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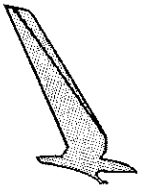
MODEL 172 AND Skyhawk



OWNER'S MANUAL

PERFORMANCE - SPECIFICATIONS

	Model 172*	Skyhawk*
GROSS WEIGHT	2300 lbs	2300 lbs
SPEED:		
Top Speed at Sea Level	140 mph	144 mph
Cruise, 75% Power at 8000 ft	135 mph	138 mph
RANGE:		
Cruise, 75% Power at 8000 ft	635 mi	650 mi
38 Gallons, No Reserve	4.7 hrs	4.7 hrs
	135 mph	138 mph
Cruise, 75% Power at 8000 ft	795 mi	815 mi
48 Gallons, No Reserve	5.9 hrs	5.9 hrs
	135 mph	138 mph
Maximum Range at 10,000 ft	695 mi	700 mi
38 Gallons, No Reserve	6.0 hrs	6.0 hrs
	116 mph	117 mph
Maximum Range at 10,000 ft	870 mi	875 mi
48 Gallons, No Reserve	7.5 hrs	7.5 hrs
	116 mph	117 mph
RATE OF CLIMB AT SEA LEVEL	645 fpm	645 fpm
SERVICE CEILING	13,100 ft	13,100 ft
TAKE-OFF:		
Ground Run	865 ft	865 ft
Total Distance Over 50-Foot Obstacle	1525 ft	1525 ft
LANDING:		
Ground Roll	520 ft	520 ft
Total Distance Over 50-Foot Obstacle	1250 ft	1250 ft
STALL SPEED:		
Flaps Up, Power Off	57 mph	57 mph
Flaps Down, Power Off	49 mph	49 mph
EMPTY WEIGHT (Approximate)	1300 lbs	1345 lbs
USEFUL LOAD (Approximate)	1000 lbs	955 lbs
BAGGAGE	120 lbs	120 lbs
WING LOADING: Pounds/Sq Foot	13.2	13.2
POWER LOADING: Pounds/HP	15.3	15.3
FUEL CAPACITY: Total		
Standard Tanks	42 gal.	42 gal.
Optional Long Range Tanks	52 gal.	52 gal.
OIL CAPACITY: Total	8 qts	8 qts
PROPELLER: Fixed Pitch, Diameter	75 inches	75 inches
ENGINE:		
Lycoming Engine	O-320-E2D	O-320-E2D
150 rated HP at 2700 RPM		

*This manual covers operation of the Model 172/Skyhawk which is certificated as Model 172M under FAA Type Certificate No. 3A12. The manual also covers operation of the Reims/Cessna F172 Skyhawk which is certificated as Model F172M under French Type Certificate No. 25 and FAA Type Certificate No. A4EU.

D1016-13

Cessna Aircraft Company
Wichita, Kansas USA

CONGRATULATIONS . . . . . .

Welcome to the ranks of Cessna owners! Your Cessna has been designed and constructed to give you the most in performance, economy, and comfort. It is our desire that you will find flying it, either for business or pleasure, a pleasant and profitable experience.

This Owner's Manual has been prepared as a guide to help you get the most pleasure and utility from your Model 172/Skyhawk. It contains information about your Cessna's equipment, operating procedures, and performance; and suggestions for its servicing and care. We urge you to read it from cover to cover, and to refer to it frequently.

Our interest in your flying pleasure has not ceased with your purchase of a Cessna. World-wide, the Cessna Dealer Organization backed by the Cessna Service Department stands ready to serve you. The following services are offered by most Cessna Dealers:

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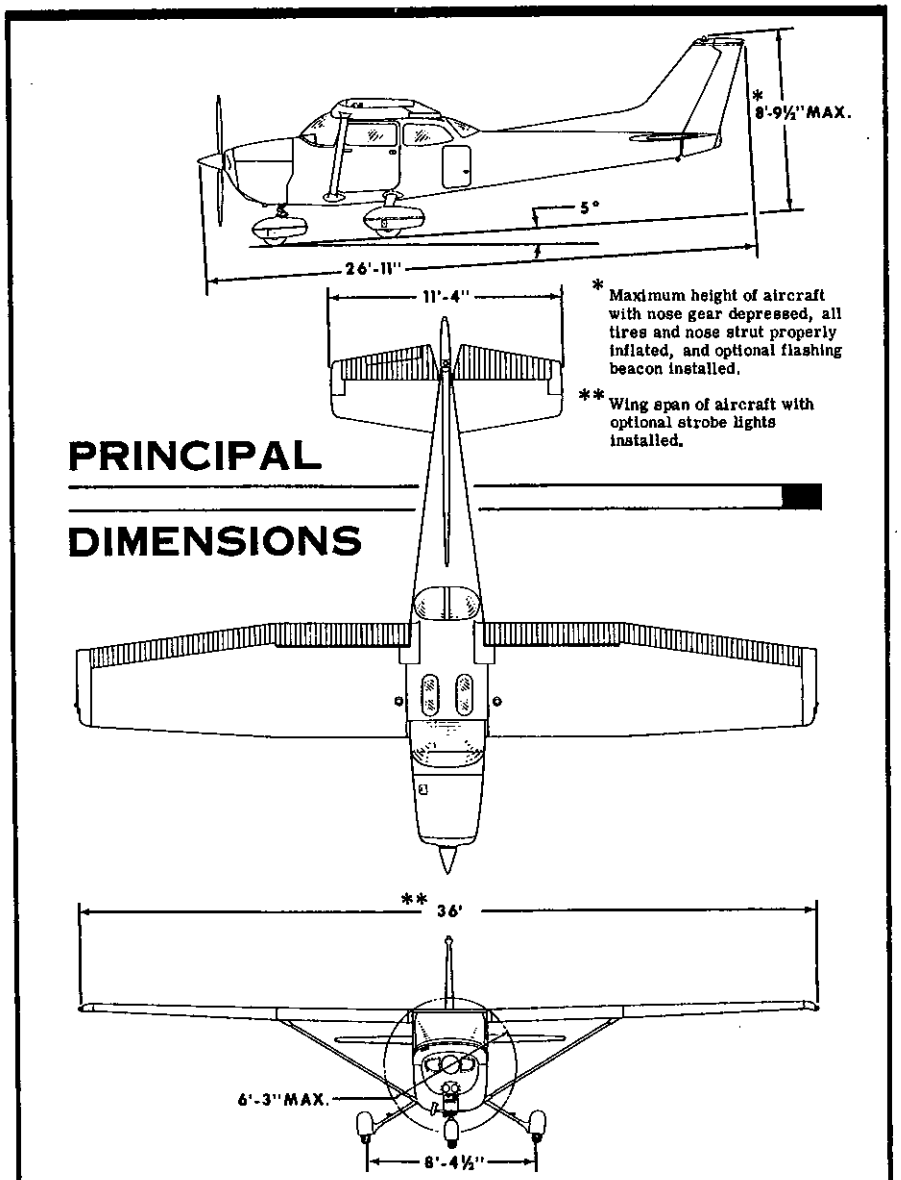
PRINCIPAL DIMENSIONS



* Maximum height of aircraft with nose gear depressed, all tires and nose strut properly inflated, and optional flashing beacon installed.

** Wing span of aircraft with optional strobe lights installed.

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This manual describes the operation and performance of both the Cessna Model 172 and Skyhawk. Equipment described as "Optional" denotes that the subject equipment is optional on the Model 172. Much of this equipment is standard on the Skyhawk model.

Section I

OPERATING CHECK LIST

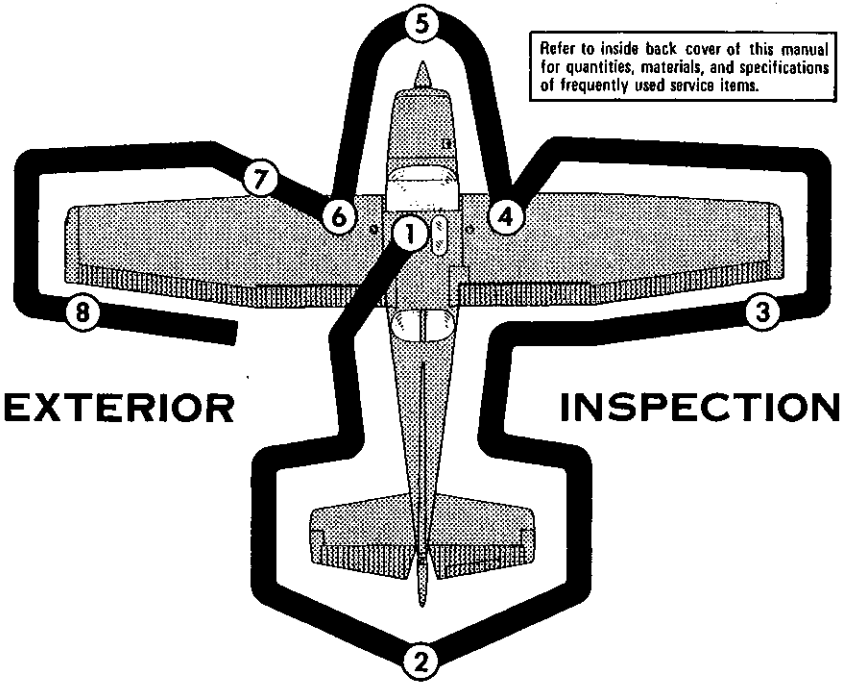
One of the first steps in obtaining the utmost performance, service, and flying enjoyment from your Cessna is to familiarize yourself with your aircraft's equipment, systems, and controls. This can best be done by reviewing this equipment while sitting in the aircraft. Those items whose function and operation are not obvious are covered in Section II.

Section I lists, in Pilot's Check List form, the steps necessary to operate your aircraft efficiently and safely. It is not a check list in its true form as it is considerably longer, but it does cover briefly all of the points that you should know for a typical flight. An abbreviated check list covering the "Before Take-Off" and "Before Landing" phases of aircraft operation is provided on a plastic card and normally stowed in the map compartment. This abbreviated check list is a convenient reference of key items to be rechecked immediately prior to taxiing into position for take-off and before entering the final approach for landing.

The flight and operational characteristics of your aircraft are normal in all respects. There are no "unconventional" characteristics or operations that need to be mastered. All controls respond in the normal way within the entire range of operation. All airspeeds mentioned in Sections I, II and III are indicated airspeeds. Corresponding calibrated airspeeds may be obtained from the Airspeed Correction Table in Section VI.

BEFORE ENTERING THE AIRPLANE.

(1) Make an exterior inspection in accordance with figure 1-1.



Note

Visually check aircraft for general condition during walk-around inspection. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces. Also, make sure that control surfaces contain no internal accumulations of ice or debris. If night flight is planned, check operation of all lights, and make sure a flashlight is available.

(1) a. Remove control wheel lock.
b. Check ignition switch OFF.
c. Turn on master switch and check fuel quantity indicators; then turn off master switch.
d. Check fuel selector valve handle on BOTH.
e. Check baggage door for security. Lock with key if children are to occupy child's seat.

Figure 1-1.

(2) a. Remove rudder gust lock, if installed.
b. Disconnect tail tie-down.
c. Check control surfaces for freedom of movement and security.

(3) a. Check aileron for freedom of movement and security.

(4) a. Disconnect wing tie-down.
b. Check main wheel tire for proper inflation.
c. Visually check fuel quantity; then check fuel filler cap secure.

(5) a. Check oil level. Do not operate with less than six quarts. Fill to eight quarts for extended flights.
b. Before first flight of the day and after each refueling, drain fuel strainer. With fuel selector valve turned to the left and right tank positions, pull out strainer drain knob for about four seconds to clear fuel system of possible water and sediment. After both tanks have been drained, make sure that strainer drain is closed. If water is observed in these checks, the system may contain additional water, and the fuel tank sump drain plugs and fuel selector valve drain plug should be removed to check for the presence of water.
c. Check propeller and spinner for nicks and security.
d. Check landing light(s) for condition and cleanliness.
e. Check carburetor air filter for restrictions by dust or other foreign matter.
f. Check nose wheel strut and tire for proper inflation.
g. Disconnect tie-down rope.
h. Inspect flight instrument static source opening on side of fuselage for stoppage (left side only).

(6) a. Check main wheel tire for proper inflation.
b. Visually check fuel quantity, then check fuel filler cap secure.

(7) a. Remove pitot tube cover, if installed, and check pitot tube opening for stoppage.
b. Check fuel tank vent opening for stoppage.
c. Check stall warning vent opening for stoppage.
d. Disconnect wing tie-down.

(8) a. Check aileron for freedom of movement and security.

BEFORE STARTING THE ENGINE.

(1) Seats, Seat Belts and Shoulder Harnesses -- Adjust and lock.
(2) Fuel Selector Valve -- BOTH.
(3) Brakes -- Test and set.
(4) Radios and Electrical Equipment -- OFF.

STARTING THE ENGINE.

(1) Mixture -- Rich.
(2) Carburetor Heat -- Cold.
(3) Primer -- 2 - 6 strokes as required (none if engine is warm). Close and lock primer.
(4) Throttle -- Open 1/8".
(5) Master Switch -- ON.
(6) Propeller Area -- Clear.
(7) Ignition Switch -- START (release when engine starts).
(8) Oil Pressure -- Check.

BEFORE TAKE-OFF.

(1) Parking Brake -- Set.
(2) Flight Controls -- Check for free and correct movement.
(3) Fuel Selector Valve -- BOTH.
(4) Elevator Trim Control Wheel -- TAKE-OFF setting.
(5) Throttle Setting -- 1700 RPM.
(6) Engine Instruments and Ammeter -- Check.
(7) Suction Gage -- Check (4.6 to 5.4 inches of mercury).
(8) Magnetos -- Check (RPM drop should not exceed 125 RPM on either magneto or 50 RPM differential between magnetos).
(9) Carburetor Heat -- Check operation.
(10) Flight Instruments and Radios -- Set.
(11) Optional Autopilot -- Off.
(12) Throttle Friction Lock -- Adjust.
(13) Cabin Doors and Window -- Closed and locked.

TAKE-OFF.

NORMAL TAKE-OFF.

(1) Wing Flaps -- 0°.

(2) Carburetor Heat -- Cold.
(3) Power -- Full throttle.
(4) Elevator Control -- Lift nose wheel at 60 MPH.
(5) Climb Speed -- 75 to 85 MPH.

MAXIMUM PERFORMANCE TAKE-OFF.

(1) Wing Flaps -- 0°.
(2) Carburetor Heat -- Cold.
(3) Brakes -- Apply.
(4) Power -- Full throttle.
(5) Brakes -- Release.
(6) Airplane Attitude -- Slightly tail low.
(7) Climb Speed -- 68 MPH until all obstacles are cleared.

ENROUTE CLIMB.

(1) Airspeed -- 80 to 90 MPH.

NOTE

If a maximum performance climb is necessary, use speeds shown in the Maximum Rate-Of-Climb Data chart in Section VI.

(2) Power -- Full throttle.
(3) Mixture -- Full rich (mixture may be leaned above 3000 feet).

CRUISING.

(1) Power -- 2200 to 2700 RPM.
(2) Elevator Trim Control Wheel -- Adjust.
(3) Mixture -- Lean for maximum RPM.

LET-DOWN.

(1) Mixture -- Rich.
(2) Power -- As desired.
(3) Carburetor Heat -- As required to prevent carburetor icing.

BEFORE LANDING.

(1) Fuel Selector Valve -- Both.
(2) Mixture -- Rich.
(3) Carburetor Heat -- Apply full heat before closing throttle.
(4) Wing Flaps -- As desired.
(5) Airspeed -- 70 to 80 MPH (flaps up), 65 to 75 MPH (flaps down).

BALKED LANDING (GO-AROUND).

(1) Power -- Full throttle.
(2) Carburetor Heat -- Cold.
(3) Wing Flaps -- Retract to 20°.
(4) Upon reaching an airspeed of approximately 65 MPH, retract flaps slowly.

NORMAL LANDING.

(1) Touchdown -- Main wheels first.
(2) Landing Roll -- Lower nose wheel gently.
(3) Braking -- Minimum required.

AFTER LANDING.

(1) Wing Flaps -- Up.
(2) Carburetor Heat -- Cold.

SECURING AIRCRAFT.

(1) Parking Brake -- Set.
(2) Radios and Electrical Equipment -- OFF.
(3) Mixture -- Idle cut-off (pulled full out).
(4) Ignition and Master Switch -- OFF.
(5) Control Lock -- Installed.

