This speed increases with reduced power and/or increased altitude. Manual override of the device is provided by an emergency gear lever located between the front seats to the right of the pitch trim wheel (refer to Figure 7-9). The sensing device operation is controlled by differential air pressure across a flexible diaphragm which is mechanically linked to a hydraulic valve and an electrical switch which actuates the pump motor. A high pressure and static air source for actuating the diaphragm is provided in a mast mounted on the left side of the fuselage above the wing. Any obstruction of the holes in this mast will cause the gear to extend. An optional heated mast is available to alleviate obstruction in icing conditions. The optional heated mast is turned on whenever the PITOT HEAT switch is turned on.

WARNING

Avoid ejecting objects out of the pilot storm window which could possibly enter or obstruct the holes in the mast.

The emergency gear lever, when placed in the raised position, can be used to override the system, and gear position is then controlled by the selector switch regardless of airspeed/power combinations. The emergency gear lever is provided with a latching device which may be used to lock the override lever in the up position. The latch is located on the right side of the manual override lever. To lock the override lever in the up position, raise the override lever to the full up position and push the latch down. A yellow warning light located below the gear selector switch (Figure 7-3) flashes to warn the pilot that the automatic gear lowering system is disabled. The latch is spring-loaded to the off position to aid disengagement. To disengage the latch raise the override lever and release. The lever will return to its normal position and the yellow flashing light will extinguish. The lever must also be latched in the raised (up) position when gear-up stalls are practiced.

Emergency extension of the landing gear is accomplished by releasing the hydraulic pressure which allows the gear to free-fall with spring assistance on the nose gear. Two types of release mechanisms have been installed and system operation depends on the system installed (Figure 7-9). On aircraft equipped with the lever release the control must be held in the downward position for emergency extension. On aircraft equipped with the cable release the retaining clip must be moved and the red knob pulled for emergency extension.

Gear down and locked positions are indicated by three green lights located above the selector, and a red "Warning Gear Unsafe" light located at the top of the panel. An all lights out condition indicates the gear is up. The landing gear should not be retracted above a speed of 110 KIAS and should not be extended above a speed of 132 KIAS.

The main landing gear uses Cleveland 6.00 x 6 wheels. The main gear incorporate brake drums and Cleveland double disc hydraulic brake assemblies. The nose wheel carries a 5.00 x 5 six ply tire and the main gear use 6.00 x 6 eight ply tires. All three tires are tube type.

Two micro-switches in the throttle quadrant activate a warning horn and red "Warning Gear Unsafe" light under the following conditions:

- (1) Gear up and power reduced below approximately 14 inches of manifold pressure.
- (2) On aircraft equipped with the backup gear extender, if the system has extended the landing gear and the gear selector switch is UP, except at full power.
- (3) Gear selector switch UP while on the ground.

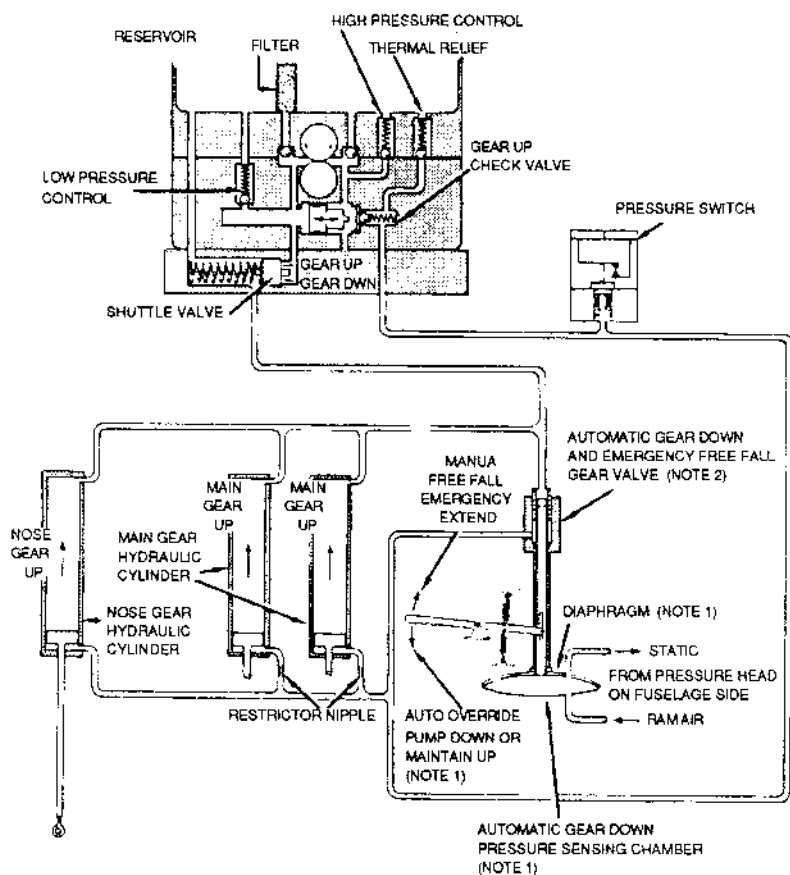
On aircraft which are NOT equipped with the backup gear extender an additional switch is installed which activates the warning horn and light whenever the flaps are extended beyond the approach position (10°) and the landing gear are not down and locked.

The gear warning horn emits a 90 cycle per minute beeping sound in contrast to the stall warning horn which emits a continuous sound.

The nose gear is steerable through a 22.5 degree arc each side of center through the use of the rudder pedals. As the nose wheel retracts, the steering linkage disengages to reduce rudder pedal loads in flight. The nose wheel is equipped with a hydraulic shimmy dampener to reduce nose wheel shimmy.

The oleo struts are of the air-oil type, with normal extension being $3.25 \pm .25$ inches for the nose gear and $4.5 \pm .5$ inches for the main gear under normal static load (empty weight of airplane plus full fuel and oil).

The standard brake system includes toe brakes on the left and right set of rudder pedals and a hand brake located below and near the center of the instrument panel. The toe brakes and the hand brake have individual brake cylinders, but all cylinders use a common reservoir. The parking brake is incorporated in the lever brake and is operated by pulling back on the lever and depressing the knob attached to the top of the handle. To release the parking brake, pull back on the brake lever; then allow the handle to swing forward.



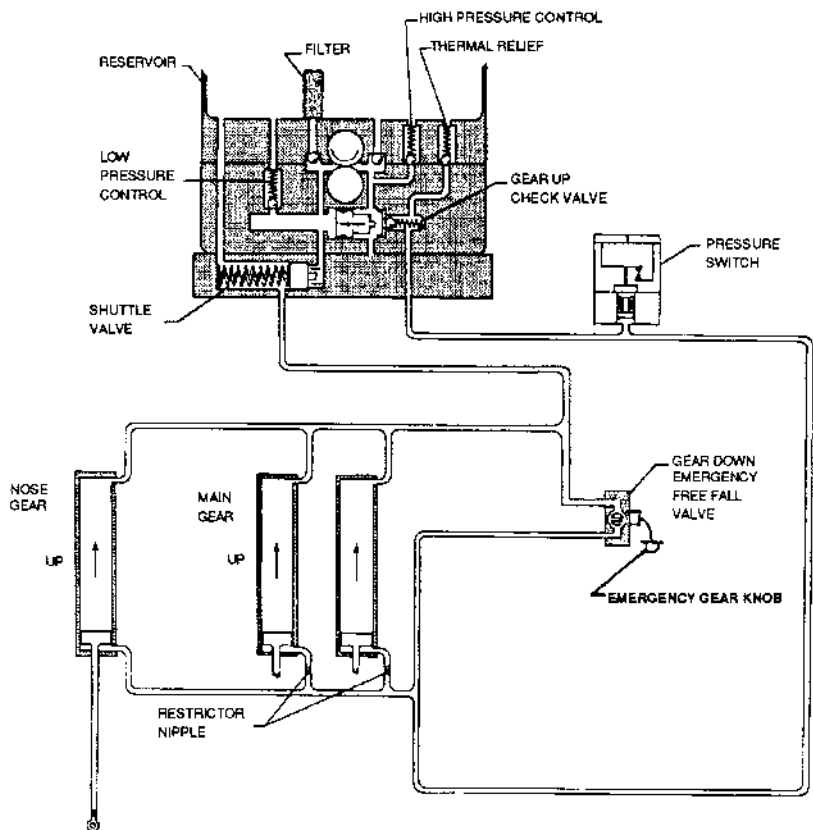
NOTE 1. AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER.