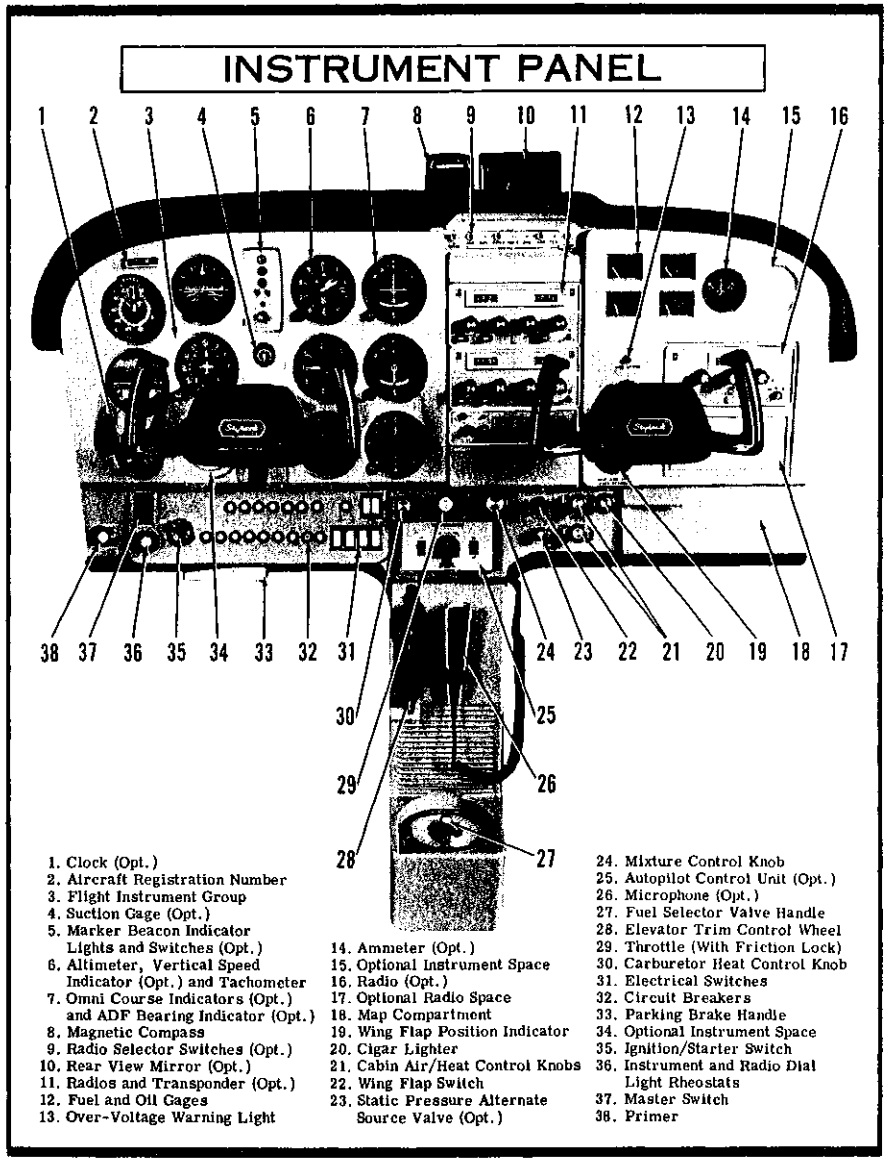


Figure 2-1.

Section II

DESCRIPTION AND OPERATING DETAILS

The following paragraphs describe the systems and equipment whose function and operation is not obvious when sitting in the aircraft. This section also covers in somewhat greater detail some of the items listed in Check List form in Section I that require further explanation.

FUEL SYSTEM.

Fuel is supplied to the engine from two tanks, one in each wing. With the fuel selector valve on BOTH, the total usable fuel for all flight conditions is 38 gallons for the standard tanks.

Fuel from each wing tank flows by gravity to a selector valve. Depending upon the setting of the selector valve, fuel from the left, right, or both tanks flows through a fuel strainer and carburetor to the engine induction system.

The fuel selector valve should be in the BOTH position for take-off, climb, landing, and maneuvers that involve prolonged slips or skids. Operation from either LEFT or RIGHT tank is reserved for cruising flight.

NOTE

With low fuel (1/8th tank or less), a prolonged steep descent (1500 feet or more) with partial power, full flaps, and 80 MPH or greater should be avoided due to the possibility of the fuel tank outlets being uncovered, causing temporary fuel starvation. If starvation occurs, leveling the nose should restore power within 20 seconds.

NOTE

When the fuel selector valve handle is in the BOTH position in cruising flight, unequal fuel flow from each

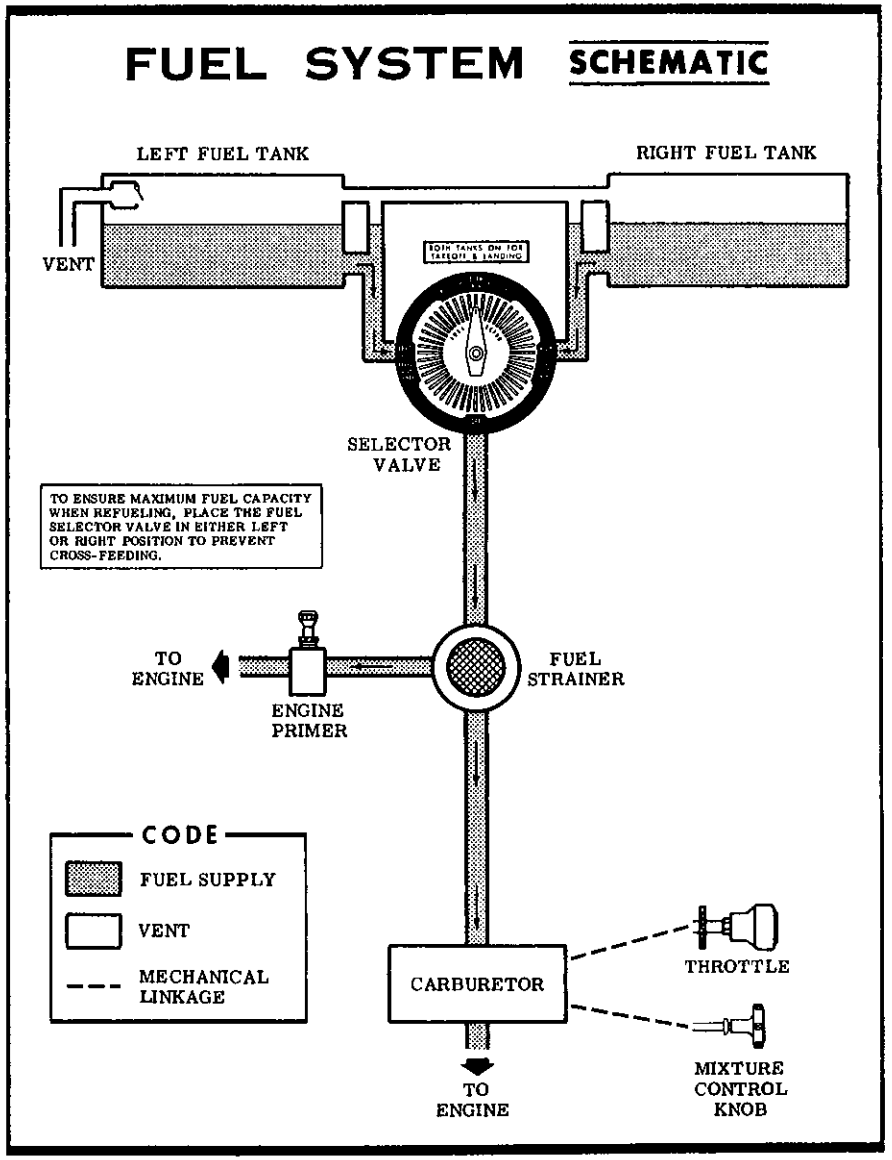


Figure 2-2.

tank may occur if the wings are not maintained exactly level. Resulting wing heaviness can be alleviated gradually by turning the selector valve handle to the tank in the "heavy" wing.

NOTE

It is not practical to measure the time required to consume all of the fuel in one tank, and, after switching to the opposite tank, expect an equal duration from the remaining fuel. The airspace in both fuel tanks is interconnected by a vent line (figure 2-2) and, therefore, some sloshing of fuel between tanks can be expected when the tanks are nearly full and the wings are not level.

For fuel system servicing information, refer to Servicing Requirements on the inside back cover.

LONG RANGE FUEL TANKS.

Special wings with long range fuel tanks are available to replace the standard wings and fuel tanks for greater endurance and range. When these tanks are installed, the total usable fuel for all flight conditions is 48 gallons.

ELECTRICAL SYSTEM.

Electrical energy is supplied by a 14-volt, direct-current system powered by an engine-driven alternator (see figure 2-3). A 12- volt battery is located on the left-hand forward portion of the firewall. Power is supplied to all electrical circuits through a split bus bar, one side containing electronic systems and the other side having general electrical systems. Both sides of the bus are on at all times except when either an external power source is connected or the ignition/starter switch is turned on; then a power contactor is automatically activated to open the circuit to the electronic bus. Isolating the electronic circuits in this manner prevents harmful transient voltages from damaging the transistors in the electronic equipment.

MASTER SWITCH.

The master switch is a split-rocker type switch labeled MASTER, and is ON in the up position and OFF in the down position. The right half

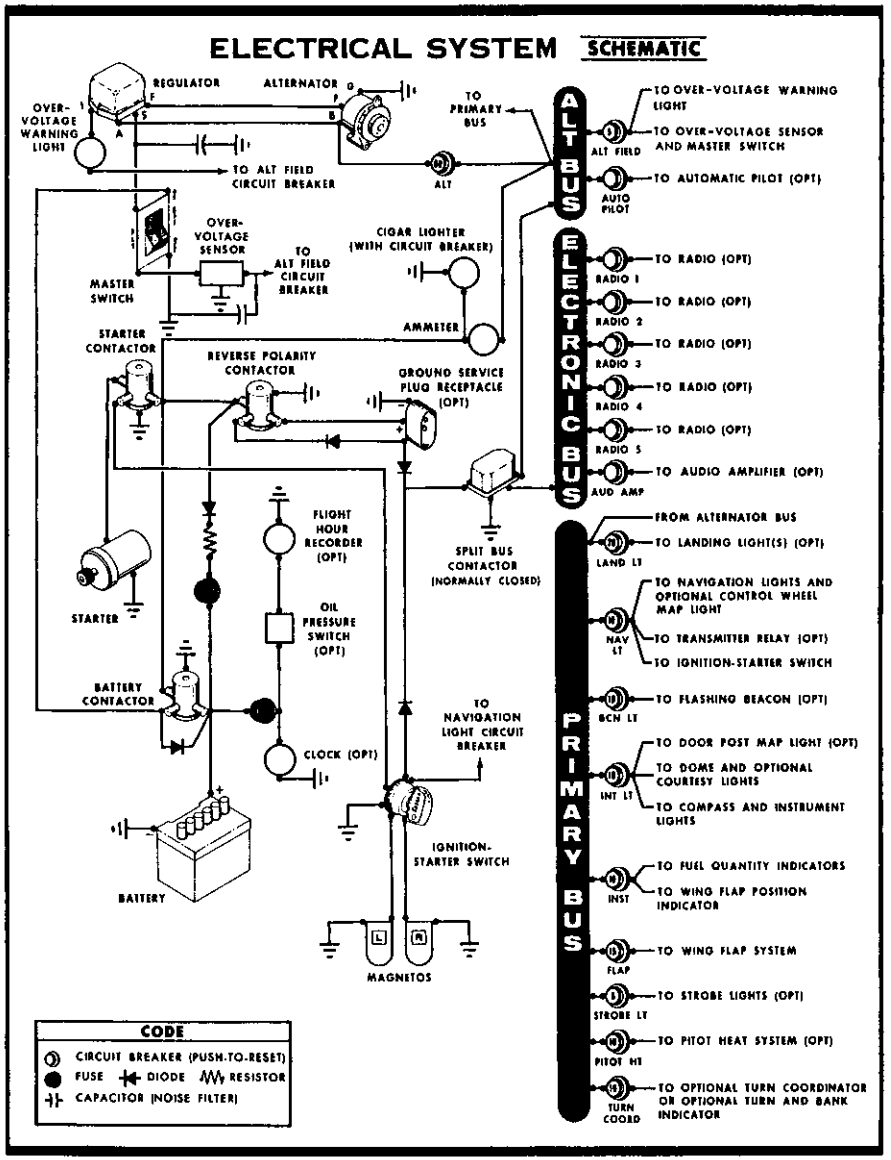


Figure 2-3.

of the switch, labeled BAT, controls all electrical power to the airplane. The left half, labeled ALT controls the alternator.

Normally, both sides of the master switch should be used simultaneously; however, the BAT side of the switch could be turned ON separately to check equipment while on the ground. The ALT side of the switch, when placed in the OFF position, removes the alternator from the electrical system. With this switch in the OFF position, the entire electrical load is placed on the battery. Continued operation with the alternator switch OFF will reduce battery power low enough to open the battery contactor, remove power from the alternator field, and prevent alternator restart.

AMMETER.

The ammeter indicates the flow of current, in amperes, from the alternator to the battery or from the battery to the aircraft electrical system. When the engine is operating and the master switch is ON, the ammeter indicates the charging rate applied to the battery. In the event the alternator is not functioning or the electrical load exceeds the output of the alternator, the ammeter indicates the discharge rate of the battery.

OVER-VOLTAGE SENSOR AND WARNING LIGHT.

The aircraft is equipped with an automatic over-voltage protection system consisting of an over-voltage sensor behind the instrument panel and a red warning light, labeled HIGH VOLTAGE, under the oil temperature and pressure gages.

In the event an over-voltage condition occurs, the over-voltage sensor automatically removes alternator field current and shuts down the alternator. The red warning light will then turn on, indicating to the pilot that the alternator is not operating and the aircraft battery is supplying all electrical power.

The over-voltage sensor may be reset by turning the master switch off and back on again. If the warning light does not illuminate, normal alternator charging has resumed; however, if the light does illuminate again, a malfunction has occurred, and the flight should be terminated as soon as practical.

The over-voltage warning light may be tested by momentarily turning off the ALT portion of the master switch and leaving the BAT portion

turned on.

CIRCUIT BREAKERS AND FUSES.

The majority of electrical circuits in the airplane are protected by "push-to-reset" circuit breakers mounted on the instrument panel. Exceptions to this are the optional clock and flight hour recorder circuits, and the battery contactor closing (external power) circuit which have fuses mounted adjacent to the battery. Also, the cigar lighter is protected by a manually reset type circuit breaker mounted directly on the back of the lighter behind the instrument panel.

When more than one radio is installed, the radio transmitter relay (which is a part of the radio installation) is protected by the navigation lights circuit breaker labeled NAV LT. It is important to remember that any malfunction in the navigation lights system which causes the circuit breaker to open will de-activate both the navigation lights and the transmitter relay. In this event, the navigation light switch should be turned off to isolate the circuit; then reset the circuit breaker to re-activate the transmitter relay and permit its usage. Do not turn on the navigation lights switch until the malfunction has been corrected.

LIGHTING EQUIPMENT.

EXTERIOR LIGHTING.

Conventional navigation lights are located on the wing tips and top of the rudder. Optional lighting includes a single landing light or dual landing/taxi lights in the cowl nose cap, a flashing beacon on the top of the vertical fin, a strobe light on each wing tip, and two courtesy lights, one under each wing, just outboard of the cabin door. The courtesy lights are controlled by the dome light switch located on the overhead console. All other exterior lights are controlled by rocker type switches located on the left switch and control panel. The switches are ON in the up position and OFF in the down position.

The flashing beacon should not be used when flying through clouds or overcast; the flashing light reflected from water droplets or particles in the atmosphere, particularly at night, can produce vertigo and loss of orientation.

The two high intensity strobe lights will enhance anti-collision protection. However, the lights should be turned off when taxiing in the

vicinity of other aircraft, or during flight through clouds, fog or haze.

INTERIOR LIGHTING.

Illumination of the instrument panel is provided by red flood lighting in the forward portion of the overhead console. The magnetic compass and radio equipment have integral lighting. A dual rheostat control on the left switch and control panel operates these lights. The inner knob, labeled PANEL, operates the instrument panel and compass lighting. The outer knob, labeled RADIO, controls all radio lighting.

A cabin dome light is located in the overhead console, and is operated by a switch adjacent to the light. To turn the light on, move the switch to the right. This will also operate the optional courtesy lights.

An optional map light may be mounted on the bottom of the pilot's control wheel. The light illuminates the lower portion of the cabin, just forward of the pilot, and is helpful when checking maps and other flight data during night operations. To operate the light, first turn on the NAV LT switch, then adjust the map light's intensity with the disk type rheostat control located on the bottom of the control wheel.

A doorpost map light is also offered as optional equipment, and is located at the top of the left forward doorpost. The light contains both red and white bulbs, and may be positioned to illuminate any area desired by the pilot. A switch on the left forward doorpost is labeled RED, OFF, and WHITE. Placing the switch in the top position will provide a red light. In the bottom position, standard white lighting is provided. The center position is OFF.

WING FLAP SYSTEM.

The wing flaps are electrically operated by a flap motor located in the right wing. Flap position is controlled by a switch, labeled WING FLAPS on the lower center portion of the instrument panel. Flap position is shown by an indicator on the lower right portion of the instrument panel below the right control wheel position.

To extend the wing flaps, the flap switch must be depressed and held in the DOWN position until the desired degree of extension is reached. Releasing the switch allows it to return to the center off position. Normal full flap extension in flight will require approximately 9 seconds. After the flaps reach maximum extension or retraction, limit switches will

automatically shut off the flap motor.

To retract the flaps, place the flap switch in the UP position. The switch will remain in the UP position without manual assistance due to an over-center design of the switch. Full flap retraction in flight requires approximately 7 seconds. More gradual flap retraction can be accomplished by intermittent operation of the flap switch to the UP position. After full retraction, the switch is normally returned to the center off position.

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM.

For cabin ventilation, pull the CABIN AIR knob out. To raise the air temperature, pull the CABIN HT knob out approximately 1/4" to 1/2" for a small amount of cabin heat. Additional heat is available by pulling the knob out farther; maximum heat is available with the CABIN HT knob pulled out and the CABIN AIR knob pushed full in. When no heat is desired in the cabin, the CABIN HT knob is pushed full in.

Front cabin heat and ventilating air is supplied by outlet holes spaced across a cabin manifold just forward of the pilot's and copilot's feet. Rear cabin heat and air is supplied by two ducts from the manifold, one extending down each side of the cabin to an outlet at the front door post at floor level. Windshield defrost air is also supplied by a duct leading from the cabin manifold. Two knobs control sliding valves in the defroster outlet and permit regulation of defroster airflow.

Separate adjustable ventilators supply additional air; one near each upper corner of the windshield supplies air for the pilot and copilot, and two optional ventilators in the rear cabin ceiling supply air to the rear seat passengers.

SHOULDER HARNESSES.

Shoulder harnesses are provided as standard equipment for the pilot and front seat passenger, and as optional equipment for the rear seat passengers.

Each front seat harness is attached to a rear door post just above window line and is stowed behind a stowage sheath mounted above the cabin door. To stow each front seat harness, fold the free end and place it behind the sheath. The optional rear seat shoulder harnesses are attached just behind the lower corners of the aft side windows. Each harness is stowed behind a stowage sheath located above the aft side window.

To use the front and rear seat shoulder harnesses, fasten and adjust the seat belt first. Remove the harness from the stowed position, and lengthen as required by pulling on the end of the harness and the narrow release strap. Snap the harness metal stud firmly into the retaining slot adjacent to the seat belt buckle. Then adjust to length by pulling down on the free end of the harness. A properly adjusted harness will permit the occupant to lean forward enough to sit completely erect but is tight enough to prevent excessive forward movement and contact with objects during sudden deceleration. Also, the pilot will want the freedom to reach all controls easily.

Releasing and removing the shoulder harness is accomplished by pulling upward on the narrow release strap and removing the harness stud from the slot in the seat belt buckle. In an emergency, the shoulder harness may be removed by releasing the seat belt first and pulling the harness over the head by pulling up on the release strap.

STARTING ENGINE.

During engine starting, open the throttle approximately 1/8 inch. In warm temperatures, one or two strokes of the primer should be sufficient. In cold weather, up to six strokes of the primer may be necessary. If the engine is warm, no priming will be required. In extremely cold temperatures, it may be necessary to continue priming while cranking the engine.

Weak intermittent firing followed by puffs of black smoke from the exhaust stack indicates overpriming or flooding. Excess fuel can be cleared from the combustion chambers by the following procedure: Set the mixture control full lean and the throttle full open; then crank the engine through several revolutions with the starter. Repeat the starting procedure without any additional priming.

If the engine is underprimed (most likely in cold weather with a cold

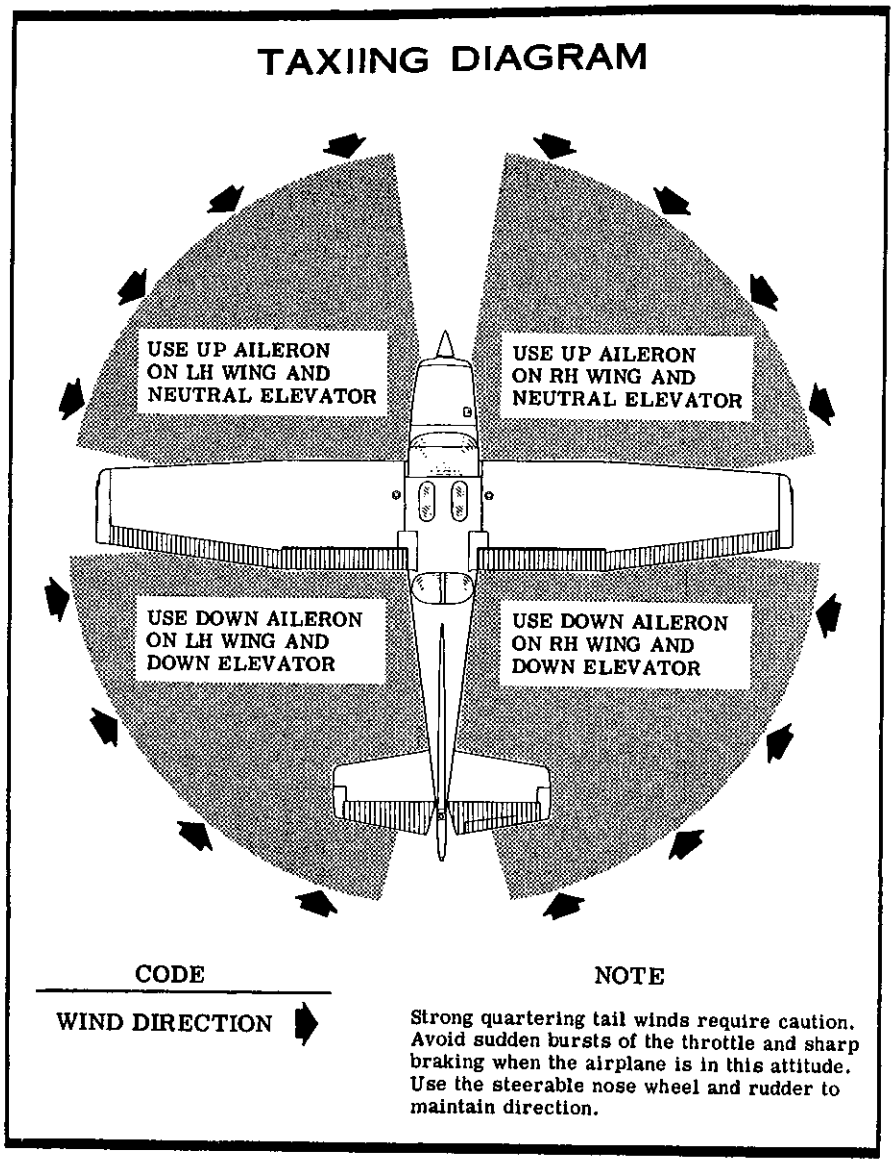


Figure 2-4.

engine) it will not fire at all, and additional priming will be necessary. As soon as the cylinders begin to fire, open the throttle slightly to keep it running.

After starting, if the oil gage does not begin to show pressure within 30 seconds in the summertime and about twice that long in very cold weather, stop engine and investigate. Lack of oil pressure can cause serious engine damage. After starting, avoid the use of carburetor heat unless icing conditions prevail.

NOTE

Additional details for cold weather starting and operation may be found under Cold Weather Operation in this section.

TAXIING.

When taxiing, it is important that speed and use of brakes be held to a minimum and that all controls be utilized (see Taxiing Diagram, figure 2-4) to maintain directional control and balance.

The carburetor heat control knob should be pushed full in during all ground operations unless heat is absolutely necessary. When the knob is pulled out to the heat position, air entering the engine is not filtered.

Taxiing over loose gravel or cinders should be done at low engine speed to avoid abrasion and stone damage to the propeller tips.

BEFORE TAKE-OFF.

WARM-UP.

If the engine accelerates smoothly, the aircraft is ready for take-off. Since the engine is closely cowled for efficient in-flight engine cooling, precautions should be taken to avoid overheating during prolonged engine operation on the ground. Also, long periods of idling may cause fouled spark plugs.

MAGNETO CHECK.

The magneto check should be made at 1700 RPM as follows. Move

ignition switch first to R position and note RPM. Next move switch back to BOTH to clear the other set of plugs. Then move switch to the L position, note RPM and return the switch to the BOTH position. RPM drop should not exceed 125 RPM on either magneto or show greater than 50 RPM differential between magnetos. If there is a doubt concerning operation of the ignition system, RPM checks at higher engine speeds will usually confirm whether a deficiency exists.

An absence of RPM drop may be an indication of faulty grounding of one side of the ignition system or should be cause for suspicion that the magneto timing is set in advance of the setting specified.

ALTERNATOR CHECK.

Prior to flights where verification of proper alternator and voltage regulator operation is essential (such as night or instrument flights), a positive verification can be made by loading the electrical system momentarily (3 to 5 seconds) with the optional landing light (if so equipped), or by operating the wing flaps during the engine runup (1700 RPM). The ammeter will remain within a needle width of zero if the alternator and voltage regulator are operating properly.

TAKE-OFF.

POWER CHECK.

It is important to check full-throttle engine operation early in the take-off run. Any signs of rough engine operation or sluggish engine acceleration is good cause for discontinuing the take-off. If this occurs, you are justified in making a thorough full-throttle, static runup before another take-off is attempted. The engine should run smoothly and turn approximately 2270 to 2370 RPM with carburetor heat off and mixture full rich.

NOTE

Carburetor heat should not be used during take-off unless it is absolutely necessary for obtaining smooth engine acceleration.

Full-throttle runups over loose gravel are especially harmful to propeller tips. When take-offs must be made over a gravel surface, it is

very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it. When unavoidable small dents appear in the propeller blades, they should be immediately corrected as described in Section V under propeller care.

Prior to take-off from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full-throttle, static runup.

After full throttle is applied, adjust the throttle friction lock clockwise to prevent the throttle from creeping back from a maximum power position. Similar friction lock adjustments should be made as required in other flight conditions to maintain a fixed throttle setting.

WING FLAP SETTINGS.

Normal and obstacle clearance take-offs are performed with wing flaps up. The use of 10° flaps will shorten the ground run approximately 10%, but this advantage is lost in the climb to a 50-foot obstacle. Therefore, the use of 10° flaps is reserved for minimum ground runs or for take-off from soft or rough fields. If 10° of flaps are used for minimum ground runs, it is preferable to leave them extended rather than retract them in the climb to the obstacle. In this case, use an obstacle clearance speed of 65 MPH. As soon as the obstacle is cleared, the flaps may be retracted as the airplane accelerates to the normal flaps-up climb speed of 80 to 90 MPH.

During a high altitude take-off in hot weather where climb would be marginal with 10° flaps, it is recommended that the flaps not be used for take-off. Flap settings greater than 10° are not recommended at any time for take-off.

PERFORMANCE CHARTS.

Consult the Take-Off Data chart in Section VI for take-off distances under various gross weight, altitude, headwind, temperature, and runway surface conditions.

CROSSWIND TAKE-OFFS.

Take-offs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length to minimize the drift angle immediately after take-off. The airplane is accelerated to a speed slightly higher than normal, then pulled off abruptly to prevent

possible settling back to the runway while drifting. When clear of the ground, make a coordinated turn into the wind to correct for drift.

ENROUTE CLIMB.

CLIMB DATA.

For detailed data, refer to the Maximum Rate-Of-Climb Data chart in Section VI.

CLIMB SPEEDS.

Normal climbs are performed at 80 to 90 MPH with flaps up and full throttle for best engine cooling. The mixture should be full rich below 3000 feet and may be leaned above 3000 feet for smoother engine operation or to obtain maximum RPM for maximum performance climb. The maximum rate-of-climb speeds range from 91 MPH at sea level to 80 MPH at 10,000 feet. If an enroute obstruction dictates the use of a steep climb angle, climb at 75 MPH with flaps retracted.

NOTE

Steep climbs at low speeds should be of short duration to improve engine cooling.

CRUISE.

Normal cruising is done between 65% and 75% power. The power settings required to obtain these powers at various altitudes and outside air temperatures can be determined by using your Cessna Power Computer or the OPERATIONAL DATA, Section VI.

Cruising can be done more efficiently at high altitudes because of lower air density and therefore higher true airspeeds for the same power. This is illustrated in the Maximum Cruise Speed Performance table, which shows performance at 75% power at various altitudes.

To achieve lean mixture fuel consumption figures shown in Section VI, the mixture should be leaned as follows: pull mixture control out until RPM peaks and begins to fall off, then enrichen slightly back to peak RPM.

Carburetor ice, as evidenced by an unexplained drop in RPM, can be removed by application of full carburetor heat. Upon regaining the original RPM (with heat off), use the minimum amount of heat (by trial and error) to prevent ice from forming. Since the heated air causes a richer mixture, readjust the mixture setting when carburetor heat is to be used continuously in cruise flight.

MAXIMUM CRUISE SPEED PERFORMANCE
75% POWER

ALTITUDE	RPM	TRUE AIRSPEED
Sea Level	2500	128
4000 Feet	2600	133
8000 Feet	2700	138

The use of full carburetor heat is recommended during flight in heavy rain to avoid the possibility of engine stoppage due to excessive water ingestion or carburetor ice. The mixture setting should be readjusted for smoothest operation.

In extremely heavy rain, the use of partial carburetor heat (control approximately 2/3 out), and part throttle (closed at least one inch), may be necessary to retain adequate power. Power changes should be made cautiously followed by prompt adjustment of the mixture for smoothest operation.

STALLS.

The stall characteristics are conventional and aural warning is provided by a stall warning horn which sounds between 5 and 10 MPH above the stall in all configurations.

Power-off stall speeds at maximum gross weight and aft c.g. position are presented on page 6-2 as calibrated airspeeds since indicated airspeeds are unreliable near the stall.

SPINS.

Intentional spins are approved in this aircraft in the Utility Category only. Although this aircraft is inherently resistant to spins, the follow-

ing techniques may be used to perform intentional spins for training or practice. To obtain a clean entry, decelerate the aircraft at a faster rate than is used for stalls. Then, just as the stall occurs, apply full up elevator, full rudder in the desired spin direction, and momentarily use full engine power. As the aircraft begins to spin, reduce the power to idle and maintain full pro-spin elevator and rudder deflections. The application of ailerons in the direction of the desired spin may also help obtain a clean entry.

During extended spins of two to three turns or more, the spin will tend to change into a spiral, particularly to the right. This will be accompanied by an increase in airspeed and gravity loads on the aircraft. If this occurs, recovery should be accomplished quickly by leveling the wings and recovering from the resulting dive.

To recover from an intentional or inadvertent spin, use the following procedure:

(1) Retard throttle to idle position.
(2) Apply full rudder opposite to the direction of rotation.
(3) After one-fourth turn, move the control wheel forward of neutral in a brisk motion.
(4) As the rotation stops, neutralize the rudder, and make a smooth recovery from the resulting dive.

Intentional spins with flaps extended are prohibited.

LANDINGS.

Normal landings are made power-off with any flap setting desired. Steep slips should be avoided with flap settings greater than 20° due to a slight tendency for the elevator to oscillate under certain combinations of airspeed, sideslip angle, and center of gravity loadings.

NOTE

Carburetor heat should be applied prior to any significant reduction or closing of the throttle.

NORMAL LANDING.

Landings should be made on the main wheels first to reduce the landing speed and subsequent need for braking in the landing roll. The nose

wheel is lowered to the runway gently after the speed has diminshed to avoid unnecessary nose gear loads. This procedure is especially important in rough or soft field landings.

SHORT FIELD LANDING.

For short field landings, make a power-off approach at approximately 70 MPH indicated airspeed with 40° of flaps. Touchdown should be made on the main wheels first. Immediately after touchdown, lower the nose gear to the ground and apply heavy braking as required. For maximum brake effectiveness after all three wheels are on the ground, retract the flaps, hold full nose up elevator and apply maximum possible brake pressure without sliding the tires.

CROSSWIND LANDING.

When landing in a strong crosswind, use the minimum flap setting required for the field length. If flap settings greater than 20° are used in sideslips with full rudder deflection, some elevator oscillation may be felt at normal approach speeds. However, this does not affect control of the aircraft. Although the crab or combination method of drift correction may be used, the wing-low method gives the best control. After touchdown, hold a straight course with the steerable nose wheel and occasional braking if necessary.

The maximum allowable crosswind velocity is dependent upon pilot capability rather than airplane limitations. With average pilot technique, direct crosswinds of 15 knots can be handled with safety.

BALKED LANDING (GO-AROUND).

In a balked landing (go-around) climb, reduce the wing flap setting to 20° immediately after full power is applied. If the flaps were extended to 40°, the reduction to 20° may be approximated by placing the flap switch in the UP position for two seconds and then returning the switch to neutral. If obstacles must be cleared during the go-around climb, leave the wing flaps in the 10° to 20° range until the obstacles are cleared. After clearing any obstacles, the flaps may be retracted as the aircraft accelerates to the normal flaps-up climb speed of 80 to 90 MPH.

COLD WEATHER OPERATION.

STARTING.

Prior to starting on a cold morning, it is advisable to pull the propeller through several times by hand to "break loose" or "limber" the oil, thus conserving battery energy.

NOTE

When pulling the propeller through by hand, treat it as if the ignition switch is turned on. A loose or broken ground wire on either magneto could cause the engine to fire.

In extremely cold (0°F and lower) weather, the use of an external preheater and an external power source are recommended whenever possible to obtain positive starting and to reduce wear and abuse to the engine and electrical system. Pre-heat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures. When using an external power source, the position of the master switch is important. Refer to Section VII under Ground Service Plug Receptacle for operating details.

Cold weather starting procedures are as follows:

With Preheat:

(1) With ignition switch OFF and throttle closed, prime the engine four to eight strokes as the propeller is being turned over by hand.

NOTE

Use heavy strokes of primer for best atomization of fuel. After priming, push primer all the way in and turn to locked position to avoid possibility of engine drawing fuel through the primer.

(2) Propeller Area -- Clear.
(3) Master Switch -- ON.
(4) Mixture -- Full rich.
(5) Throttle -- Open 1/8".
(6) Ignition Switch -- START.
(7) Release ignition switch to BOTH when engine starts.
(8) Oil Pressure -- Check.

Without Preheat:

(1) Prime the engine six to ten strokes while the propeller is being turned by hand with throttle closed. Leave primer charged and ready for stroke.
(2) Propeller Area -- Clear.
(3) Master Swtich -- ON.
(4) Mixture -- Full rich.
(5) Ignition Switch -- START.
(6) Pump throttle rapidly to full open twice. Return to 1/8" open position.
(7) Release ignition switch to BOTH when engine starts.
(8) Continue to prime engine until it is running smoothly, or alternately pump throttle rapidly over first 1/4 to total travel.
(9) Oil Pressure -- Check.
(10) Pull carburetor heat knob full on after engine has started. Leave on until engine is running smoothly.
(11) Lock Primer.

NOTE

If the engine does not start during the first few attempts, or if the engine firing diminishes in strength, it is probable that the spark plugs have been frosted over. Preheat must be used before another start is attempted.

IMPORTANT

Pumping the throttle may cause raw fuel to accumulate in the intake air duct, creating a fire hazard in the event of a backfire. If this occurs, maintain a cranking action to suck flames into the engine. An outside attendant with a fire extinguisher is advised for cold starts without preheat.

During cold weather operations, no indication will be apparent on the oil temperature gage prior to take-off if outside air temperatures are very cold. After a suitable warm-up period (2 to 5 minutes at 1000 RPM), accelerate the engine several times to higher engine RPM. If the engine accelerates smoothly and the oil pressure remains normal and steady, the aircraft is ready for take-off.

FLIGHT OPERATIONS.

Take-off is made normally with carburetor heat off. Avoid excessive leaning in cruise.

Carburetor heat may be used to overcome any occasional engine roughness due to ice.

When operating in sub-zero temperature, avoid using partial carburetor heat. Partial heat may increase the carburetor air temperature to the 32° to 70°F range, where icing is critical under certain atmospheric conditions.

Refer to Section VII for cold weather equipment.

HOT WEATHER OPERATION.

Refer to the general warm temperature starting information under Starting Engine in this section. Avoid prolonged engine operation on the ground.

NOISE ABATEMENT.

Increased emphasis on improving the quality of our environment requires renewed effort on the part of all pilots to minimize the effect of aircraft noise on the public.