NOTE 2. AUTOMATIC GEAR DOWN REFERENCE IS FOR AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER.

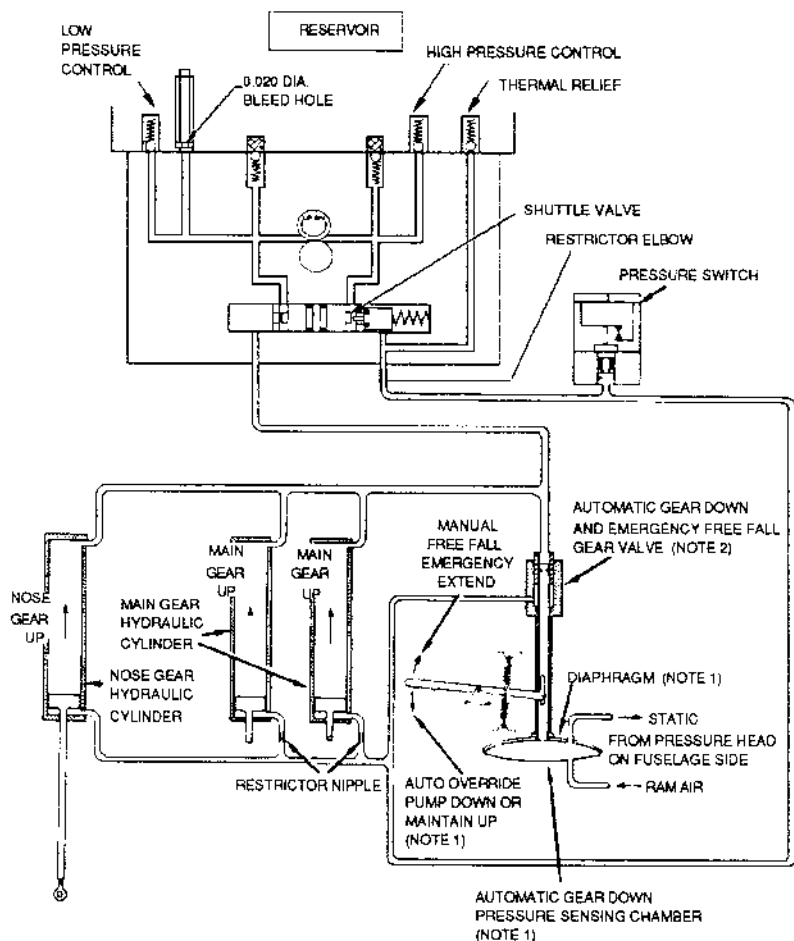
LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC

Aircraft equipped with Prestolite pump and lever emergency gear release

Figure 7-7



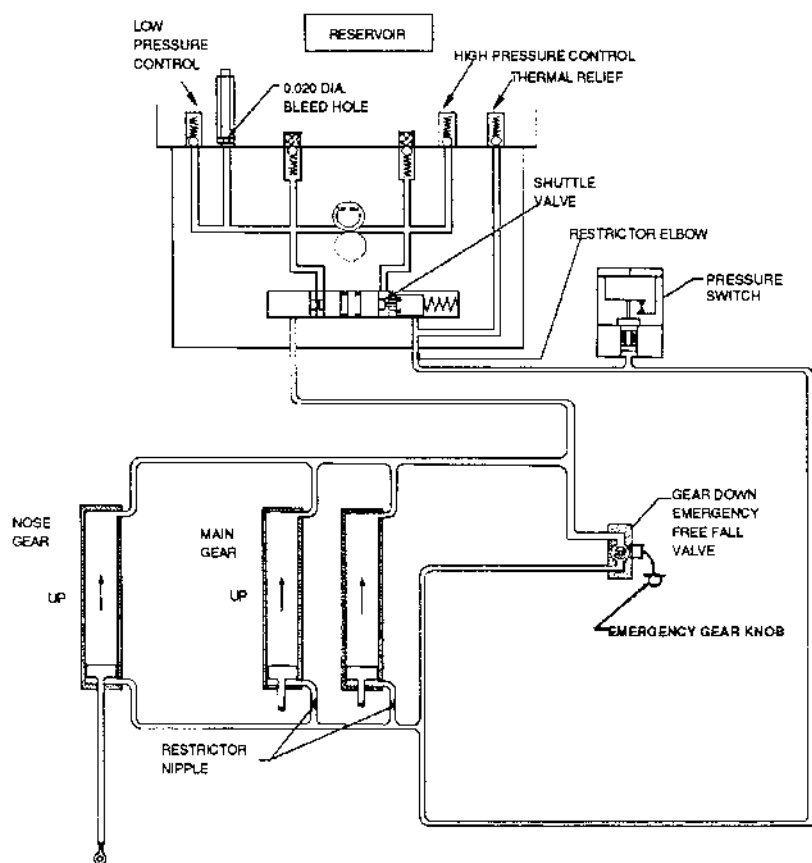
LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Aircraft equipped with Prestolite pump and cable emergency gear release |
Figure 7-7a



NOTE 1. AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER

NOTE 2. AUTOMATIC GEAR DOWN REFERENCE IS FOR AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER

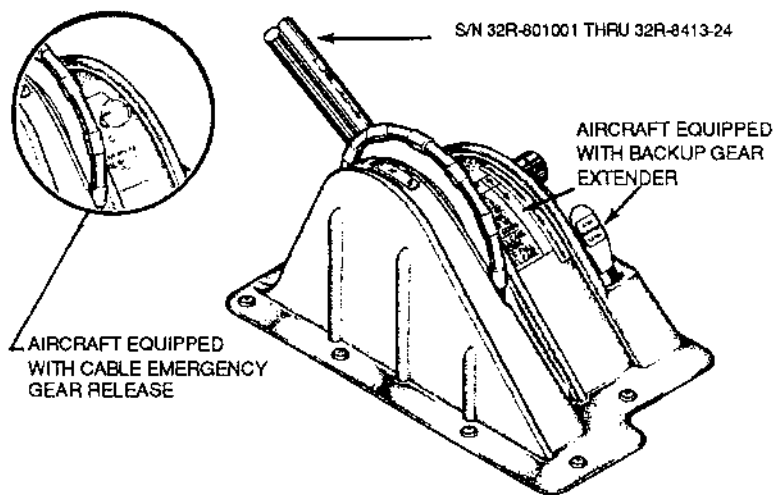
LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Aircraft equipped with Oildyne pump and lever emergency gear release
Figure 7-7b



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC

Aircraft equipped with Oildyne pump and cable emergency gear release

Figure 7-7c



FLIGHT CONTROL CONSOLE

Figure 7-9

7.11 FLIGHT CONTROLS

Dual flight controls are provided as standard equipment. A cable system provides actuation of the control surfaces when the flight controls are moved in their respective directions.

The horizontal surface (stabilator) features a trim tab/servo mounted on the trailing edge. This tab serves the dual function of providing trim control and pitch control forces. The trim function is controlled by a trim control wheel located on the control console between the two front seats (Figure 7-9). Rotating the wheel forward gives nose down trim and rotation aft gives nose up trim.

The rudder is conventional in design and incorporates a rudder trim. The trim mechanism is a spring-loaded recentering device. The trim control is located on the right side of the pedestal below the throttle quadrant. Turning the trim control clockwise gives nose right trim and counterclockwise rotation gives nose left trim.

On aircraft serial numbers 32R-8013001 through 32R-8413024, manually controlled flaps are provided. They are extended by a control cable and are spring-loaded to the retracted (up) position. The control is located between the two front seats on the control console. To extend the flaps pull the handle up to the desired flap setting of 10, 25 or 40 degrees. To retract, depress the button on the end of the handle and lower the control.