We, as pilots, can demonstrate our concern for environmental improvement, by application of the following suggested procedures, and thereby tend to build public support for aviation:

(1) Pilots operating aircraft under VFR over outdoor assemblies of persons, recreational and park areas, and other noise-sensitive areas should make every effort to fly not less than 2,000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.
(2) During departure from or approach to an airport, climb after take-off and descent for landing should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas.

NOTE

The above recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgement, an altitude of less than 2,000 feet is necessary for him to adequately exercise his duty to see and avoid other aircraft.

Section III

EMERGENCY PROCEDURES

Emergencies caused by aircraft or engine malfunctions are extremely rare if proper pre-flight inspections and maintenance are practiced. Enroute weather emergencies can be minimized or eliminated by careful flight planning and good judgement when unexpected weather is encountered. However, should an emergency arise the basic guidelines described in this section should be considered and applied as necessary to correct the problem.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS.

Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and over-voltage warning light; however, the cause of these malfunctions is usually difficult to determine. A broken alternator drive belt or wiring is most likely the cause of alternator failures, although other factors could cause the problem. A damaged or improperly adjusted voltage regulator can also cause malfunctions. Problems of this nature constitute an electrical emergency and should be dealt with immediately. Electrical power malfunctions usually fall into two categories: excessive rate of charge and insufficient rate of charge. The paragraphs below describe the recommended remedy for each situation.

EXCESSIVE RATE OF CHARGE.

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than two needle widths of charging current. If the charging rate were to remain above this value on a long flight, the battery would overheat and evaporate the electrolyte at an excessive rate. Electronic components in the electrical system could be adversely affected by higher than normal voltage if a faulty voltage regulator setting is causing the

overcharging. To preclude these possibilities, an over-voltage sensor will automatically shut down the alternator and the over-voltage warning light will illuminate if the charge voltage reaches approximately 16 volts. Assuming that the malfunction was only momentary, an attempt should be made to reactivate the alternator system. To do this, turn both sides of the master switch off and then on again. If the problem no longer exists, normal alternator charging will resume and the warning light will go off. If the light comes on again, a malfunction is confirmed. In this event, the flight should be terminated and/or the current drain on the battery minimized because the battery can supply the electrical system for only a limited period of time. If the emergency occurs at night, power must be conserved for later use of the landing light and flaps during landing.

INSUFFICIENT RATE OF CHARGE.

If the ammeter indicates a continuous discharge rate in flight, the alternator is not supplying power to the system and should be shut down since the alternator field circuit may be placing an unnecessary load on the system. All non-essential equipment should be turned OFF and the flight terminated as soon as practical.

ROUGH ENGINE OPERATION OR LOSS OF POWER.

CARBURETOR ICING.

A gradual loss of RPM and eventual engine roughness may result from the formation of carburetor ice. To clear the ice, apply full throttle and pull the carburetor heat knob full out until the engine runs smoothly; then remove carburetor heat and readjust the throttle. If conditions require the continued use of carburetor heat in cruise flight, use the minimum amount of heat necessary to prevent ice from forming and lean the mixture slightly for smoothest engine operation.

SPARK PLUG FOULING.

An engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from BOTH to either LEFT or RIGHT position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the normal lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the BOTH position of the ignition switch unless extreme roughness dictates the use of a single ignition position.

MAGNETO MALFUNCTION.

A sudden engine roughness or misfiring is usually evidence of magneto problems. Switching from BOTH to either LEFT or RIGHT ignition switch position will identify which magneto is malfunctioning. Select different power settings and enrichen the mixture to determine if continued operation on BOTH magnetos is practicable. If not, switch to the good magneto and proceed to the nearest airport for repairs.

LOW OIL PRESSURE.

If low oil pressure is accompanied by normal oil temperature, there is a possibility the oil pressure gage or relief valve is malfunctioning. A leak in the line to the gage is not necessarily cause for an immediate precautionary landing because an orifice in this line will prevent a sudden loss of oil from the engine sump. However, a landing at the nearest airport would be advisable to inspect the source of trouble.

If a total loss of oil pressure is accompanied by a rise in oil temperature, there is reason to suspect an engine failure is imminent. Reduce engine power immediately and select a suitable forced landing field. Leave the engine running at low power during the approach, using only the minimum power required to reach the desired touchdown spot.

FORCED LANDINGS.

PRECAUTIONARY LANDING WITH ENGINE POWER.

Before attempting an "off airport" landing, one should drag the landing area at a safe but low altitude to inspect the terrain for obstructions and surface conditions, proceeding as follows:

(1) Drag over selected field with flaps 20° and 70 MPH airspeed, noting the preferred area for touchdown for the next landing approach. Then retract flaps after well clear of all obstacles.
(2) On downwind leg, turn off all switches except the ignition and master switches.

(3) Approach with flaps 40° at 70 MPH.
(4) Unlatch cabin doors prior to final approach.
(5) Before touchdown, turn off ignition and master switches.
(6) Land in a slightly tail-low attitude.

EMERGENCY LANDING WITHOUT ENGINE POWER.

If an engine stoppage occurs, establish a flaps up glide at 80 MPH. If time permits, attempt to restart the engine by checking for fuel quantity, proper fuel selector valve position, and mixture control setting. Also check that engine primer is full in and locked and ignition switch is properly positioned.

If all attempts to restart the engine fail, and a forced landing is imminent, select a suitable field and prepare for the landing as follows:

(1) Pull mixture control to idle cut-off position.
(2) Turn fuel selector valve handle to OFF.
(3) Turn off all switches except master switch.
(4) Airspeed -- 70 to 80 MPH (flaps up).
(5) Extend wing flaps as necessary within gliding distance of field.
(6) Airspeed -- 65 to 75 MPH (flaps down).
(7) Turn off master switch.
(8) Unlatch cabin doors prior to final approach.
(9) Land in a slightly tail-low attitude.
(10) Apply heavy braking while holding full up elevator.

DITCHING.

Prepare for ditching by securing or jettisoning heavy objects located in the baggage area, and collect folded coats or cushions for protection of occupant's face at touchdown. Transmit Mayday message on 121.5 MHz., giving location and intentions.

(1) Plan approach into wind if winds are high and seas are heavy. With heavy swells and light wind, land parallel to swells.
(2) Approach with flaps 40° and sufficient power for a 300 ft./min. rate of descent at 70 MPH.
(3) Unlatch the cabin doors.
(4) Maintain a continuous descent until touchdown in level attitude. Avoid a landing flare because of difficulty in judging aircraft height over a water surface.
(5) Place folded coat or cushion in front of face at time of touchdown.
(6) Evacuate aircraft through cabin doors. If necessary, open window to flood cabin compartment for equalizing pressure so that door can be opened.
(7) Inflate life vests and raft (if available) after evacuation of cabin. The aircraft can not be depended on for flotation for more than a few minutes.

DISORIENTATION IN CLOUDS.

When flying in marginal weather, if the airplane is not equipped with gyro horizon and directional gyro instruments, the pilot will have to rely on the turn coordinator or the turn and bank indicator if he inadvertently flies into clouds. The following instructions assume than only one of the latter two instruments is available.

EXECUTING A 180° TURN IN CLOUDS.

Upon entering the clouds, an immediate plan should be made to turn back as follows:

(1) Note the time of the minute hand and observe the position of the sweep second hand on the clock.
(2) When the sweep second hand indicates the nearest half-minute, initiate a standard rate left turn, holding the turn coordinator symbolic airplane wing opposite the lower left index mark for 60 seconds. Then roll back to level flight by leveling the miniature airplane.
(3) Check accuracy of the turn by observing the compass heading which should be the reciprocal of the original heading.
(4) If necessary, adjust heading primarily with skidding motions rather than rolling motions so that the compass will read more accurately.
(5) Maintain altitude and airspeed by cautious application of elevator control. Avoid overcontrolling by keeping the hands off the control wheel and steering only with rudder.

EMERGENCY LET-DOWNS THROUGH CLOUDS.

If possible, obtain radio clearance for an emergency descent through clouds. To guard against a spiral dive, choose an easterly or westerly heading to minimize compass card swings due to changing bank angles. In addition, keep hands off the control wheel and steer a straight course with rudder control by monitoring the turn coordinator. Occasionally

check the compass heading and make minor corrections to hold an approximate course. Before descending into the clouds, set up a stabilized let-down condition as follows:

(1) Apply full rich mixture.
(2) Use full carburetor heat.
(3) Reduce power to set up a 500 to 800 ft./min. rate of descent.
(4) Adjust the elevator trim tab for a stabilized descent at 90 MPH.
(5) Keep hands off the control wheel.
(6) Monitor turn coordinator and make corrections by rudder alone.
(7) Check trend of compass card movement and make cautious corrections with rudder to stop the turn.
(8) Upon breaking out of clouds, resume normal cruising flight.

RECOVERY FROM A SPIRAL DIVE.

If a spiral is encountered, proceed as follows:

(1) Close the throttle.
(2) Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon reference line.
(3) Cautiously apply elevator back pressure to slowly reduce the indicated airspeed to 90 MPH.
(4) Adjust the elevator trim control to maintain a 90 MPH glide.
(5) Keep hands off the control wheel, using rudder control to hold a straight heading.
(6) Apply carburetor heat.
(7) Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
(8) Upon breaking out of clouds, apply normal cruising power and resume flight.

FIRES.

ENGINE FIRE DURING START ON GROUND.

Improper starting procedures such as pumping the throttle during a difficult cold weather start can cause a backfire which could ignite fuel that has accumulated in the intake duct. In this event, proceed as follows:

(1) Continue cranking in an attempt to get a start which would suck the flames and accumulated fuel through the carburetor and into the engine.
(2) If the start is successful, run the engine at 1700 RPM for a few minutes before shutting it down to inspect the damage.
(3) If engine start is unsuccessful, continue cranking for two or three minutes with throttle full open while ground attendants obtain fire extinguishers.
(4) When ready to extinguish fire, release the starter switch and turn off master switch, ignition switch, and fuel selector valve handle.
(5) Smother flames with fire extinguisher, seat cushion, wool blanket, or loose dirt. If practical try to remove carburetor air filter if it is ablaze.
(6) Make a thorough inspection of fire damage, and repair or replace damaged components before conducting another flight.

ENGINE FIRE IN FLIGHT.

Although engine fires are extremely rare in flight, the following steps should be taken if one is encountered:

(1) Pull mixture control to idle cut-off.
(2) Turn off fuel selector valve handle.
(3) Turn off master switch.
(4) Establish a 120 MPH glide.
(5) Close cabin heat control.
(6) Select a field suitable for a forced landing.
(7) If fire is not extinguished, increase glide speed in an attempt to find an airspeed that will provide an incombustible mixture.
(8) Execute a forced landing as described in paragraph Emergency Landing Without Engine Power. Do not attempt to restart the engine.

ELECTRICAL FIRE IN FLIGHT.

The initial indication of an electrical fire is the odor of burning insulation. The immediate response should be to turn off the master switch. Then close off ventilating air as much as practicable to reduce the chances of a sustained fire.

If electrical power is indispensable for the flight, an attempt may be made to identify and cut off the defective circuit as follows:

(1) Master Switch -- OFF.

(2) All other switches (except ignition switch) -- OFF
(3) Check condition of circuit breakers to identify faulty circuit if possible. Leave faulty circuit deactivated.
(4) Master Switch -- ON.
(5) Select switches ON successively, permitting a short time delay to elapse after each switch is turned on until the short circuit is localized.
(6) Make sure fire is completely extinguished before opening ventilators.

FLIGHT IN ICING CONDITIONS.

Although flying in known icing conditions is prohibited, an unexpected icing encounter should be handled as follows:

(1) Turn on pitot heat switch (if installed).
(2) Turn back or change altitude to obtain an outside air temperature that is less conducive to icing.
(3) Pull cabin heat control full out and adjust sliding valves in defroster outlet to obtain windshield defroster heat and airflow. Increase the flow of heated air by limited use of the cabin air control.
(4) Open the throttle to increase engine speed and minimize ice build up on propeller blades.
(5) Watch for signs of carburetor air filter ice and apply carburetor heat as required. An unexplained loss in engine speed could be caused by carburetor ice or air intake filter ice.
(6) Plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
(7) With an ice accumulation of one quarter inch or more on the wing leading edges, be prepared for significantly higher stall speed.
(8) Leave wing flaps retracted. With a severe ice build-up on the horizontal tail, the change in wing wake airflow direction caused by wing flap extension could result in a loss of elevator effectiveness.
(9) Open left window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
(10) Perform a landing approach using a forward slip, if necessary, for improved visibility.
(11) Approach at 75 to 85 MPH, depending upon the amount of ice accumulation.
(12) Avoid steep turns during the landing approach.
(13) Perform a landing in level attitude.

EMERGENCY LOCATOR TRANSMITTER (ELT).

The ELT consists of a self-contained dual-frequency radio transmitter and battery power supply, and is activated by an impact of 5g or more as may be experienced in a crash landing. The ELT emits an omnidirectional signal on the international distress frequencies of 121.5 and 243.0 MHz. General aviation and commercial aircraft, the FAA, and CAP monitor 121.5 MHz, and 243.0 MHz is monitored by the military. Following a crash landing, the ELT should function continuously under ideal conditions for 48 hours with line-of-sight transmission up to 100 miles at 10,000 feet.

The ELT is readily identified as a bright orange unit mounted behind a cover in the aft baggage compartment on the right side of the fuselage. To gain access to the unit, pull out on the black fasteners on the bottom of the cover and remove the cover. The ELT is operated by a control panel at the forward facing end of the unit (see figure 3-1).

ELT OPERATION.

(1) NORMAL OPERATION: As long as the function selector switch remains in the ARM position, the ELT automatically activates following an impact of 5g or more.

(2) ELT FAILURE: If "g" switch actuation is questioned following a minor crash landing, gain access to the ELT and place the function selector switch in the ON position.

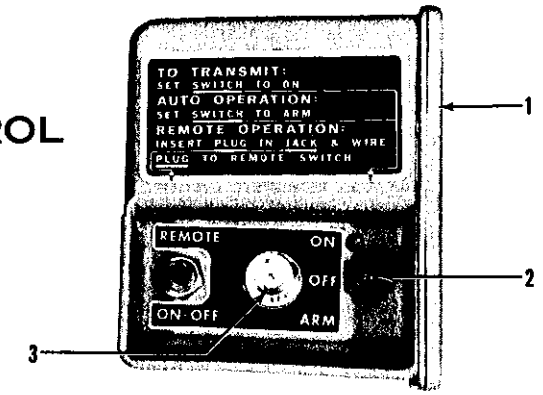
(3) PRIOR TO SIGHTING RESCUE AIRCRAFT: Conserve aircraft battery. Do not activate Nav/Com transceiver.

(4) AFTER SIGHTING RESCUE AIRCRAFT: Place ELT function selector switch in the OFF position, preventing radio interference. Attempt contact with rescue aircraft with the Nav/Com transceiver set to a frequency of 121.5 MHz. If no contact is established, return the function selector switch to ON immediately.

(5) FOLLOWING RESCUE: Place ELT function selector switch in the OFF position, terminating emergency transmissions.

(6) INADVERTENT ACTIVATION: Following a lightning strike or an exceptionally hard landing, the ELT may activate although no emergency exists. Select 121.5 MHz on your Nav/Com transceiver. If

ELT CONTROL PANEL



1. COVER - Removable for access to battery.

2. FUNCTION SELECTOR SWITCH (3-position toggle switch):

   ON - Activates transmitter instantly. Used for test purposes and if "g" switch is inoperative.

   OFF - Deactivates transmitter. Used during shipping, storage and following rescue.

   ARM - Activates transmitter only when "g" switch receives 5g or more impact.

3. ANTENNA RECEPTACLE - Connection to antenna mounted on top of the tailcone.

Figure 3-1.

the ELT can be heard transmitting, place the function selector switch in the OFF position; then immediately return the switch to ARM.

Section IV

OPERATING LIMITATIONS

OPERATIONS AUTHORIZED.

Your Cessna exceeds the requirements of airworthiness as set forth by the United States Government, and is certificated under FAA Type Certificate No. 3A12 as Cessna Model No. 172M.

The airplane may be equipped for day, night, VFR, or IFR operation. Your Cessna Dealer will be happy to assist you in selecting equipment best suited to your needs.

Your airplane must be operated in accordance with all FAA-approved markings and placards in the airplane. If there is any information in this section which contradicts the FAA-approved markings and placards, it is to be disregarded.

MANEUVERS - NORMAL CATEGORY.

This airplane is certificated in both the normal and utility category. The normal category is applicable to airplanes intended for non-aerobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls) and turns in which the angle of bank is not more than 60°. In connection with the foregoing, the following gross weight and flight load factors apply:

Gross Weight	2300 lbs	
Flight Load Factor		
*Flaps Up	+3.8	-1.52
*Flaps Down	+3.0	

*The design load factors are 150% of the above, and in all cases, the structure meets or exceeds design loads.

MANEUVERS - UTILITY CATEGORY.

This airplane is not designed for purely aerobatic flight. However, in the acquisition of various certificates such as commercial pilot, instrument pilot and flight instructor, certain maneuvers are required by the FAA. All of these maneuvers are permitted in this airplane when operated in the utility category. In connection with the utility category, the following gross weight and flight load factors apply, with maximum entry speeds for maneuvers as shown:

Gross Weight	2000 lbs	
Flight Load Factor		
Flaps Up	+4.4	-1.76
Flaps Down	+3.0	

In the utility category, the baggage compartment and rear seat must not be occupied. No aerobatic maneuvers are approved except those listed below:

MANEUVER	RECOMMENDED ENTRY SPEED*
Chandelles	120 mph (104 knots)
Lazy Eights	120 mph (104 knots)
Steep Turns	112 mph (97 knots)
Spins	Slow Deceleration
Stalls (Except Whip Stalls)	Slow Deceleration

*Abrupt use of the controls is prohibited above 112 MPH.

Aerobatics that may impose high loads should not be attempted. The important thing to bear in mind in flight maneuvers is that the aircraft is clean in aerodynamic design and will build up speed quickly with the nose down. Proper speed control is an essential requirement for execution of any maneuver, and care should always be exercised to avoid excessive speed which in turn can impose excessive loads. In the execution of all maneuvers, avoid abrupt use of controls. Intentional spins with flaps extended are prohibited.