On aircraft serial numbers 32R-8513001 and up, the flaps are electrically operated (Figure 7-10). A control lever and indicator light are located on the lower right instrument panel. Selection of a new flap position will activate the flap motor and the light. When the flaps reach the desired position, the flap motor is automatically switched off and the indicator light goes out.

In the event of a flap drive malfunction; move the flap lever until the light goes out. The position of the flap lever relative to the instrument panel markings indicates the approximate flap position.

On aircraft serial numbers 32R-8513001 thru 32R-8513016 there are three stops for the flap control lever, full up (0° flap), 1st notch (25° flap), and full down (40° flap).

On aircraft serial numbers 32R-8613001 and up there are four stops for the flap control lever, full up (0° flap), 1st notch (10° flap), 2nd notch (25° flap) and full down (40° flap).

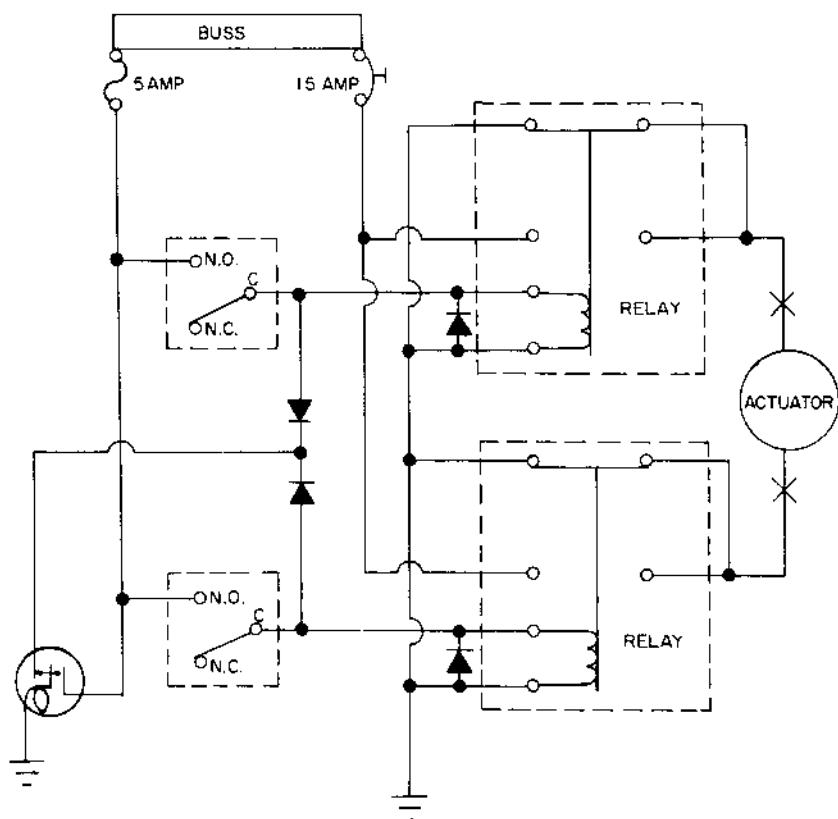
When extending or retracting flaps, there is a pitch change in the aircraft. This pitch change can be corrected either by stabilator trim or increased control wheel force. When the flaps are in the retracted position the right flap, provided with a over-center lock mechanism, acts as a step.

NOTE

The right flap will support a load only in the fully retracted (up) position. When loading and unloading passengers make sure the flaps are in the retracted (up) position.

7.13 FUEL SYSTEM

The standard fuel capacity of the Saratoga SP is 107 gallons, of which 102 gallons are usable. The inboard tank is attached to the wing structure with screws and nut plates and can be removed for service or inspection. The outboard tank consists of a bladder fuel cell that is interconnected with the inboard tank. A flush fuel cap is located in the outboard tank only.



ELECTRIC FLAP SCHEMATIC

Figure 7-10

When using less than the standard 107 gallon capacity of the tanks, fuel should be distributed equally between each side.

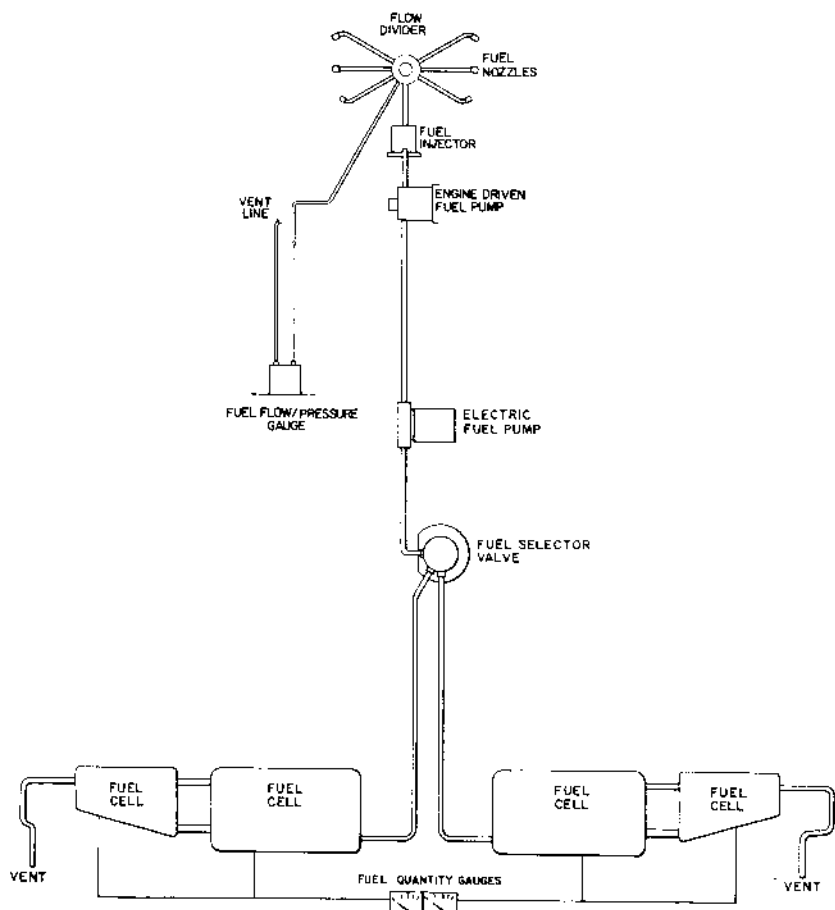
The fuel selector control is located below the center of the instrument panel on the sloping face of the control tunnel (refer to Figure 7-1). It has three positions, one position corresponding to each wing tank plus an OFF position.

To avoid the accumulation of water and sediment, the fuel tank sumps and strainer should be drained daily prior to first flight and after refueling. Each inboard tank is equipped with an individual quick drain located at the lower inboard rear corner of the tank. The fuel strainer and a system quick drain valve are located in the fuselage at the lowest point of the fuel system. It is important that the fuel system be drained in the following manner:

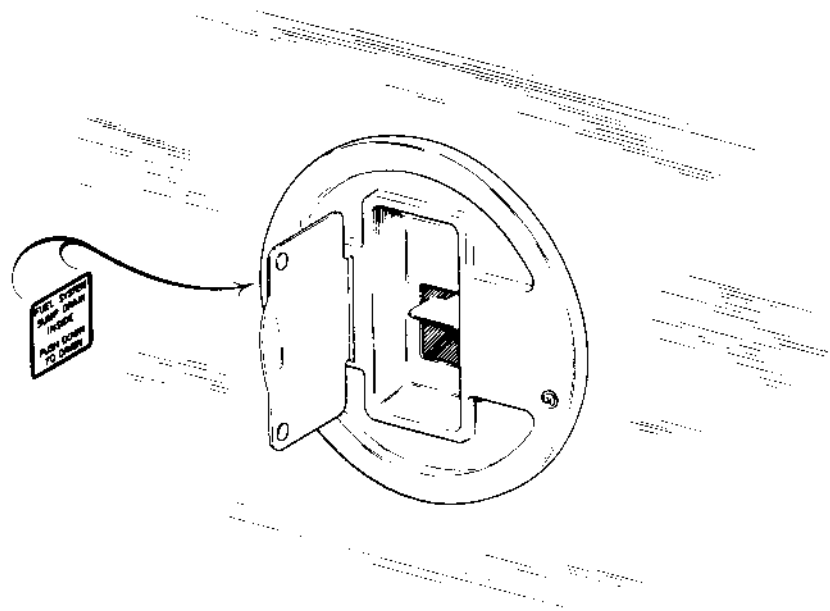
1. Drain each tank sump through its individual quick drain located at the lower inboard rear corner of the tank, making sure that enough fuel has flowed to ensure the removal of all water and sediment.
2. Place a container beneath the fuel strainer sump drain outlet located under the fuselage.
3. Drain the fuel strainer sump by pressing down on the lever located on the right side of the cabin on the forward edge of the wing spar housing (Figure 7-13). Move the selector through the following sequence: OFF position, left, right, while draining the strainer sump. Make sure that enough fuel has flowed to drain the fuel line between each tank outlet and the fuel strainer, as well as the strainer itself. With full fuel tanks, it will take approximately 6 seconds to drain all of the fuel from the line from either tank to the fuel strainer. When the tanks are less than full, it will take a few seconds longer.
4. Examine the contents of the container placed under the fuel sump drain outlet. When the fuel flow is free of water and sediment, close the drain and dispose of the contents of the bottle.

CAUTION

When draining fuel, care should be taken to ensure that no fire hazard exists before starting the engine.



FUEL SYSTEM SCHEMATIC
Figure 7-11



FUEL DRAIN LEVER

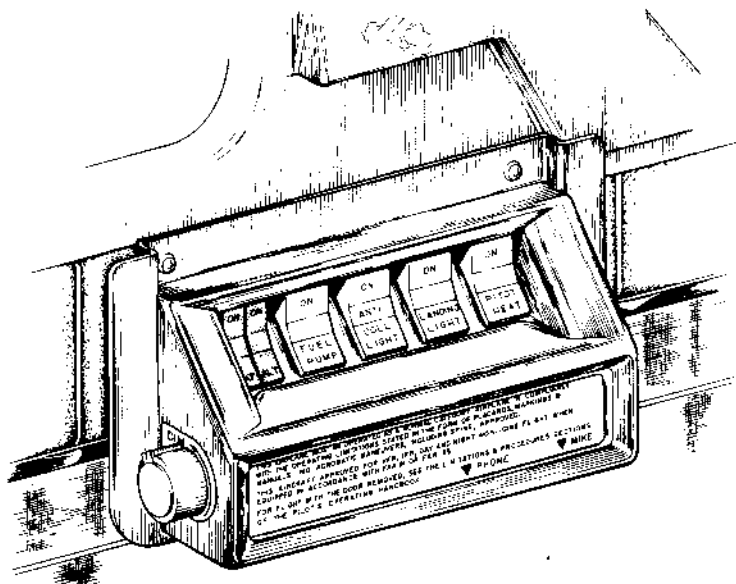
Figure 7-13

After using the underseat quick drain, check from the outside to make sure that it has closed completely and is not leaking.

Fuel quantity gauges for each of the tanks are located in the engine gauge cluster on the left side of the instrument panel.

A fuel quantity indicator to measure the fuel not visible through the filler neck in each wing is installed in the inboard fuel tank. This gauge indicates usable fuel quantities from 5 gallons to 35 gallons in the ground attitude. The sole purpose of this gauge is to assist the pilot in determining fuel quantities of less than 35 gallons during the preflight inspection.

An electric fuel pump is provided for use in case of failure of the engine driven pump. The electric pump operates from a single switch and independent circuit protector. It should be ON for all takeoffs and landings.



SWITCH PANEL
Figure 7-15

7.15 ELECTRICAL SYSTEM

The 14-volt electrical system includes a 12-volt battery for starting and to back up alternator output. Electrical power is supplied by a 60 ampere alternator. The battery, a master switch relay, a voltage regulator and an overvoltage relay are located beneath the floor of the forward baggage compartment. Access to these electrical components is gained by removing the compartment floor and the access panel located on the left side of the forward fuselage.

Electrical switches are located on a panel to the pilot's left (Figure 7-15) and all circuit breakers are on the lower right instrument panel (refer to Figure 7-19). A switch panel light is available as optional equipment. The light is installed above the switch panel and is controlled by a rheostat switch mounted on the left side of the panel. Two thumb-wheel rheostat switches to the left of the circuit breakers control the navigation lights and the intensity of the instrument panel lights.

Standard electrical accessories include the starter, the electric fuel pump, the stall warning indicator, the ammeter, and the annunciator panel.

The annunciator panel includes alternator and low oil pressure indicator lights and provisions for optional baggage door ajar, air conditioner door open and low vacuum (gyro system) lights. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that the applicable system gauge should be checked and monitored to determine when or if any corrective action is required.

Optional electrical accessories include the navigation lights, anti-collision strobe lights, instrument panel lighting and cabin courtesy lights. The cabin courtesy light installation consists of two light/switch panels, one mounted above each cabin entrance. Make sure the lights are off when leaving the aircraft. Leaving the lights on for an extended period of time could cause depletion of the battery.

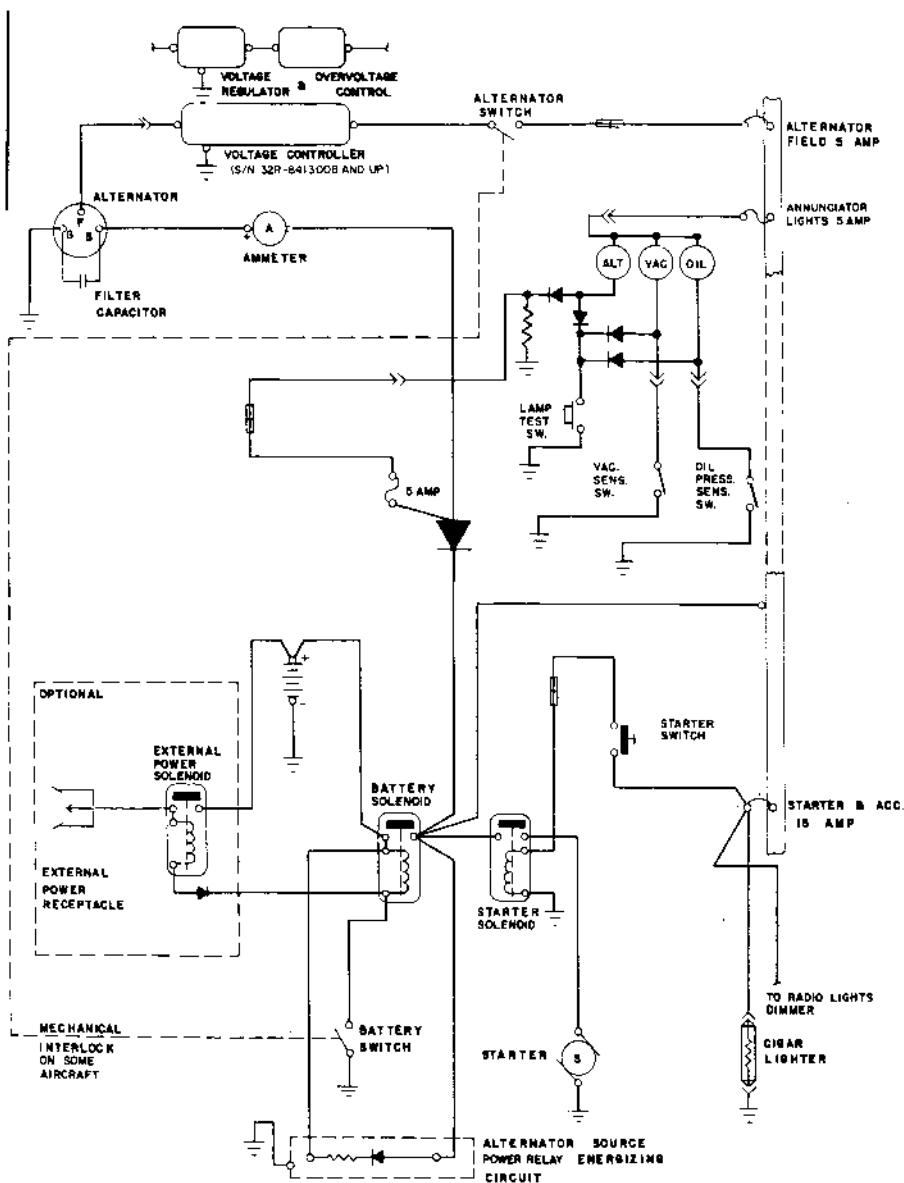
Two optional lights, mounted in the overhead panel, provide instrument and cockpit lighting for night flying. The lights are controlled by rheostat switches located adjacent to them. A map light window in each lens is actuated by an adjacent switch. An optional wing tip/recognition light system consists of 2 lights (one in each wing tip) and is operated by a split landing light/recognition light rocker type switch mounted on the pilot's switch panel.

Circuit provisions are made to handle the addition of communications and navigational equipment.

The ammeter in the alternator system displays in amperes the load placed on the alternator. It does not indicate battery discharge. With all electrical equipment off (except the master switch) the ammeter will be indicating the amount of charging current demanded by the battery. As each item of electrical equipment is turned on, the current will increase to a total appearing on the ammeter. This total includes the battery. The average continuous load for night flight, with radios on, is about 30 amperes. This 30 ampere value, plus approximately 2 amperes for a fully charged battery, will appear continuously under these flight conditions.

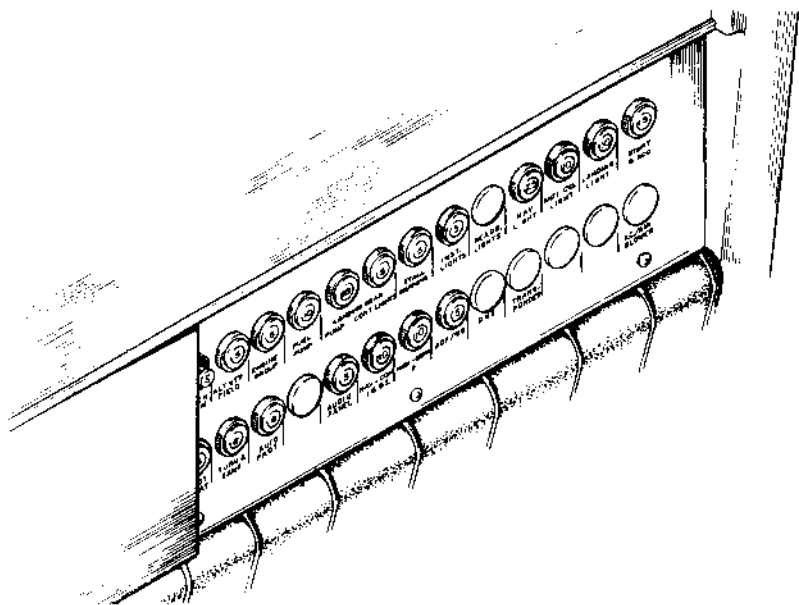
NOTE

On airplanes with interlocked BAT and ALT switches, the ALT switch is mechanically interlocked with the BAT switch. When the ALT switch is turned ON, the BAT switch will also be turned ON. On airplanes with separate BAT and ALT switch operations, the switches may be positioned independently as desired.



ALTERNATOR AND STARTER SCHEMATIC

Figure 7-17



CIRCUIT BREAKER PANEL

Figure 7-19

For Abnormal and/or Emergency procedures, see Section 3.

WARNING

When optional panel lights are installed, radio dimming switch must be off to obtain gear lights full intensity during daytime flying. When aircraft is operated at night and the radio light dimming switch is turned on, gear lights will automatically dim.

WARNING

Anti-collision lights should not be operating when flying through cloud, fog or haze, since the reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

CAUTION

Do not use cigar lighter receptacles as power sources for any devices other than the cigar lighters supplied with the airplane. Any other device plugged into these receptacles may be damaged.

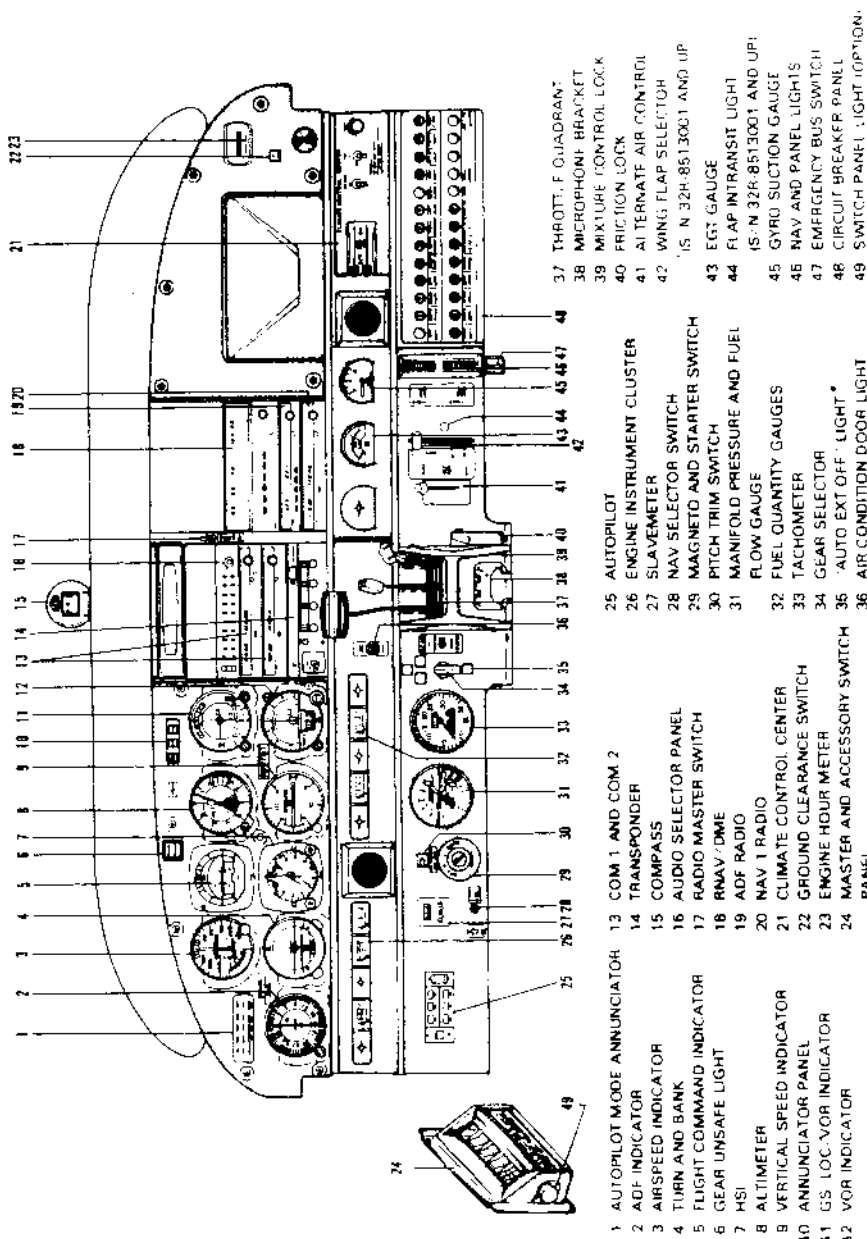
7.17 VACUUM SYSTEM

The vacuum system is designed to operate the air driven gyro instruments. This includes the directional and attitude gyros when installed. The system consists of an engine driven vacuum pump, a vacuum regulator, a filter and the necessary plumbing.

The vacuum pump is a dry type pump which eliminates the need for an air/oil separator and its plumbing. A shear drive protects the engine from damage. If the drive shears the gyros will become inoperative.

The vacuum gauge, mounted on the right instrument panel to the right of the radios, (refer to Figure 7-21) provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period, may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in system (a low vacuum indicator light is provided in the annunciator panel). Zero pressure would indicate a sheared pump drive, defective pump, possibly a defective gauge or collapsed line. In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.8 to 5.1 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros and with a low setting the gyros will be unreliable. The regulator is located behind the instrument panel.