AIRSPEED LIMITATIONS (CAS).

The following is a list of the certificated calibrated airspeed (CAS) limitations for the aircraft.

Never Exceed Speed (glide or dive, smooth air)	182 MPH
Maximum Structural Cruising Speed	145 MPH
Maximum Speed, Flaps Extended	100 MPH
*Maneuvering Speed	112 MPH

*The maximum speed at which you may use abrupt control travel.

AIRSPEED INDICATOR MARKINGS.

The following is a list of the certificated calibrated airspeed markings (CAS) for the aircraft.

Never Exceed (glide or dive, smooth air)	182 MPH (red line)
Caution Range	145-182 MPH (yellow arc)
Normal Operating Range	61-145 MPH (green arc)
Flap Operating Range	54-100 MPH (white arc)

ENGINE OPERATION LIMITATIONS.

Power and Speed	150 BHP at 2700 RPM

ENGINE INSTRUMENT MARKINGS.

OIL TEMPERATURE GAGE.

Normal Operating Range	Green Arc
Maximum Allowable	245°F (red line)

OIL PRESSURE GAGE.

Minimum Idling	25 psi (red line)
Normal Operating Range	60-90 psi (green arc)
Maximum	100 psi (red line)

FUEL QUANTITY INDICATORS.

Empty (2.0 gallons unusable each tank) . . . . . E (red line)

TACHOMETER.

Normal Operating Range:

At sea level . . . . . 2200-2500 RPM (inner green arc)
At 5000 feet . . . . . 2200-2600 RPM (middle green arc)
At 10,000 feet . . . . . 2200-2700 RPM (outer green arc)
Maximum Allowable . . . . . 2700 RPM (red line)

CARBURETOR AIR TEMPERATURE GAGE (OPT).

Icing Range . . . . . -15° to 5°C (yellow arc)

WEIGHT AND BALANCE.

The following information will enable you to operate your Cessna within the prescribed weight and center of gravity limitations. To figure weight and balance, use the Sample Loading Problem, Loading Graph, and Center of Gravity Moment Envelope as follows:

Take the licensed empty weight and moment from appropriate weight and balance records carried in your airplane, and write them down in the column titled YOUR AIRPLANE on the Sample Loading Problem.

NOTE

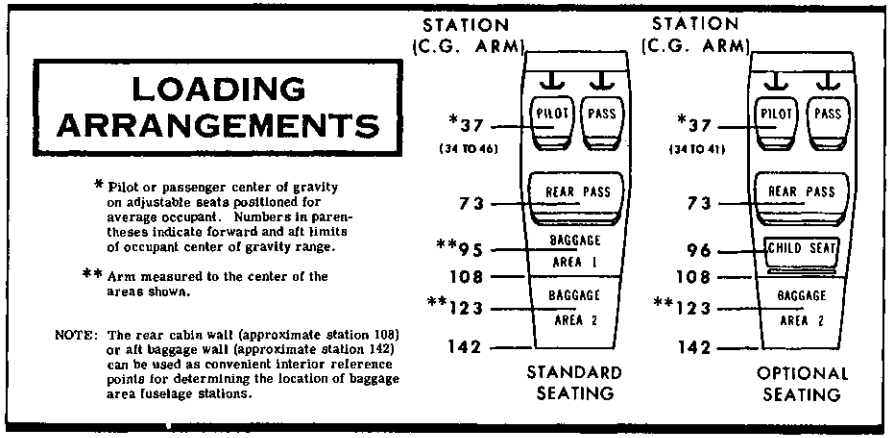
The licensed empty weight and moment are recorded on the Weight and Balance and Installed Equipment Data sheet, or on revised weight and balance records, and are included in the aircraft file. In addition to the licensed empty weight and moment noted on these records, the c.g. arm (fuselage station) is also shown, but need not be used on the Sample Loading Problem. The moment which is shown must be divided by 1000 and this value used as the moment/1000 on the loading problem.

Use the Loading Graph to determine the moment/1000 for each additional item to be carried, then list these on the loading problem.

NOTE

Loading Graph information for the pilot, passengers and baggage is based on seats positioned for average occupants and baggage loaded in the center of the baggage area as shown on the Loading Arrangements diagram. For loadings which may differ from these, the Sample Loading Problem lists fuselage stations for these items to indicate their forward and aft c.g. range limitation (seat travel or baggage area limitation). Additional moment calculations, based on the actual weight and c.g. arm (fuselage station) of the item being loaded, must be made if the position of the load is different from that shown on the Loading Graph.

Total the weights and moments/1000 and plot these values on the Center of Gravity Moment Envelope to determine whether the point falls within the envelope, and if the loading is acceptable.

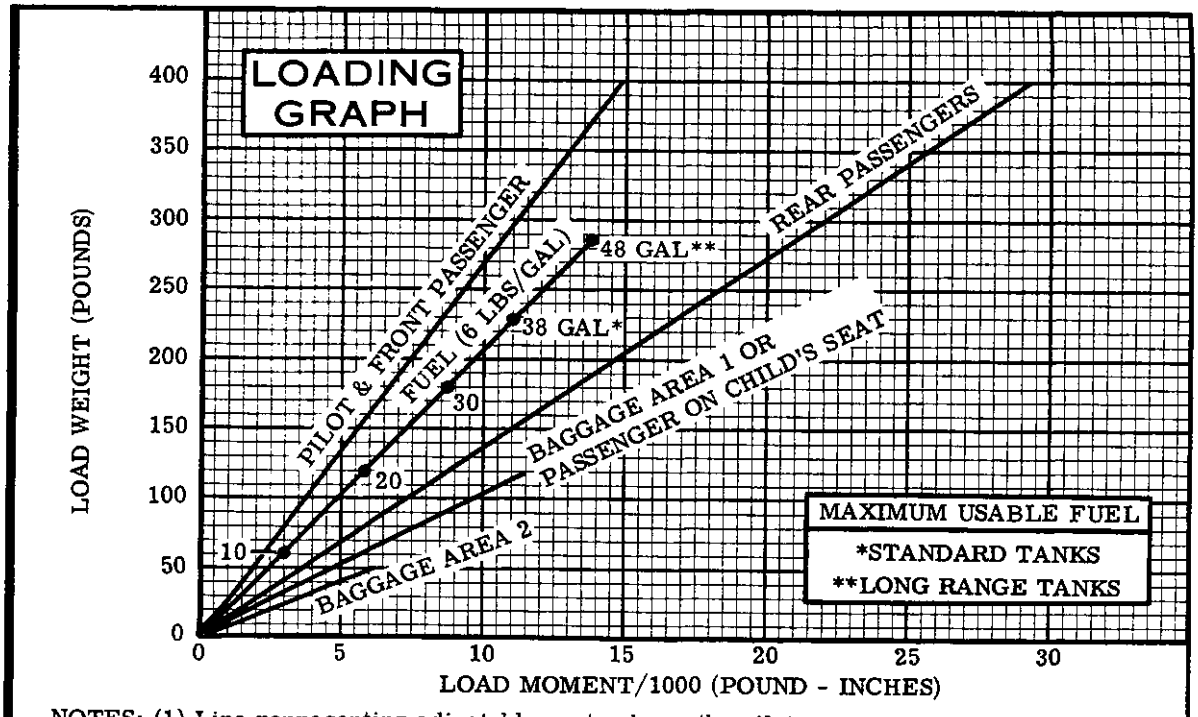


SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE Weight (lbs.)	SAMPLE AIRPLANE Moment (lb.-ins. /1000)	YOUR AIRPLANE Weight (lbs.)	YOUR AIRPLANE Moment (lb.-ins. /1000)
1. Licensed Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel.)	1366	53.8		
2. Oil (8 Qts. - The weight of full oil may be used for all calculations. 8 Qts. = 15 Lbs. at -0.2 Moment/1000)	15	-0.2	15	-0.2
3. Usable Fuel (At 6 Lbs./Gal.)				
Standard Tanks (38 Gal. Maximum)	228	10.9		
Long Range Tanks (48 Gal. Maximum)				
4. Pilot and Front Passenger (Station 34 to 46)	340	12.6		
5. Rear Passengers	340	24.8		
6.*Baggage Area 1 or Passenger on Child's Seat (Station 82 to 108) 120 Lbs. Max.	11	1.0		
7.*Baggage Area 2 (Station 108 to 142) 50 Lbs. Max.				
8. TOTAL WEIGHT AND MOMENT	2300	102.9		

9. Locate this point (2300 at 102.9) on the Center of Gravity Moment Envelope, and since this point falls within the envelope, the loading is acceptable.

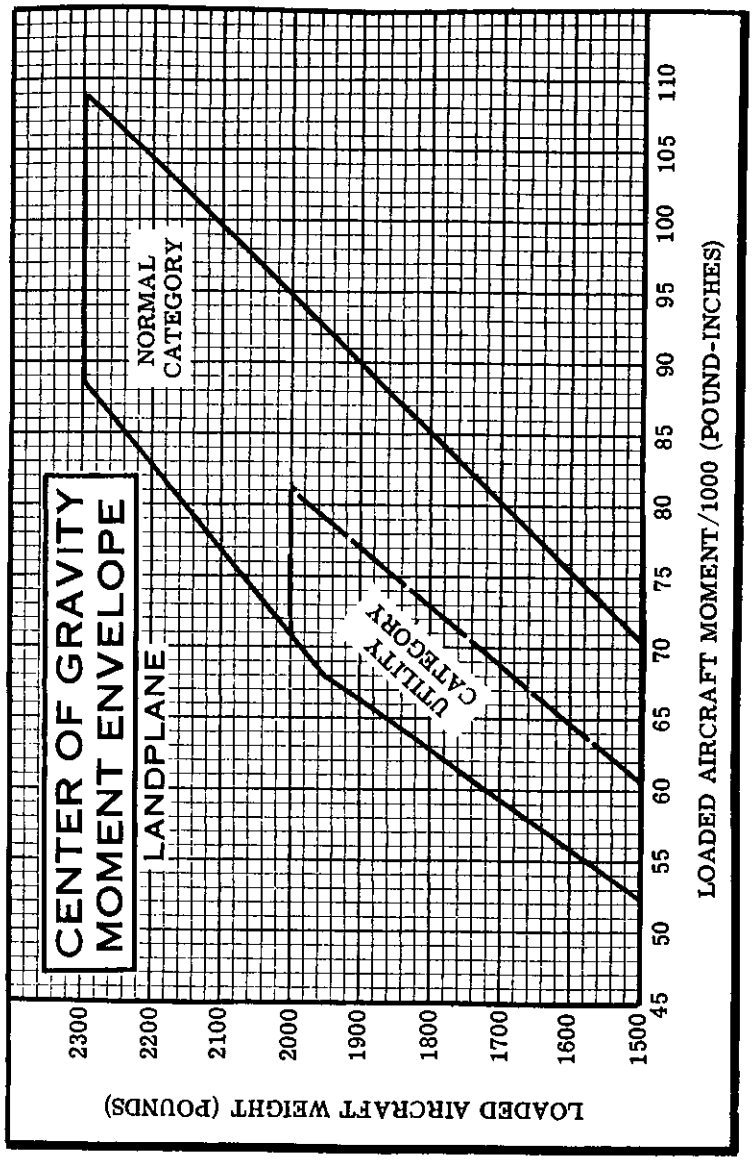
NOTE

* The maximum allowable combined weight capacity for baggage areas 1 and 2 is 120 lbs.



NOTES: (1) Line representing adjustable seats shows the pilot or passenger center of gravity on adjustable seats positioned for an average occupant. Refer to the Loading Arrangements diagram for forward and aft limits of occupant c.g. range.

(2) Engine Oil: 8 Qts. = 15 Lbs. at -0.2 Moment/1000.



Section V

CARE OF THE AIRPLANE

If your airplane is to retain that new plane performance and dependability, certain inspection and maintenance requirements must be followed. It is wise to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered in your locality.

Keep in touch with your Cessna Dealer and take advantage of his knowledge and experience. He knows your airplane and how to maintain it. He will remind you when lubrications and oil changes are necessary, and about other seasonal and periodic services.

GROUND HANDLING.

The airplane is most easily and safely maneuvered by hand with the tow-bar attached to the nose wheel. When towing with a vehicle, do not exceed the nose gear turning angle of 30° either side of center, or damage to the gear will result. If the airplane is towed or pushed over a rough surface during hangaring, watch that the normal cushioning action of the nose strut does not cause excessive vertical movement of the tail and the resulting contact with low hangar doors or structure. A flat nose wheel tire or deflated strut will also increase tail height.

MOORING YOUR AIRPLANE.

Proper tie-down procedure is your best precaution against damage to your parked airplane by gusty or strong winds. To tie down your airplane securely, proceed as follows:

(1) Set the parking brake and install the control wheel lock.
(2) Tie sufficiently strong ropes or chains (700 pounds tensile strength) to wing, tail and nose tie-down rings and secure each rope to a ramp tie-down.

(3) Install a surface control lock over the fin and rudder.
(4) Install a pitot tube cover.

WINDSHIELD - WINDOWS.

The plastic windshield and windows should be cleaned with an aircraft windshield cleaner. Apply the cleaner sparingly with soft cloths, and rub with moderate pressure until all dirt, oil scum and bug stains are removed. Allow the cleaner to dry, then wipe it off with soft flannel cloths.

If a windshield cleaner is not available, the plastic can be cleaned with soft cloths moistened with Stoddard solvent to remove oil and grease.

NOTE

Never use gasoline, benzine, alcohol, acetone, carbon tetrachloride, fire extinguisher or anti-ice fluid, lacquer thinner or glass cleaner to clean the plastic. These materials will attack the plastic and may cause it to craze.

Follow by carefully washing with a mild detergent and plenty of water. Rinse thoroughly, then dry with a clean moist chamois. Do not rub the plastic with a dry cloth since this builds up an electrostatic charge which attracts dust. Waxing with a good commercial wax will finish the cleaning job. A thin, even coat of wax, polished out by hand with clean soft flannel cloths, will fill in minor scratches and help prevent further scratching.

Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated since the cover may scratch the plastic surface.

PAINTED SURFACES.

The painted exterior surfaces of your new Cessna have a durable, long lasting finish and, under normal conditions, require no polishing or buffing. Approximately 15 days are required for the paint to cure completely; in most cases, the curing period will have been completed prior to delivery of the airplane. In the event that polishing or buffing is required within the curing period, it is recommended that the work be done by someone experienced in handling uncured paint. Any Cessna Dealer can accomplish this work.

Generally, the painted surfaces can be kept bright by washing with water and mild soap, followed by a rinse with water and drying with cloths or a chamois. Harsh or abrasive soaps or detergents which cause corrosion or scratches should never be used. Remove stubborn oil and grease with a cloth moistened with Stoddard solvent.

Waxing is unnecessary to keep the painted surfaces bright. However, if desired, the airplane may be waxed with a good automotive wax. A heavier coating of wax on the leading edges of the wings and tail and on the engine nose cap and propeller spinner will help reduce the abrasion encountered in these areas.

When the airplane is parked outside in cold climates and it is necessary to remove ice before flight, care should be taken to protect the painted surfaces during ice removal with chemical liquids. A 50-50 solution of isopropyl alcohol and water will satisfactorily remove ice accumulations without damaging the paint. A solution with more than 50% alcohol is harmful and should be avoided. While applying the de-icing solution, keep it away from the windshield and cabin windows since the alcohol will attack the plastic and may cause it to craze.

ALUMINUM SURFACES.

The clad aluminum surfaces of your Cessna may be washed with clear water to remove dirt; oil and grease may be removed with gasoline, naphtha, carbon tetrachloride or other non-alkaline solvents. Dulled aluminum surfaces may be cleaned effectively with an aircraft aluminum polish.

After cleaning, and periodically thereafter, waxing with a good automotive wax will preserve the bright appearance and retard corrosion. Regular waxing is especially recommended for airplanes operated in salt water areas as a protection against corrosion.

PROPELLER CARE.

Preflight inspection of propeller blades for nicks, and wiping them occasionally with an oily cloth to clean off grass and bug stains will assure long, trouble-free service. Small nicks on the propeller, particularly near the tips and on the leading edges, should be dressed out as soon as possible since these nicks produce stress concentrations, and if

ignored, may result in cracks. Never use an alkaline cleaner on the blades; remove grease and dirt with carbon tetrachloride or Stoddard solvent.

INTERIOR CARE.

To remove dust and loose dirt from the upholstery and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly, with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot-clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

Soiled upholstery and carpet may be cleaned with foam-type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

If your airplane is equipped with leather seating, cleaning of the seats is accomplished using a soft cloth or sponge dipped in mild soap suds. The soap suds, used sparingly, will remove traces of dirt and grease. The soap should be removed with a clean damp cloth.

The plastic trim, headliner, instrument panel and control knobs need only be wiped off with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with Stoddard solvent. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the plastic.

MAA PLATE/FINISH AND TRIM PLATE.

Information concerning the Type Certificate Number (TC), Production Certificate Number (PC), Model Number and Serial Number of your particular aircraft can be found on the MAA (Manufacturers Aircraft Association) plate located on the lower part of the left forward door post.

A Finish and Trim plate contains a code describing the interior color scheme and exterior paint combination of the aircraft. The code may be used in conjunction with an applicable Parts Catalog if finish and trim information is needed. This plate is located adjacent to the MAA plate on the left forward door post.

AIRCRAFT FILE.

There are miscellaneous data, information and licenses that are a part of the aircraft file. The following is a check list for that file. In addition, a periodic check should be made of the latest Federal Aviation Regulations to ensure that all data requirements are met.

A. To be displayed in the aircraft at all times:

(1) Aircraft Airworthiness Certificate (FAA Form 8100-2).
(2) Aircraft Registration Certificate (FAA Form 8050-3).
(3) Aircraft Radio Station License, if transmitter installed (FCC Form 556).

B. To be carried in the aircraft at all times:

(1) Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
(2) Aircraft Equipment List.