TYPICAL INSTRUMENT PANEL.

Figure 7-21

- 1 AUTOPILOT MODE ANNUNCIATOR
- 2 ADF INDICATOR
- 3 AIRSPEED INDICATOR
- 4 TURN AND BANK
- 5 FLIGHT COMMAND INDICATOR
- 6 GEAR UNSAFE LIGHT
- 7 HSI
- 8 ALTITUDE
- 9 VERTICAL SPEED INDICATOR
- 10 ANNUNCIATOR PANEL
- 11 GS LOC VOR INDICATOR
- 12 VOR INDICATOR
- 13 COM 1 AND COM 2
- 14 TRANSPONDER
- 15 COMPASS
- 16 AUDIO SELECTOR PANEL
- 17 RADIO MASTER SWITCH
- 18 RNAV/DME
- 19 ADF RADIO
- 20 NAV 1 RADIO
- 21 CLIMATE CONTROL CENTER
- 22 GROUND CLEARANCE SWITCH
- 23 ENGINE HOUR METER
- 24 MASTER AND ACCESSORY SWITCH PANEL
- 25 AUTOPILOT
- 26 ENGINE INSTRUMENT CLUSTER
- 27 SLA VEMETER
- 28 NAV SELECTOR SWITCH
- 29 MAGNETO AND STARTER SWITCH
- 30 PITCH TRIM SWITCH
- 31 MANIFOLD PRESSURE AND FUEL FLOW GAUGE
- 32 FUEL QUANTITY GAUGES
- 33 TACHOMETER
- 34 GEAR SELECTOR
- 35 AUTO EXT OFF LIGHT*
- 36 AIR CONDITION DOOR LIGHT
- 37 THROTTLE QUADRANT
- 38 MICROPHONE BRACKET
- 39 MIXTURE CONTROL LOCK
- 40 FRICTION LOCK
- 41 ALTERNATE AIR CONTROL
- 42 WING FLAP SELECTOR
- 43 EGT GAUGE
- 44 FLAP TRANSIT LIGHT
- 45 GYRO SUCTION GAUGE
- 46 NAV AND PANEL LIGHTS
- 47 EMERGENCY BUS SWITCH
- 48 CIRCUIT BREAKER PANEL
- 49 SWITCH PANEL LIGHT (OPTION)

* AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER

7.19 INSTRUMENT PANEL

The instrument panel is designed to accommodate the customary advanced flight instruments and the normally required power plant instruments. The artificial horizon and directional gyro are vacuum operated and are located in the center of the left-hand instrument panel. The vacuum gauge is located on the right hand instrument panel. The turn indicator, on the left side, is electrically operated.

The radios are located in the center section of the panel, and the circuit breakers are in the lower right corner of the panel. An optional radio MASTER switch is located near the top of the instrument panel between the radio stacks. It controls the power to all radios through the aircraft MASTER switch. The radio power switch has an OFF, and ON position. An emergency bus switch is also provided to give AUXILIARY power to the avionics bus in the event of a radio MASTER switch circuit failure. The emergency bus switch is located behind the lower right shin guard, left of the circuit breaker panel.

A ground clearance energy saver system is available to provide direct power to Comm #1 without turning on the master switch. An internally lit pushbutton switch, located on the instrument panel, provides annunciation for engagement of the system. When the button is engaged direct aircraft battery power is applied to Comm #1, audio amplifier (speaker) and radio accessories. The switch must be turned OFF or depletion of battery could result.

7.21 PITOT-STATIC SYSTEM

The system supplies both pitot and static pressure for the airspeed indicator, altimeter and vertical speed indicator (when installed).

Pitot and static pressure are picked up by the pitot head on the bottom of the left wing. An optional heated pitot head, which alleviates problems with icing or heavy rain, is available. The switch for pitot heat is located on the switch panel to the pilot's left. Push-button type pitot and static drains are located on the lower left sidewall of the cockpit.

An alternate static source is available as optional equipment. The control valve is located below the left side of the instrument panel. When the valve is set in the alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin air for static pressure. The storm window and cabin vents must be closed and the cabin heater and defroster must be on during alternate static source operation. The altimeter error is less than 50 feet unless otherwise placarded.

To prevent bugs and water from entering the pitot and static pressure holes when the airplane is parked, a cover should be placed over the pitot head. A partially or completely blocked pitot head will give erratic or zero readings on the instruments.

NOTE

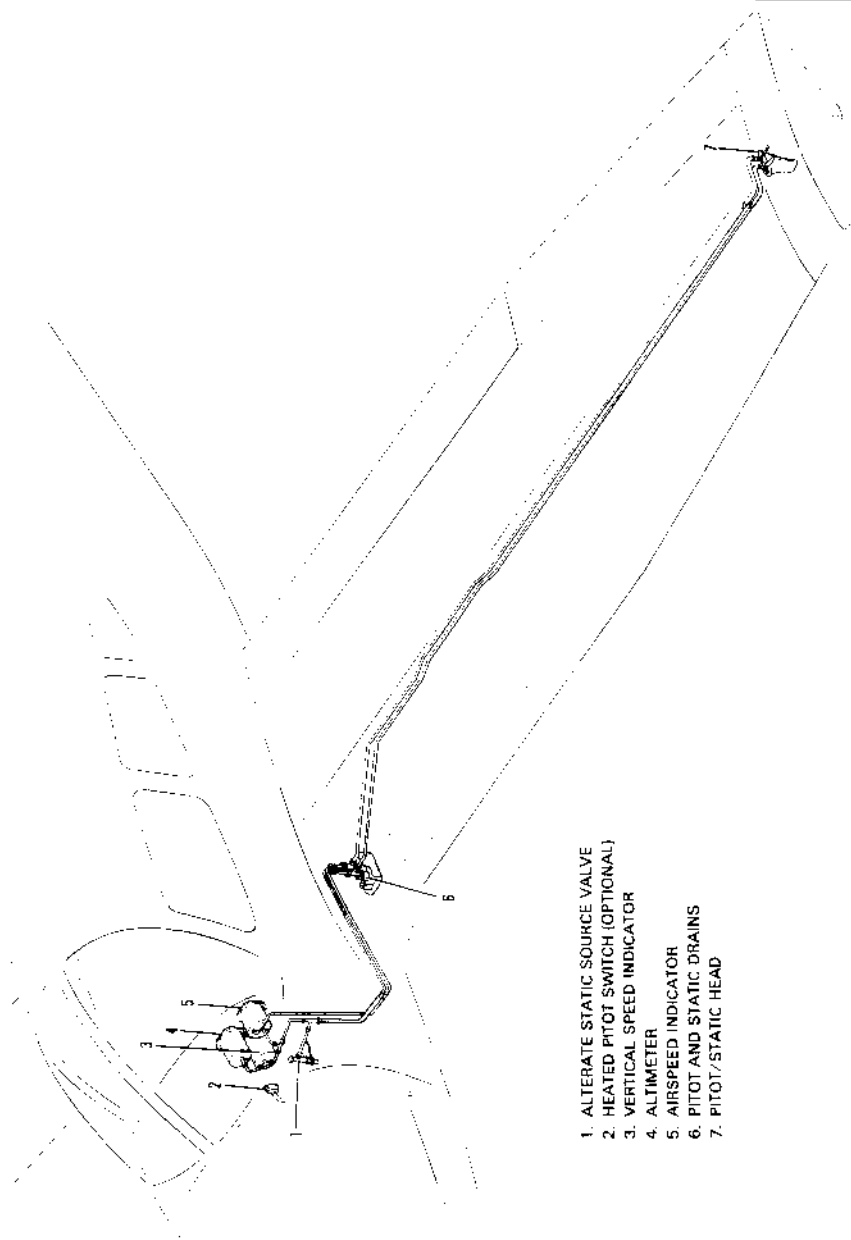
During preflight, check to make sure the pitot cover is removed.

7.23 CABIN FEATURES

For ease of entry and exit and for pilot and passenger comfort, the front seats are adjustable fore and aft. All seats recline and have armrests and are available with optional headrests. The front seats can be equipped with optional vertical adjustment. The center and rear seats may be removed for additional cargo space.

NOTE

To remove the center seats, retainers securing the back legs of the seats must be unlocked. This is accomplished by depressing the plunger behind each rear leg. Any time the seats are installed in the airplane, the retainers should be in the locked position. To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.



1. ALTERNATE STATIC SOURCE VALVE
2. HEATED PITOT SWITCH (OPTIONAL)
3. VERTICAL SPEED INDICATOR
4. ALTIMETER
5. AIRSPEED INDICATOR
6. PITOT AND STATIC DRAINS
7. PITOT/STATIC HEAD

PITOT-STATIC SYSTEM

Figure 7-23

An optional jump seat can be installed between the two middle seats to give the airplane a seven-place capacity.

Shoulder harnesses with inertia reels are standard equipment for the front seats.

On aircraft serial numbers 32R-8013001 through 32R-8413024, shoulder harnesses with inertia reels are offered as optional equipment for the third, fourth, fifth and sixth seats, but not for the seventh seat.

The inertia reel should be checked by tugging sharply on the strap. The reel will lock in place under this test and prevent the strap from extending. Under normal movement, the strap will extend and retract as required.

On earlier aircraft provided with a single strap adjustable shoulder harness for each front seat the shoulder strap is routed over the shoulder adjacent to the windows and attached to the lap belt in the general area of the person's inboard hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant.

Shoulder harnesses should be routinely worn during takeoff, landing and whenever an inflight emergency occurs.

An optional club seating interior is also available. In the club seating interior the center seats face aft. These seats are equipped with lap belts and adjustable shoulder harnesses* Removal of the seats is accomplished by removing the two bolts holding the aft attach points and sliding the seat aft.

*Earlier airplanes are equipped with lap belts only.

An optional refreshment console is located between the center seats. It is removed in an identical manner to the center seats.

An optional cabin work table, serving the two seats on the right side of the passenger cabin, is offered to the club seating arrangement. The table must be stowed during takeoff and landing. If the table is to be used, it should be set up after a level cruise is established.

To remove the cabin work table from the aft baggage compartment, unlock the stud located on the bottom of the close-out bulkhead. Loosen the white tie-down strap and remove the table from the mounting brackets by lifting the table two inches straight up until it clears the mounting brackets. Do not twist the table while it is in the brackets.

To install the cabin work table during flight, hold the table in place and tilt the free end of the table upward 30° until the lobed upper knobs on the table supports align with the top holes of the escutcheons located below the right cabin window trim. Hold the upper lobes in place and lower the free end of the table to the level work position. The retaining springs will click when secure.

To stow the cabin work table, remove the table by lifting the free end of the table upward to disengage the bottom lobes of the table supports. Lift until the top support lobes disengage at approximately 30° of tilt and remove the table. Position the table in the stowage area and, with the table work surface facing forward, place the slots in the table support into the receptacle clips mounted on the hat shelf. Make sure the white tie-down strap is not behind the table. With the table fully placed in the clips, bring the white tie-down strap across the face of the table and lock over the stud located on the bottom of the close-out bulkhead.

7.25 BAGGAGE AREA

The airplane has two separate baggage areas, each with a 100 pound capacity. A 7 cubic foot forward luggage compartment, located just aft of the fire wall, is accessible through a 16 x 22 inch door on the right side of the fuselage. A 17.3 cubic foot aft compartment is located behind the fifth and sixth seats and is accessible through the cargo door on the aft side of the fuselage and during flight from inside the cabin.

An automatic forward baggage compartment light feature is available which utilizes a magnetic reed switch and a magnet for activation. The switch and magnet are mounted just above the hinge line of the forward baggage door.

Opening the baggage door fully, activates the switch which turns on the baggage compartment light. The baggage compartment light is independent of the aircraft master switch; therefore, the light will illuminate regardless of the position of the master switch. The baggage door should not be left open for extended time periods, as battery depletion could result.

An optional forward baggage door ajar annunciation system is available which senses baggage door latch pin position. Failing to latch the forward baggage door will illuminate an amber light located on the pilot's annunciator panel. The annunciation, when illuminated, is "BAGGAGE DOOR" advising the pilot of this condition.

NOTE

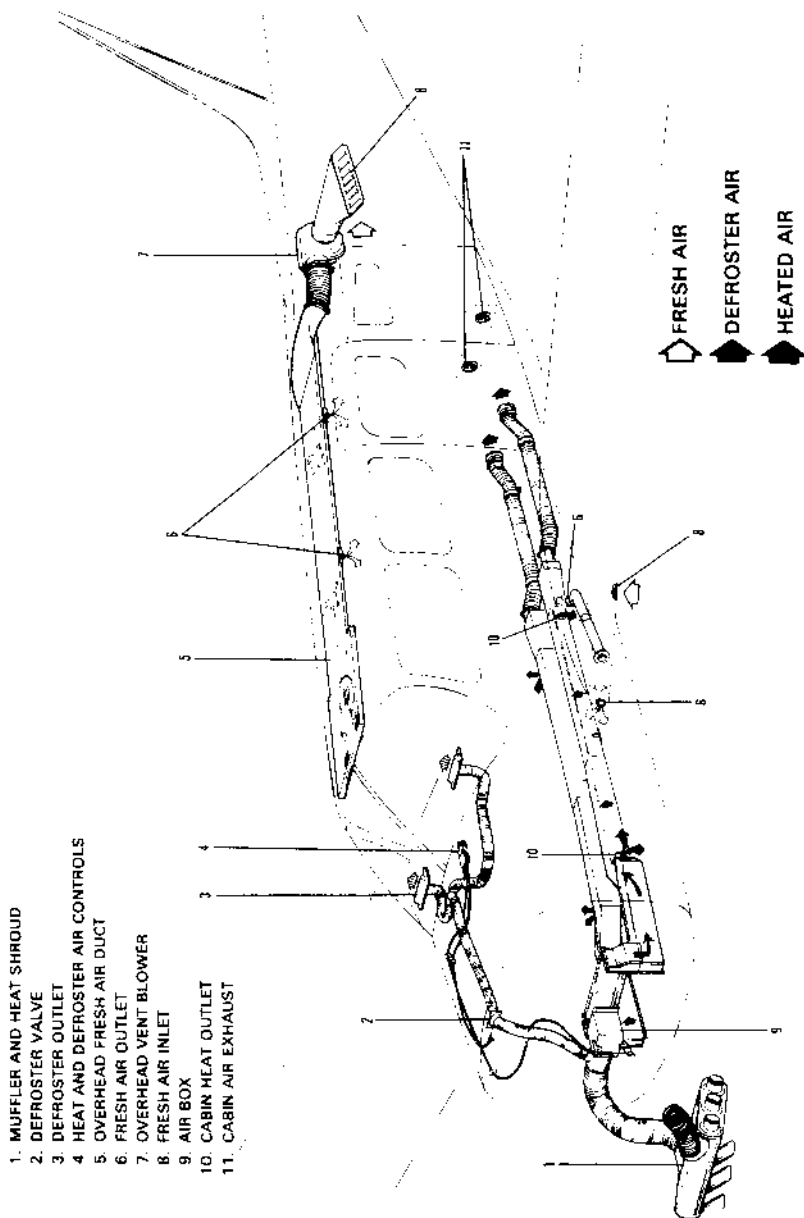
It is the pilot's responsibility to be sure when the baggage is loaded that the airplane's C.G. falls within the allowable C.G. range. (Refer to Weight and Balance Section.)

7.27 HEATING AND VENTILATING SYSTEM

Fresh air is ducted from the aft lower right engine baffle to the heater muff by a flexible hose. Hot air from the heater muff is routed through a flexible hose on the right side of the engine compartment, to the valve box mounted on the fire wall just above the tunnel cut out. It is then ducted down each side of the tunnel below the baggage floor to the cabin ducting and outlets (Figure 7-25).

CAUTION

When cabin heat is operated, heat duct surface becomes hot. This could result in burns if arms or legs are placed too close to heat duct outlets or surface.