C. To be made available upon request:

(1) Aircraft Log Book.
(2) Engine Log Book.

Most of the items listed are required by the United States Federal Aviation Regulations. Since the regulations of other nations may require other documents and data, owners of exported aircraft should check with their own aviation officials to determine their individual requirements.

Cessna recommends that these items, plus the Owner's Manual, Power Computer, Pilot's Check List, Customer Care Program book and Customer Care Card, be carried in the aircraft at all times.

FLYABLE STORAGE.

Aircraft placed in non-operational storage for a maximum of 30 days or those which receive only intermittent operational use for the first 25 hours are considered in flyable storage status. Every seventh day during these periods, the propeller should be rotated by hand through five revolutions. This action "limbers" the oil and prevents any accumulation of corrosion on engine cylinder walls.

IMPORTANT

For maximum safety, check that the ignition switch is OFF, the throttle is closed, the mixture control is in the idle cut-off position, and the airplane is secured before rotating the propeller by hand. Do not stand within the arc of the propeller blades while turning the propeller.

After 30 days, the aircraft should be flown for 30 minutes or a ground runup should be made just long enough to produce an oil temperature within the lower green arc range. Excessive ground runup should be avoided.

Engine runup also helps to eliminate excessive accumulations of water in the fuel system and other air spaces in the engine. Keep fuel tanks full to minimize condensation in the tanks. Keep the battery fully charged to prevent the electrolyte from freezing in cold weather. If the aircraft is to be stored temporarily, or indefinitely, refer to the Service Manual for proper storage procedures.

INSPECTION REQUIREMENTS.

As required by Federal Aviation Regulations, all civil aircraft of U.S. registry must undergo a complete inspection (annual) each twelve calendar months. In addition to the required ANNUAL inspection, aircraft operated commercially (for hire) must have a complete inspection every 100 hours of operation.

In lieu of the above requirements, an aircraft may be inspected in accordance with a progressive inspection schedule, which allows the work load to be divided into smaller operations that can be accomplished in shorter time periods.

The CESSNA PROGRESSIVE CARE PROGRAM has been developed to provide a modern progressive inspection schedule that satisfies the complete aircraft inspection requirements of both the 100 HOUR and ANNUAL inspections as applicable to Cessna aircraft.

CESSNA PROGRESSIVE CARE.

The Cessna Progressive Care Program has been designed to help you realize maximum utilization of your aircraft at a minimum cost and downtime. Under this program, your aircraft is inspected and maintained in four operations at 50-hour intervals during a 200-hour period. The operations are recycled each 200 hours and are recorded in a specially provided Aircraft Inspection Log as each operation is conducted.

The Cessna Aircraft Company recommends Progressive Care for aircraft that are being flown 200 hours or more per year, and the 100-hour inspection for all other aircraft. The procedures for the Progressive Care Program and the 100-hour inspection have been carefully worked out by the factory and are followed by the Cessna Dealer Organization. The complete familiarity of Cessna Dealers with Cessna equipment and factory-approved procedures provides the highest level of service possible at lower cost to Cessna owners.

CESSNA CUSTOMER CARE PROGRAM.

Specific benefits and provisions of the CESSNA WARRANTY plus other important benefits for you are contained in your CUSTOMER CARE PROGRAM book supplied with your aircraft. You will want to thoroughly review your Customer Care Program book and keep it in your aircraft at all times.

Coupons attached to the Program book entitle you to an initial inspection and either a Progressive Care Operation No. 1 or the first 100-hour inspection within the first 6 months of ownership at no charge to you. If you take delivery from your Dealer, the initial inspection will have been performed before delivery of the aircraft to you. If you pick up your aircraft at the factory, plan to take it to your Dealer reasonably soon after you take delivery, so the initial inspection may be performed allowing the Dealer to make any minor adjustments which may be necessary.

You will also want to return to your Dealer either at 50 hours for your first Progressive Care Operation, or at 100 hours for your first 100-hour inspection depending on which program you choose to establish for your aircraft. While these important inspections will be performed for you by any Cessna Dealer, in most cases you will prefer to have the Dealer from whom you purchased the aircraft accomplish this work.

SERVICING REQUIREMENTS.

For quick and ready reference, quantities, materials, and specifications for frequently used service items (such as fuel, oil, etc.) are shown on the inside back cover of this manual.

In addition to the EXTERIOR INSPECTION covered in Section I, COMPLETE servicing, inspection, and test requirements for your aircraft are detailed in the aircraft Service Manual. The Service Manual outlines all items which require attention at 50, 100, and 200 hour intervals plus those items which require servicing, inspection, and/or testing at special intervals.

Since Cessna Dealers conduct all service, inspection, and test procedures in accordance with applicable Service Manual, it is recommended that you contact your Dealer concerning these requirements and begin scheduling your aircraft for service at the recommended intervals.

Cessna Progressive Care ensures that these requirements are accomplished at the required intervals to comply with the 100-hour or ANNUAL inspection as previously covered.

Depending on various flight operations, your local Government Aviation Agency may require additional service, inspections, or tests. For these regulatory requirements, owners should check with local aviation officials where the aircraft is being operated.

OWNER FOLLOW-UP SYSTEM.

Your Cessna Dealer has an Owner Follow-Up System to notify you when he receives information that applies to your Cessna. In addition, if you wish, you may choose to receive similar notification, in the form of Service Letters, directly from the Cessna Customer Services Department.

A subscription form is supplied in your Customer Care Program book for your use, should you choose to request this service. Your Cessna Dealer will be glad to supply you with details concerning these follow-up programs, and stands ready, through his Service Department, to supply you with fast, efficient, low-cost service.

PUBLICATIONS.

Various publications and flight operation aids are furnished in the aircraft when delivered from the factory. These items are listed below.

- CUSTOMER CARE PROGRAM BOOK
- OWNER'S MANUALS FOR YOUR
  AIRCRAFT
  AVIONICS AND AUTOPILOT
- POWER COMPUTER
- SALES AND SERVICE DEALER DIRECTORY

Tne following additional publications, plus many other supplies that are applicable to your aircraft, are available from your Cessna Dealer.

- SERVICE MANUALS AND PARTS CATALOGS FOR YOUR
  AIRCRAFT
  ENGINE AND ACCESSORIES
  AVIONICS AND AUTOPILOT

Your Cessna Dealer has a current catalog of all Customer Services Supplies that are available, many of which he keeps on hand. Supplies which are not in stock, he will be happy to order for you.

Section VI

OPERATIONAL DATA

The operational data shown on the following pages are compiled from actual tests with the aircraft and engine in good condition and using average piloting technique. You will find this data a valuable aid when planning your flights.

A power setting selected from the range chart usually will be more efficient than a random setting, since it will permit you to estimate your fuel consumption more accurately. You will find that using the charts and your Power Computer will pay dividends in overall efficiency.

Cruise and range performance shown in this section is based on the use of a McCauley 1C160/DTM7553 (or CTM7553) propeller and a standard equipped Skyhawk. Other conditions for the performance data are shown in the chart headings. Allowances for fuel reserve, headwinds, take-off and climb, and variations in mixture leaning technique should be made and are in addition to those shown on the chart. Other indeterminate variables such as carburetor metering characteristics, engine and propeller conditions, externally-mounted optional equipment and turbulence of the atmosphere may account for variations of 10% or more in maximum range.

Remember that the charts contained herein are based on standard day conditions. For more precise power, fuel consumption, and endurance information, consult the Cessna Power Computer supplied with your aircraft. With the Power Computer, you can easily take into account temperature variations from standard at any flight altitude.

AIRSPEED CORRECTION TABLE

	IAS	40	50	60	70	80	90	100	110	120	130	140
FLAPS UP	CAS	53	58	64	72	79	88	97	107	117	127	137
FLAPS DOWN	CAS	49	55	63	72	81	90	100	•	•	•	•

Figure 6-1.

STALL SPEEDS – MPH CAS

	CONDITION	ANGLE OF BANK 0°	20°	40°	60°
2300 LBS. GROSS WEIGHT	FLAPS UP	57	59	65	81
	FLAPS 10°	52	54	59	74
	FLAPS 40°	49	51	56	69

POWER OFF — AFT CG

Figure 6-2.

TAKE-OFF DATA

TAKE-OFF DISTANCE FROM HARD SURFACE RUNWAY WITH FLAPS UP

GROSS WEIGHT POUNDS	IAS AT 50' MPH	HEAD WIND KNOTS	AT SEA LEVEL & 59°F GROUND RUN	AT SEA LEVEL & 59°F TOTAL TO CLEAR 50 FT OBS	AT 2500 FT. & 50°F GROUND RUN	AT 2500 FT. & 50°F TOTAL TO CLEAR 50 FT OBS	AT 5000 FT. & 41°F GROUND RUN	AT 5000 FT. & 41°F TOTAL TO CLEAR 50 FT OBS	AT 7500 FT. & 32°F GROUND RUN	AT 7500 FT. & 32°F TOTAL TO CLEAR 50 FT OBS
2300	68	0	865	1525	1040	1910	1255	2480	1565	3855
		10	615	1170	750	1485	920	1955	1160	3110
		20	405	850	505	1100	630	1480	810	2425
2000	63	0	630	1095	755	1325	905	1625	1120	2155
		10	435	820	530	1005	645	1250	810	1685
		20	275	580	340	720	425	910	595	1255
1700	58	0	435	780	520	920	625	1095	765	1370
		10	290	570	355	680	430	820	535	1040
		20	175	385	215	470	270	575	345	745

NOTES:
1. Increase distance 10% for each 25°F above standard temperature for particular altitude.
2. For operation on a dry, grass runway, increase distances (both "ground run" and "total to clear 50 ft. obstacle") by 7% of the "total to clear 50 ft. obstacle" figure.

MAXIMUM RATE-OF-CLIMB DATA

GROSS WEIGHT POUNDS	AT SEA LEVEL & 59°F IAS MPH	AT SEA LEVEL & 59°F RATE OF CLIMB FT/MIN	AT SEA LEVEL & 59°F GAL. OF FUEL USED	AT 5000 FT. & 41°F IAS MPH	AT 5000 FT. & 41°F RATE OF CLIMB FT/MIN	AT 5000 FT. & 41°F FROM S.L. FUEL USED	AT 10,000 FT. & 23°F IAS MPH	AT 10,000 FT. & 23°F RATE OF CLIMB FT/MIN	AT 10,000 FT. & 23°F FROM S.L. FUEL USED	AT 15,000 FT. & 5°F IAS MPH	AT 15,000 FT. & 5°F RATE OF CLIMB FT/MIN	AT 15,000 FT. & 5°F FROM S.L. FUEL USED
2300	91	645	1.0	85	435	2.6	80	230	4.8	73	20	11.5
2000	88	840	1.0	81	610	2.2	75	380	3.6	68	155	6.3
1700	83	1085	1.0	77	825	1.9	70	570	2.9	64	315	4.4

NOTES:
1. Flaps up, full throttle, mixture leaned for smooth operation above 3000 ft.
2. Fuel used includes warm up and take-off allowance.
3. For hot weather, decrease rate of climb 20 ft./min. for each 10°F above standard day temperature for particular altitude.

Figure 6-3.

CRUISE PERFORMANCE

SKYHAWK

Gross Weight- 2300 Lbs.
Standard Conditions
Zero Wind Lean Mixture

NOTE: Maximum cruise is normally limited to 75% power. Cruise speeds for the standard Model 172 are 1 to 3 MPH lower than shown with the maximum difference occurring at higher powers.

ALTITUDE	RPM	% BHP	TAS MPH	GAL/ HOUR	38 GAL (NO RESERVE)		48 GAL (NO RESERVE)	
					ENDR. HOURS	RANGE MILES	ENDR. HOURS	RANGE MILES
2500	2700	87	139	9.6	3.9	545	5.0	690
	2600	78	133	8.6	4.4	590	5.6	745
	2500	70	128	7.7	4.9	630	6.2	795
	2400	63	122	7.1	5.3	655	6.7	825
	2300	57	116	6.6	5.7	665	7.2	840
	2200	51	109	6.2	6.1	665	7.7	840
5000	2700	81	138	8.9	4.3	585	5.4	740
	2600	73	133	8.1	4.7	630	6.0	795
	2500	66	128	7.4	5.1	655	6.5	830
	2400	60	121	6.8	5.6	675	7.0	850
	2300	54	114	6.4	5.9	675	7.5	855
	2200	48	107	6.0	6.3	675	8.0	850
7500	2700	76	138	8.4	4.5	630	5.7	795
	2600	69	133	7.6	5.0	660	6.3	835
	2500	63	126	7.1	5.4	675	6.8	855
	2400	57	119	6.6	5.8	685	7.3	865
	2300	51	112	6.2	6.1	685	7.8	865
10,000	2700	72	138	7.9	4.8	665	6.1	840
	2600	66	131	7.3	5.2	685	6.6	860
	2500	59	124	6.8	5.6	695	7.1	875
	2400	54	117	6.4	6.0	700	7.5	880
	2300	48	110	6.0	6.3	700	8.0	880
12,500	2650	65	132	7.2	5.3	695	6.6	880
	2500	56	122	6.5	5.8	710	7.3	895
	2400	51	115	6.2	6.2	710	7.8	895

Figure 6-4.

LANDING DATA

LANDING DISTANCE ON HARD SURFACE RUNWAY
NO WIND – 40° FLAPS – POWER OFF

GROSS WEIGHT LBS.	APPROACH IAS MPH	AT SEA LEVEL & 59°F		AT 2500 FT. & 50°F		AT 5000 FT. & 41°F		AT 7500 FT. & 32°F	
		GROUND ROLL	TOTAL TO CLEAR 50' OBS.	GROUND ROLL	TOTAL TO CLEAR 50' OBS.	GROUND ROLL	TOTAL TO CLEAR 50' OBS.	GROUND ROLL	TOTAL TO CLEAR 50' OBS.
2300	70	520	1250	560	1310	605	1385	650	1455

NOTES: 1. Reduce landing distance 10% for each 5 knot headwind.
2. For operation on a dry, grass runway, increase distances (both "ground roll" and "total to clear 50 ft. obstacle") by 20% of the "total to clear 50 ft. obstacle" figure.

Figure 6-5.

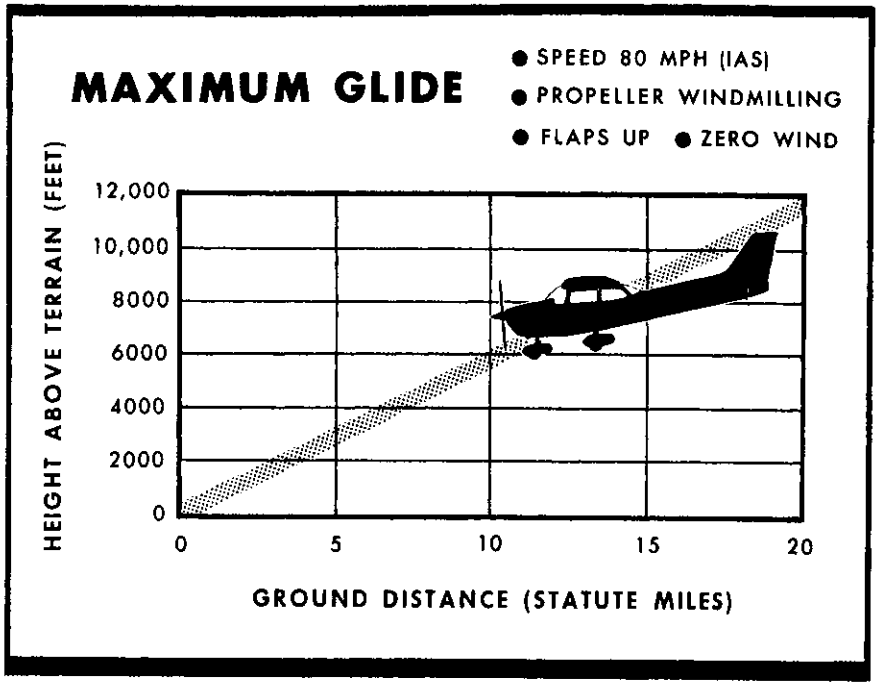


Figure 6-6.

Section VII

OPTIONAL SYSTEMS

This section contains a description, operating procedures, and performance data (when applicable) for some of the optional equipment which may be installed in your Cessna. Owner's Manual Supplements are provided to cover operation of other optional equipment systems when installed in your airplane. Contact your Cessna Dealer for a complete list of available optional equipment.

COLD WEATHER EQUIPMENT

WINTERIZATION KIT.

For continuous operation in temperatures consistently below 20°F, the Cessna winterization kit, available from your Cessna Dealer, should be installed to improve engine operation. The kit consists of two baffles which attach to the engine air intakes in the cowling, a restrictive cover plate for the oil cooler air inlet in the right rear vertical engine baffle, and insulation for the crankcase breather line. Once installed, the crankcase breather insulation is approved for permanent use in both cold and hot weather.

GROUND SERVICE PLUG RECEPTACLE.

A ground service plug receptacle may be installed to permit use of an external power source for cold weather starting and during lengthy maintenance work on the airplane electrical system (with the exception of electronic equipment).

NOTE

Electrical power for the airplane electrical circuits is pro-

vided through a split bus bar having all electronic circuits on one side of the bus and other electrical circuits on the other side of the bus. When an external power source is connected, a contactor automatically opens the circuit to the electronic portion of the split bus bar as a protection against damage to the transistors in the electronic equipment by transient voltages from the power source. Therefore, the external power source can not be used as a source of power when checking electronic components.

Just before connecting an external power source (generator type or battery cart), the master switch should be turned on.

The ground service plug receptacle circuit incorporates a polarity reversal protection. Power from the external power source will flow only if the ground service plug is correctly connected to the airplane. If the plug is accidentally connected backwards, no power will flow to the airplane's electrical system, thereby preventing any damage to electrical equipment.

The battery and external power circuits have been designed to completely eliminate the need to "jumper" across the battery contactor to close it for charging a completely "dead" battery. A special fused circuit in the external power system supplies the needed "jumper" across the contacts so that with a "dead" battery and an external power source applied, turning on the master switch will close the battery contactor.

STATIC PRESSURE ALTERNATE SOURCE VALVE.

A static pressure alternate source valve may be installed in the static system for use when the external static source is malfunctioning.

If erroneous instrument readings are suspected due to water or ice in the static pressure lines, the static pressure alternate source valve control knob located below the wing flap switch should be opened, thereby supplying static pressure from the cabin. Cabin pressures will vary, however, with open cabin ventilators or windows. The most adverse combinations will result in airspeed and altimeter variations of no more than 2 MPH and 15 feet, respectively.

RADIO SELECTOR SWITCHES

RADIO SELECTOR SWITCH OPERATION.

Operation of the radio equipment is normal as covered in the respective radio manuals. When more than one radio is installed, an audio switching system is necessary. The operation of this switching system is described below.

TRANSMITTER SELECTOR SWITCH.

The transmitter selector switch, labeled TRANS, has two positions. When two transmitters are installed, it is necessary to switch the microphone to the radio unit the pilot desires to use for transmission. This is accomplished by placing the transmitter selector switch in the position corresponding to the radio unit which is to be used. The up position selects the upper transmitter and the down position selects the lower transmitter.

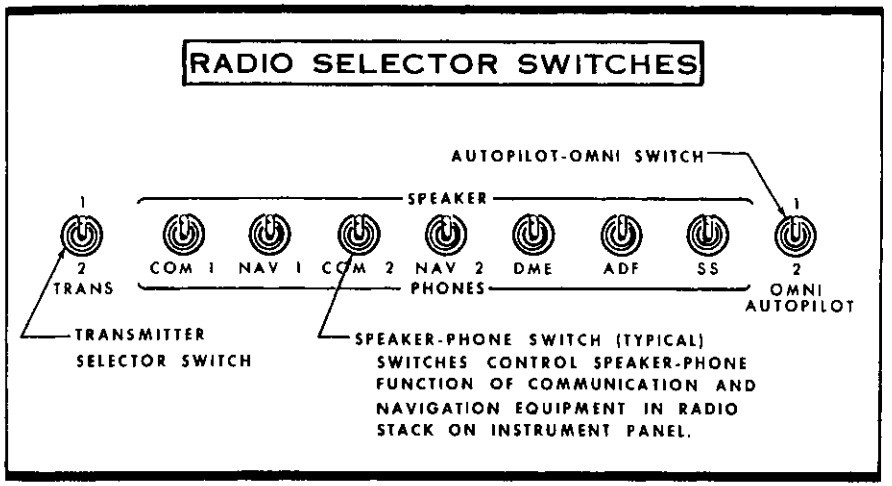


Figure 7-1.

The installation of Cessna radio equipment provides certain audio back-up capabilities and transmitter selector switch functions that the pilot should be familiar with. When the transmitter selector switch is placed in position 1 or 2, the audio amplifier of the corresponding transceiver is utilized to provide the speaker audio for all radios. If the audio amplifier in the selected transceiver fails, as evidenced by loss of speaker audio for all radios, place the transmitter selector switch in the other transceiver position. Since an audio amplifier is not utilized for headphones, a malfunctioning amplifier will not affect headphone operation.

SPEAKER PHONE SWITCHES.

The speaker-phone switches determine whether the output of the receiver in use is fed to the headphones or through the audio amplifier to the speaker. Place the switch for the desired receiving system either in the up position for speaker operation or in the down position for headphones.

AUTOPILOT-OMNI SWITCH.

When a Nav-O-Matic autopilot is installed with two compatible omni receivers, an autopilot-omni switch is utilized. This switch selects the omni receiver to be used for the omni course sensing function of the autopilot. The up position selects the upper omni receiver in the radio panel stack and the down position selects the lower omni receiver.

MICROPHONE-HEADSET

A microphone-headset combination is offered as optional equipment. Using the microphone-headset and a microphone keying switch on the left side of the pilot's control wheel, the pilot can conduct radio communications without interrupting other control operations to handle a hand-held microphone. Also, passengers need not listen to all communications. The microphone and headset jacks are located near the lower left corner of the instrument panel.

TRUE AIRSPEED INDICATOR

A true airspeed indicator is available to replace the standard airspeed indicator in your airplane. The true airspeed indicator has a calibrated rotatable ring which works in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer.

TO OBTAIN TRUE AIRSPEED, rotate ring until pressure altitude is aligned with outside air temperature in degrees Fahrenheit. Then read true airspeed on rotatable ring opposite airspeed needle.

NOTE

Pressure altitude should not be confused with indicated altitude. To obtain pressure altitude, set barometric scale on altimeter to "29.92" and read pressure altitude on altimeter. Be sure to return altimeter barometric scale to original barometric setting after pressure altitude has been obtained.

FUEL TANK QUICK-DRAIN VALVE KIT

Two fuel tank quick-drain valves and a fuel sampler cup are available as a kit to facilitate daily draining and inspection of fuel in the main tanks for the presence of water and sediment. The valves replace existing fuel tank drain plugs located at the lower inboard area of the wing. The fuel sampler cup, which may be stowed in the map compartment, is used to drain the valves. The sampler cup has a probe in the center of the cup. When the probe is inserted into the hole in the bottom of the drain valve and pushed upward, fuel flows into the cup to facilitate visual inspection of the fuel. As the cup is removed, the drain valve seats, stopping the flow of fuel.

OIL QUICK-DRAIN VALVE

An oil quick-drain valve is optionally offered to replace the drain plug in the oil sump drain port. The valve provides a quicker and cleaner method of draining engine oil. To drain the oil with this valve installed, slip a hose over the end of the valve, route the hose to a suitable container, then push upward on the end of the valve until it snaps into the open position. Spring clips will hold the valve open. After draining, use a screwdriver or suitable tool to snap the valve into the extended (closed) position and remove the drain hose.

CARBURETOR AIR TEMPERATURE GAGE

A carburetor air temperature gage may be installed in the aircraft to help detect carburetor icing conditions. The gage is marked with a yellow arc between -15° and +5°C. The yellow arc indicates the carburetor temperature range where carburetor icing can occur; a placard on the gage reads KEEP NEEDLE OUT OF YELLOW ARC DURING POSSIBLE ICING CONDITIONS.

Visible moisture or high humidity can cause carburetor ice formation, especially in idle or low power conditions. Under cruising conditions, the formation of ice is usually slow, providing time to detect the loss of RPM caused by the ice. Carburetor icing during take-off is rare since the full-open throttle condition is less susceptible to ice obstruction.

If the carburetor air temperature gage needle moves into the yellow arc during potential carburetor icing conditions, or there is an unexplained drop in RPM, apply full carburetor heat. Upon regaining the original RPM (with heat off), determine by trial and error the minimum amount of carburetor heat required for ice-free operation.

NOTE

Carburetor heat should not be applied during take-off unless absolutely necessary to obtain smooth engine acceleration (usually in sub-zero temperatures).

SERVICING REQUIREMENTS*

ENGINE OIL:

GRADE -- Aviation Grade SAE 50 Above 60°F.
Aviation Grade SAE 10W30 or SAE 30 Between 0° and 70°F.
Aviation Grade SAE 10W30 or SAE 20 Below 10°F.
Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting in cold weather. Detergent or dispersant oil, conforming to Specification No. MIL-L-22851, must be used.

NOTE

Your Cessna was delivered from the factory with a corrosion preventive aircraft engine oil If oil must be added during the first 25 hours, use only aviation grade straight mineral oil (non-detergent) conforming to Specification No. MIL-L-6082.

CAPACITY OF ENGINE SUMP -- 8 Quarts.
Do not operate on less than 6 quarts. To minimize loss of oil through breather, fill to 7 quart level for normal flights of less than 3 hours. For extended flight, fill to 8 quarts. These quantities refer to oil dipstick level readings. During oil and oil filter changes, one additional quart is required when the filter element is changed.
OIL AND OIL FILTER CHANGE---
After the first 25 hours of operation, drain engine oil sump and oil cooler and clean both the oil suction strainer and the oil pressure screen. If an optional oil filter is installed, change filter element at this time. Refill sump with straight mineral oil (non-detergent) and use until a total of 50 hours has accumulated or oil consumption has stabilized; then change to detergent oil. On aircraft not equipped with an optional oil filter, drain the engine oil sump and oil cooler and clean both the oil suction strainer and the oil pressure screen each 50 hours thereafter. On aircraft which have an optional oil filter, the oil change interval may be extended to 100-hour intervals, providing the oil filter element is changed at 50-hour intervals. Change engine oil at least every 6 months even though less than the recommended hours have accumulated. Reduce intervals for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.

SERVICING REQUIREMENTS*

FUEL:

GRADE -- 80/87 Minimum Grade Aviation Fuel.
100/130 low lead aviation fuel with a lead content limited to 2 c.c. per gallon is also approved.
CAPACITY EACH STANDARD TANK -- 21 Gallons.
CAPACITY EACH LONG RANGE TANK -- 26 Gallons.

NOTE

To ensure maximum fuel capacity when refueling, place the fuel selector valve in either LEFT or RIGHT position to prevent cross-feeding.

LANDING GEAR:

NOSE WHEEL TIRE PRESSURE -- 31 PSI on 5.00-5, 4-Ply Rated Tire.
26 PSI on 6.00-6, 4-Ply Rated Tire.
MAIN WHEEL TIRE PRESSURE -- 29 PSI on 6.00-6, 4-Ply Rated Tires.
NOSE GEAR SHOCK STRUT --
Keep filled with MIL-H-5606 hydraulic fluid and inflated with air to 45 PSI.

* For complete servicing requirements, refer to the aircraft Service Manual.

"TAKE YOUR CESSNA HOME
FOR SERVICE AT THE SIGN
OF THE CESSNA SHIELD"

CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS

D1016-13

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FAA Approved
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
GARMIN G5 ELECTRONIC FLIGHT INSTRUMENT
as installed in

Cessna 172M

Make and Model Airplane

Registration Number: N4480R Serial Number: 17263222

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA01818WI for the installation and operation of the Garmin G5 Electronic Flight Instrument. This document must be carried in the airplane at all times.

The information contained herein supplements or supersedes the information made available to the operator by the aircraft manufacturer in the form of clearly stated placards or markings, or in the form of an FAA approved Airplane Flight Manual, only in those areas listed herein. For limitations, procedures and performance information not contained in this document, consult the basic placards or markings, or the basic FAA approved Airplane Flight Manual.

FAA APPROVED BY: David G Armstrong

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ODA STC Unit Administrator

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Log of Revisions

FAA Approved AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

GARMIN G5 ELECTRONIC FLIGHT INSTRUMENT

REV NO.	PAGE NO(S)	DESCRIPTION	DATE OF APPROVAL	FAA APPROVED
1	ALL	Original Issue	7/22/2016	Robert Murray ODA STC Unit Administrator
2	ALL	Added information regarding G5 DG/HSI.	4/28/2017	Robert Murray ODA STC Unit Administrator
3	ALL	Added interface to 3rd party autopilots.	10/18/2017	Robert Murray ODA STC Unit Administrator
4	ALL	Added note to General section.	10/26/17	Paul Mast ODA STC Unit Administrator
5	ALL	Reformatted document. Updated system messages interface. Added DG/HSI reversion description.	12/20/17	Robert Murray ODA STC Unit Administrator
6	ALL	Added interface description to GAD 13. Added information regarding multiple NAV source inputs.	See Cover	See Cover

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SECTION 1 – GENERAL

The G5 Electronic Flight Instrument can display the following information to the pilot depending on the installation and location of the G5 instrument.

- Primary attitude
- Primary slip and turn rate information
- Primary heading
- Secondary airspeed
- Secondary altimeter
- Secondary ground track

When installed in place of the attitude indicator, the primary function of the G5 is to provide attitude information to the pilot. When installed in place of the rate of turn indicator, the primary function of the G5 is to provide turn rate and slip ball information to the pilot. When installed in place of the directional gyro, the primary function of the G5 is to provide directional information to the pilot.

NOTE:

The pilot is reminded to perform appropriate flight and navigation instrument cross checks for the type of operation being conducted.

In case of a loss of aircraft electrical power, a backup battery (optional when installed as a DG/HSI) sustains the G5 Electronic Flight Instrument for up to four hours.

An optional GAD 29B may be installed to provide course and heading datum to an autopilot based on the data selected for display on the HSI.

An optional GAD 13 and OAT probe may be installed to provide measured outside air temperature (OAT) to the G5 for display of true airspeed (TAS), outside air temperature, winds, and density altitude.

This STC allows the removal of the aircraft's vacuum system if it is not required to support any other airframe system.

Abbreviations and Terminology

The following glossary is applicable within the airplane flight manual supplement

ADI	Attitude Direction Indicator
AFMS	Airplane Flight Manual Supplement
ATT	Attitude
CDI	Course Deviation Indicator
DG	Directional Gyro
DR	Dead Reckoning
FAA	Federal Aviation Administration
GPS	Global Positioning System
GPSS	GPS Roll Steering
HDG	Heading
HSI	Horizontal Situation Indicator
ILS	Instrument Landing System
LOC	Localizer (no glideslope available)
LOI	Loss of Integrity
OAT	Outside Air Temperature
TAS	True Airspeed
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omni-directional Range

SECTION 2 – LIMITATIONS

System Software Requirements

The G5 must utilize the following or later FAA approved software versions for this AFMS revision to be applicable:

Component	Software Version
G5 Electronic Flight Instrument	6.20

Use of Secondary Instruments

The original type design approved instruments for airspeed, altitude and vertical speed remain the primary indications for these parameters.

If the G5 Electronic Flight Instrument is installed in place of the rate of turn indicator, the original type design approved instrument for attitude remains in the primary indication for attitude.

If the G5 Electronic Flight Instrument is installed in place of the directional gyro, the original type design approved instruments for attitude remains the primary indication for attitude.

NOTE:

For aircraft approved for VFR-only operations, the G5 Electronic Flight Instrument may be installed as an attitude indicator and rate of turn indicator.

Kinds of Operations

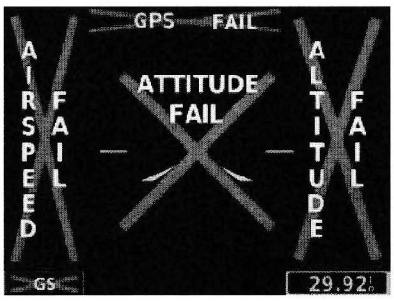
No Change except for the following:

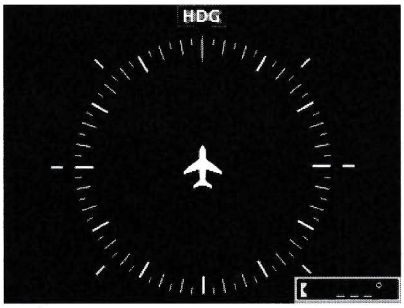
- When a portable navigation source is selected on the G5, it shall not be used for the primary means of navigation for IFR operations.

SECTION 3 – EMERGENCY PROCEDURES

G5 Failure Indications

If a G5 function fails, a large red 'X' is typically displayed over the instrument(s) or data experiencing the failure. Upon G5 power-up, certain instruments remain invalid as equipment begins to initialize. All instruments should be operational within one minute of power-up. If any instrument remains flagged and it is not likely an installation related problem, the G5 should be serviced by a Garmin-authorized repair facility.





Attitude Failure

Attitude failure is indicated by removal of the sky/ground presentation, a red X, and a yellow "ATTITUDE FAIL" on the display.

Rate-of-turn and slip information will not be available.

1. Use standby instruments.
2. Seek VFR conditions or land as soon as practical.

Heading Failure, Loss of Magnetometer Data, or Magnetic Field Error

A heading failure, loss of magnetometer data, or magnetic field error is indicated by removal of the digital heading readout, a red X, and a yellow "HDG" on the display.

1. Use standby magnetic compass.

NOTE:

If the G5 DG/HSI has a valid GPS signal the G5 DG/HSI instrument will display the GPS track information in magenta.

GPS Failure

If GPS navigation receivers and/or navigation information are not available or invalid, the G5 will display Dead Reckoning mode (DR) or Loss of Integrity mode (LOI) on the HSI in the lower left corner.

If Alternate Navigation Sources (ILS, LOC, VOR) Are Available:

1. Use alternate navigation source.

If No Alternate Navigation Sources Are Available:

If DR is Displayed on HSI:

1. Use the amber CDI for course information.
2. Fly toward known visual conditions.

If LOI is Displayed on HSI:

1. Fly toward known visual conditions.

For aircraft equipped with a GAD 29B interfaced to an autopilot, GPSS will be displayed in amber text when GPSS emulation has been selected from the G5 menu.

1. Deselect GPSS from the G5 menu and select a different autopilot mode.

Attitude Aligning

During system initialization, the G5 displays the message 'ALIGNING' over the attitude indicator. The G5 will typically display valid attitude within the first minute of power-up. The G5 can also align itself while taxiing and during level flight.

If the "ALIGNING" indication occurs during flight and attitude remains displayed, the attitude display is acceptable for use for flight in instrument conditions. The message will clear when the attitude solution is within the systems internal accuracy tolerances. It is recommended to maintain wings level to reduce the time for the system to align.

Attitude Aligning / Keep Wings Level

If the "ALIGNING KEEP WINGS LEVEL" indication occurs during flight, the G5 has detected an invalid attitude solution and will not display any attitude information.

1. Use standby instruments to maintain wings level flight. The system will display attitude when internal accuracy tolerances have been met.
2. If attitude does not return, seek VFR conditions or land as soon as practical.

Loss of Electrical Power to the G5 Display

In the event of a loss of aircraft electrical power to the G5 attitude display, the indicator will continue to function on its internal battery. If an internal battery is installed on the optional G5 HSI, the indicator will continue to function on the internal battery if aircraft power is lost. Internal battery endurance is indicated on the G5 display in hours and minutes. The charging symbol will be removed and the internal battery will not be charged.

In the event the G5 attitude display powers down, the optional G5 HSI will automatically revert to displaying attitude information. It will not revert back to the DG/HSI format if the G5 attitude unit regains power. The DG/HSI presentation may be selected from the G5 menu on the G5 DG/HSI unit after reversion to the attitude display.