HEATING AND VENTILATING SYSTEM

Figure 7-25

Defrost heat is bled off from the main flow at the heater muff and routed through flexible hose to a shut-off valve located to the right of center at the top of the fire wall. From this point, it is ducted to the defroster outlets.

Fresh air inlets are located in the leading edge of each wing and in the left side of the tail cone. Two adjustable outlets are located on each side of the cabin, one forward and one aft of the front seat near the floor. There are also adjustable outlets above each seat. In airplanes without air conditioning, an optional blower may be added to the overhead vent system to aid in the circulation of cabin air.

7.29 STALL WARNING

An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild to moderate airframe buffeting may also precede the stall. Stall speeds are shown on graphs in the Performance Section. The stall warning horn emits a continuous sound. The landing gear warning horn is different in that it emits a 90 cycle per minute beeping sound. The stall warning horn is activated by lift detectors installed on the leading edge of the left wing. During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detectors and checking to determine if the horn is actuated.

7.31 FINISH

All exterior surfaces are primed with etching primer and finished with acrylic lacquer. To keep the finish attractive looking, economy size spray cans of touch-up paint are available from Piper Dealers.

An optional polyurethane enamel finish is available.

7.33 AIR CONDITIONING*

The air conditioning system is a recirculating air system. The major components include an evaporator, a condenser, a compressor, a blower, switches and temperature control.

The evaporator is located behind the rear baggage compartment. This cools the air used for the air conditioning system.

*Optional equipment

The condenser is mounted on a retractable scoop located on the bottom of the fuselage and to the rear of the baggage compartment area. The scoop extends when the air conditioner is ON and retracts to a flush position when the system is OFF.

The compressor is mounted on the forward right underside of the engine. It has an electric clutch which automatically engages or disengages the compressor to the belt drive system of the compressor.

Air from the baggage area is drawn through the evaporator by the blower and distributed through an overhead duct to individual outlets located adjacent to each occupant.

The switches and temperature control are located on the lower right side of the instrument panel in the climate control center panel. The temperature control regulates the temperature of the cabin. Turning the control clockwise increases cooling; counterclockwise decreases cooling.

The fan speed switch and the air conditioning ON-OFF switch are inboard of the temperature control. The fan can be operated independently of the air conditioning; however, the fan must be on for air conditioner operation. Turning either switch off will disengage the compressor clutch and retract the condenser door. Cooling air should be felt within one minute after the air conditioner is turned on.

NOTE

If the system is not operating in 5 minutes, turn the system OFF until the fault is corrected.

The fan switch allows operation of the fan with the air conditioner turned OFF to aid in cabin air circulation. "LOW" or "HIGH" can be selected to direct a flow of air through the air conditioner outlets in the overhead duct. These outlets can be adjusted or turned off individually.

The condenser door light is located on the instrument panel in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

A circuit breaker on the circuit breaker panel protects the air conditioning electrical system.

Whenever the throttle is in the full forward position, it activates a micro switch which disengages the compressor and retracts the scoop. This allows maximum power and maximum rate of climb. The fan continues to operate and the air will remain cool for about one minute. When the throttle is retarded approximately 1/4 inch, the clutch will engage, the scoop will extend, and the system will again supply cool, dry air.

7.35 PIPER EXTERNAL POWER*

An optional starting installation known as Piper External Power (PEP) is accessible through a receptacle located on the left side of the nose section aft of the cowling. An external battery can be connected to the socket, thus allowing the operator to crank the engine without having to gain access to the airplane's battery.

7.37 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT), when installed, is located in the aft portion of the fuselage just below the stabilator leading edge and is accessible through a plate on the right side of the fuselage. This plate is attached with slotted-head nylon screws for ease of removal; these screws may be readily removed with a variety of common items, such as a dime, a key, a knife blade, etc. If there are no tools available in an emergency, the screw heads may be broken off by any means. The ELT is an emergency locator transmitter which meets the requirements of FAR 91.52.

A battery replacement date is marked on the transmitter. To comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter has been used in an emergency situation or if the accumulated test time exceeds one hour or if the unit has been inadvertently activated for an undetermined time period.

NOTE

If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If the tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

*Optional equipment

NARCO ELT 10 OPERATION

On the ELT unit itself is a three position switch placarded "ON," "OFF" and "ARM". The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane, and it should remain in that position.

To use the ELT as a portable unit in an emergency, remove the cover and unlatch the unit from its mounting base. The antenna cable is disconnected by a left quarter-turn of the knurled nut and a pull. A sharp tug on the two small wires will break them loose. Deploy the self-contained antenna by pulling the plastic tab marked "PULL FULLY TO EXTEND ANTENNA". Move the switch to ON to activate the transmitter.

In the event the transmitter is activated by an impact, it can only be turned off by moving the switch on the ELT unit to OFF. Normal operation can then be restored by pressing the small, clear plastic reset button located on the top of the front face of the ELT and then moving the switch to ARM.

A pilot's remote switch located on the left side panel, is provided to allow the transmitter to be turned on from inside the cabin. The pilot's remote switch is placarded "ON" and "ARMED". The switch is normally in the ARMED position. Moving the switch to ON will activate the transmitter. Moving the switch back to the ARMED position will turn off the transmitter only if the impact switch has not been activated.

The ELT should be checked to make certain the unit has not been activated during the ground check. Check by selecting 121.50 MHz on an operating receiver. If there is an oscillating chirping sound, the ELT may have been activated and should be turned off immediately. This requires removal of the access cover and moving the switch to OFF, then press the reset button and return the switch to ARM. Recheck with the receiver to ascertain that the transmitter is silent.

NARCO ELT 910 OPERATION

On the ELT unit itself is a three position switch placarded ON, OFF and ARM. The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane and it should remain in that position.

A pilot's remote switch, placarded ON and ARM, is located on the left side panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in the ARM position. Moving the switch to ON will activate the transmitter. A warning light, located above the remote switch, will blink continuously whenever the ELT is activated.

NOTE

The warning light will not blink if the ELT is activated by an incident that also results in severance of the airplane's power supply lines.

Should the ELT be activated inadvertently it can be reset by either positioning the remote switch to the ON position for two seconds, and then relocating it to the ARM position, or by setting the switch on the ELT to OFF and then back to ARM.

In the event the transmitter is activated by an impact, it can be turned off by moving the ELT switch OFF. Normal operation can then be restored by resetting the switch to ARM. It may also be turned off and reset by positioning the remote switch to the ON position for two seconds, and then to the ARM position.

The transmitter can be activated manually at any time by placing either the remote switch or the ELT switch to the ON position.

The ELT should be checked during postflight to make certain the unit has not been activated. Check by selecting 121.50 MHz on an operating receiver. If a downward sweeping audio tone is heard, the ELT may have been activated. Set the remote switch to ON. If there is no change in the volume of the signal, your airplane is probably transmitting. Setting the remote switch to ARM will automatically reset the ELT and should silence the signal being received on 121.50 MHz.

7.39 RADAR*

A weather radar system can be installed in this airplane. The basic components of this installation are an R-T/Antenna and a cockpit indicator. The function of the weather radar system is to detect weather conditions along the flight path and to visually display a continuous weather outline on the cockpit indicator. Through interpretation of the advance warning given on the display, the pilot can make an early decision on the most desirable weather avoidance course.

NOTE

When operating weather avoidance radar systems inside of moderate to heavy precipitation, it is advisable to set the range scale of the radar to its lowest scale.

For detailed information on the weather radar system and for procedures to follow in operating and adjusting the system to its optimum efficiency, refer to the appropriate operating and service manuals provided by the radar system manufacturer.

WARNING

Heating and radiation effects of radar can cause serious damage to the eyes and tender organs of the body. Personnel should not be allowed within fifteen feet of the area being scanned by the antenna while the system is transmitting. Do not operate the radar during refueling or in the vicinity of trucks or containers accommodating explosives or flammables. Flashbulbs can be exploded by radar energy. Before operating the radar, direct the nose of the airplane so that the forward 120 degree sector is free of any metal objects such as other aircraft or hangars for a distance of at least 100 yards, and tilt the antenna upward 15 degrees. Do not operate the radar while the airplane is in a hangar or other enclosure.

*Optional equipment