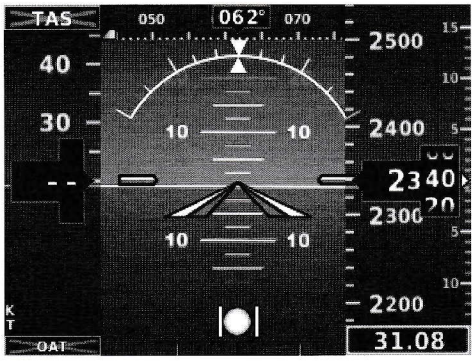
Loss of Electrical Power to the GAD 29B (If Installed)

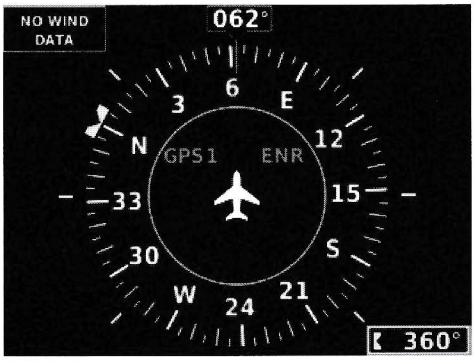
In the event of a loss of aircraft electrical power to the optional GAD 29B, the heading and course datum will be unavailable to the autopilot and the autopilot may deviate from the intended path or may disconnect. GPS flight plan course information may be displayed on the HSI and VFR will be displayed in amber text on the HSI. GPSS will be displayed in amber text, if GPSS mode is selected.

1. Deselect GPSS from the G5 menu and select a different autopilot mode.
2. Lateral GPS course guidance may only be used in VFR conditions.

Loss of Electrical Power to the GAD 13 (If Installed)

In the event of a loss of aircraft electrical power to the optional GAD 13, the OAT and TAS indications will be replaced with a red X. The Density Altitude indication will be removed, and "No Wind Data" will be displayed in the wind field.





1. Use an alternate source of outside air temperature to calculate true airspeed, density altitude, and winds.

SECTION 4 – NORMAL PROCEDURES

G5 Power Button and Knob

The G5 display will power on with the application of aircraft power. The G5 power button is used to turn the display on and off. Press and hold the power button to turn the display off.

The knob performs the following functions:

Press	Press to access the Menu. From the Menu, press to select the desired menu item. Press to accept the displayed value when editing numeric data or selecting from a list. Press to sync the heading or track bug for the HSI.
Turn	From the Menu, turn the Knob to move the cursor to the desired menu item. For the ADI, rotate to adjust the baro setting on the secondary altitude display. For the HSI, rotate to adjust the heading or track bug. Turn to select the desired value when editing numeric data or selecting from a list.

Backlight Intensity Adjustment

The power up state of the G5 backlight is in Auto adjustment mode.

To adjust the backlighting:

To select Manual mode from Auto mode:

1. While the unit is turned on, press the Power button.
2. Turn the knob to manually adjust the backlight intensity.
3. Press the knob to close the backlight page.

To select Auto mode from Manual mode:

1. While the unit is turned on, press the Power button.
2. Press the Power button again to select Auto.
3. Press the knob to close the backlight page.

Prior to Flight in Instrument Meteorological Conditions

1. Press the Power button on the G5 attitude indicator.
2. Verify the battery status indicator is green on the G5 attitude indicator.

Autopilot Operations with the G5 HSI

The G5 and optional GAD 29B offer various integration capabilities dependent upon the type of autopilot installed in a particular aircraft.

The G5 Electronic Flight Instrument installation in this aircraft provides the following autopilot functions (appropriate boxes will be checked):

- ☐ This installation does not interface with the autopilot (basic wing leveling autopilot or no autopilot is installed in the aircraft).
- ☐ A GAD 29B Adapter is installed in this aircraft.
  - ☐ Course / NAV Selection coupling to the autopilot.
  - ☐ Heading Bug coupling capability to the autopilot.
  - ☐ Roll Steering (GPSS) emulated via heading mode.

    OR
  - ☐ Roll Steering capable autopilot (GPSS menu function for emulation not applicable).

Course / NAV Selection Coupling to the Autopilot (If Configured)

When operating the autopilot in NAV mode, the deviation information from the installed navigation sources (i.e. GPS or NAV) is switched via the navigation source. The NAV source displayed on the HSI is the NAV source the autopilot is following. Many autopilots also use the course datum to determine the best intercept angles when operating in NAV mode.

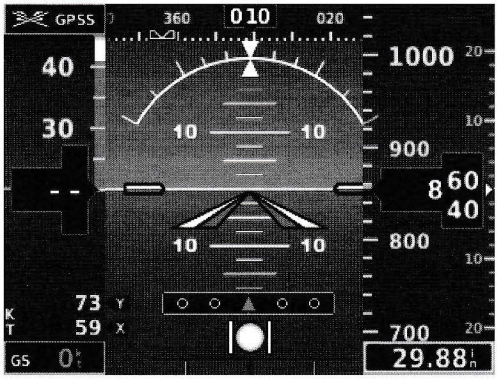
Heading Bug Coupling Capability to the Autopilot (If Configured)

When operating the autopilot in HDG mode, the difference between the HDG bug location on the HSI and the actual aircraft heading creates an error signal which the autopilot will minimize by turning in the direction of the bug. If the bug is turned more than 180 degrees, the autopilot may turn the airplane in the opposite direction of the desired turn.

Roll Steering (GPSS) Emulated via HDG Mode (If Configured)

For autopilots that do not support digital GPSS signals, GPSS functionality may be emulated by operating the autopilot in HDG mode and selecting GPSS from the G5 menu. If the autopilot is already designed to receive roll steering information, the data is transmitted digitally from the navigator to the autopilot.

When GPSS is selected on the G5 menu, the heading bug on the HSI changes to a hollow outline and a crossed-out heading bug appears on the G5 HSI display indicating that the autopilot is not coupled to the heading bug. The bug is still controllable and may still be used for reference.



When GPSS is selected on the G5, GPSS turn commands are converted into a heading error signal to the autopilot. When the autopilot is operated in HDG mode, the autopilot will fly the turn commands from the GPS

navigator. If the GPSS data is invalid (for example, if there is no active GPS leg) or the selected HSI source on the G5 HSI is not GPS, the annunciated GPSS text will be yellow and a zero turn command will be sent to the autopilot.

HSI Source Selection (If Configured)

For aircraft configured with two navigation inputs to the G5, the desired source may be selected using the G5 knob and menu selection. Press the G5 knob to cycle between the NAV1 and NAV2 input.

HSI Portable Navigation Device GPS VFR Annunciation (If Configured)

For aircraft configured for a portable navigation device input to the G5, a GPS VFR indicated in magenta will be displayed on the HSI. When the G5 with a portable navigation device is interfaced there is not enough guidance data for IFR use.

SECTION 5 – PERFORMANCE

No change.

SECTION 6 – WEIGHT AND BALANCE

See current weight and balance data.

SECTION 7 – SYSTEM DESCRIPTION

Refer to Garmin G5 Electronic Flight Instrument Pilot's Guide for Certified Aircraft, part number 190-01112-12 Rev A (or later approved revisions), for a description of the G5 electronic flight instrument. This reference material is not required to be on board the aircraft but does contain a more in depth description of all the functions and capabilities of the G5.

The ATT circuit breaker supplies power to the G5 instrument for normal power operation and to charge the internal battery.

The DG circuit breaker supplies power to the G5 instrument for normal power operation when configured as a DG, and to charge the internal battery (if installed).

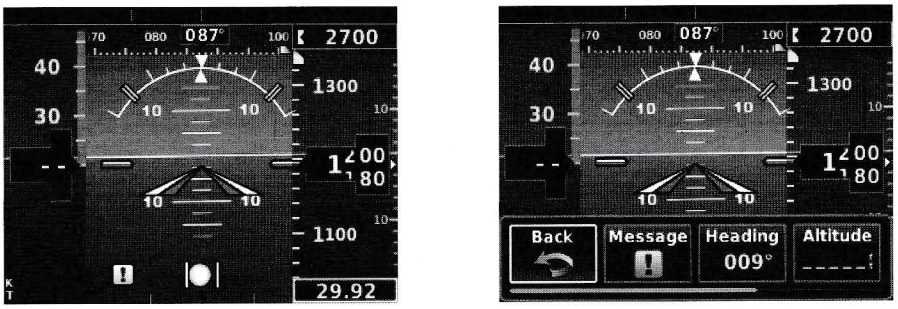
The HSI circuit breaker supplies power to the G5 instrument for normal power operation when configured as an HSI, and to charge the internal battery (if installed).

The GAD circuit breaker supplies power to the optional GAD 29 adapter and optional GAD 13 adapter for normal power operation.

System Messages

The G5 has the capability to display system messages to the crew along the bottom of the display. A system message is indicated through a white ⚠ indication on the G5.

Messages can be displayed by pressing the G5 knob, and selecting the Message menu item.



(For Reference Only)

The following table shows the meaning of each message. System messages are displayed in white text.

Message	Meaning
External Power Lost	Aircraft power has been removed from the G5.
Critical battery fault! Powering off	Battery has critical fault condition and the unit is about to power off to avoid damage to the battery.
Battery fault	Battery has a fault condition – unit needs service.
Battery charger fault	Battery charger has a fault condition – unit needs service.
Low battery	Battery charge level is low.
Hardware fault	Unit has a hardware fault – unit needs service.
Power supply fault	Unit power supply fault detected – unit needs service.
Unit temperature limit exceeded	Unit is too hot or too cold.
Network address conflict	Another G5 with the same address is detected on the network (most commonly a wiring error on one of the units).
Communication error	General communication error (most commonly appears in conjunction with Network Address Conflict message).
Factory calibration data invalid	Unit calibration data not valid – unit needs service.
Magnetic field model database out of date	Internal magnetic field database is out of date - software update required.
Magnetometer Hardware fault	The magnetometer has detected a fault – unit needs service. Heading data may not be available.
Using external GPS data	GPS data from another network LRU is being used. The unit's internal GPS receiver is enabled, but unable to establish a GPS fix.
Not receiving RS-232 data	The G5 is not receiving RS-232 data from the GPS navigator – system needs service.
Not receiving ARINC 429 data	The G5 is not receiving ARINC 429 data from the navigation source – system needs service.
GPS receiver fault	The G5 on-board GPS receiver has a fault.
ARINC 429 interface configuration error	The G5 ARINC 429 port is receiving information from an incorrect source – system needs service.
Software version mismatch	The G5 attitude indicator and the G5 HSI units have different software. Cross fill of baro, heading and altitude bugs is disabled.

These messages remain while the condition persists.

G5

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FAA Approved
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
GARMIN G5 ELECTRONIC FLIGHT INSTRUMENT
as installed in

CESSNA 172M

Make and Model Airplane

Registration Number: N4480R Serial Number: 17263222

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA01818WI for the installation and operation of the Garmin G5 Electronic Flight Instrument. This document must be carried in the airplane at all times.

The information contained herein supplements or supersedes the information made available to the operator by the aircraft manufacturer in the form of clearly stated placards or markings, or in the form of an FAA approved Airplane Flight Manual, only in those areas listed herein. For limitations, procedures and performance information not contained in this document, consult the basic placards or markings, or the basic FAA approved Airplane Flight Manual.

FAA approved sections of this supplement are labeled as "FAA APPROVED." Sections not labeled "FAA APPROVED" are provided for guidance information only.

FAA APPROVED BY: Paul Mast

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Log of Revisions

FAA Approved AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

GARMIN G5 ELECTRONIC FLIGHT INSTRUMENT

REV NO.	PAGE NO(S)	DESCRIPTION	DATE OF APPROVAL	FAA APPROVED
1	ALL	Original Issue	7/22/2016	Robert Murray ODA STC Unit Administrator
2	ALL	Added information regarding G5 DG/HSI.	4/28/2017	Robert Murray ODA STC Unit Administrator
3	ALL	Added interface to 3rd party autopilots.	10/18/2017	Robert Murray ODA STC Unit Administrator
4	ALL	Added note to General section.	10/26/2017	Paul Mast ODA STC Unit Administrator
5	ALL	Reformatted document. Updated system messages interface. Added DG/HSI reversion description.	12/20/2017	Robert Murray ODA STC Unit Administrator
6	ALL	Added interface description to GAD 13. Added information regarding multiple NAV source inputs.	7/19/2019	David G. Armstrong ODA STC Unit Administrator
7	ALL	Added information regarding FAA approved content. Updated SW ver. and references to GAD 29B to GAD 29B/GAD29D	See Cover	See Cover

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SECTION 1 – GENERAL

The G5 Electronic Flight Instrument can display the following information to the pilot depending on the installation and location of the G5 instrument.

- Primary attitude
- Primary slip and turn rate information
- Primary heading
- Secondary airspeed
- Secondary altimeter
- Secondary ground track

When installed in place of the attitude indicator, the primary function of the G5 is to provide attitude information to the pilot. When installed in place of the rate of turn indicator, the primary function of the G5 is to provide turn rate and slip ball information to the pilot. When installed in place of the directional gyro, the primary function of the G5 is to provide directional information to the pilot.

NOTE:

The pilot is reminded to perform appropriate flight and navigation instrument cross checks for the type of operation being conducted.

In case of a loss of aircraft electrical power, a backup battery (optional when installed as a DG/HSI) sustains the G5 Electronic Flight Instrument for up to four hours.

An optional GAD 29B/GAD 29D may be installed to provide course and heading datum to an autopilot based on the data selected for display on the HSI.

An optional GAD 13 and OAT probe may be installed to provide measured outside air temperature (OAT) to the G5 for display of true airspeed (TAS), outside air temperature, winds, and density altitude.

This STC allows the removal of the aircraft's vacuum system if it is not required to support any other airframe system.

Abbreviations and Terminology

The following glossary is applicable within the airplane flight manual supplement

ADI	Attitude Direction Indicator
AFMS	Airplane Flight Manual Supplement
ATT	Attitude
CDI	Course Deviation Indicator
DG	Directional Gyro
DR	Dead Reckoning
FAA	Federal Aviation Administration
GPS	Global Positioning System
GPSS	GPS Roll Steering
HDG	Heading
HSI	Horizontal Situation Indicator
ILS	Instrument Landing System
LOC	Localizer (no glideslope available)
LOI	Loss of Integrity
OAT	Outside Air Temperature
TAS	True Airspeed
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omni-directional Range

SECTION 2 – LIMITATIONS

System Software Requirements

The G5 must utilize the following or later FAA approved software versions for this AFMS revision to be applicable:

Component	Software Version
G5 Electronic Flight Instrument	7.20

Use of Secondary Instruments

The original type design approved instruments for airspeed, altitude and vertical speed remain the primary indications for these parameters.

If the G5 Electronic Flight Instrument is installed in place of the rate of turn indicator, the original type design approved instrument for attitude remains in the primary indication for attitude.

If the G5 Electronic Flight Instrument is installed in place of the directional gyro, the original type design approved instruments for attitude remains the primary indication for attitude.

NOTE:

For aircraft approved for VFR-only operations, the G5 Electronic Flight Instrument may be installed as an attitude indicator and rate of turn indicator.

Kinds of Operations

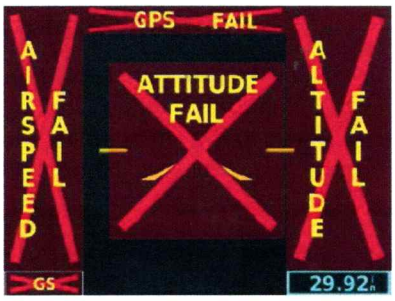
No Change except for the following:

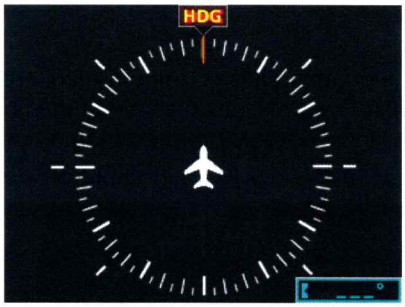
- When a portable navigation source is selected on the G5, it shall not be used for the primary means of navigation for IFR operations.

SECTION 3 – EMERGENCY PROCEDURES

G5 Failure Indications

If a G5 function fails, a large red 'X' is typically displayed over the instrument(s) or data experiencing the failure. Upon G5 power-up, certain instruments remain invalid as equipment begins to initialize. All instruments should be operational within one minute of power-up. If any instrument remains flagged and it is not likely an installation related problem, the G5 should be serviced by a Garmin-authorized repair facility.





Attitude Failure

Attitude failure is indicated by removal of the sky/ground presentation, a red X, and a yellow "ATTITUDE FAIL" on the display.

Rate-of-turn and slip information will not be available.

1. Use standby instruments.
2. Seek VFR conditions or land as soon as practical.

Heading Failure, Loss of Magnetometer Data, or Magnetic Field Error

A heading failure, loss of magnetometer data, or magnetic field error is indicated by removal of the digital heading readout, a red X, and a yellow "HDG" on the display.

1. Use standby magnetic compass.

NOTE:

If the G5 DG/HSI has a valid GPS signal the G5 DG/HSI instrument will display the GPS track information in magenta.

GPS Failure

If GPS navigation receivers and/or navigation information are not available or invalid, the G5 will display Dead Reckoning mode (DR) or Loss of Integrity mode (LOI) on the HSI in the lower left corner.

If Alternate Navigation Sources (ILS, LOC, VOR) Are Available:

1. Use alternate navigation source.

If No Alternate Navigation Sources Are Available:

If DR is Displayed on HSI:

1. Use the amber CDI for course information.
2. Fly toward known visual conditions.

If LOI is Displayed on HSI:

1. Fly toward known visual conditions.

For aircraft equipped with a GAD 29B/GAD 29D interfaced to an autopilot, GPSS will be displayed in amber text when GPSS emulation has been selected from the G5 menu.

1. Deselect GPSS from the G5 menu and select a different autopilot mode.

Attitude Aligning

During system initialization, the G5 displays the message 'ALIGNING' over the attitude indicator. The G5 will typically display valid attitude within the first minute of power-up. The G5 can also align itself while taxiing and during level flight.

If the "ALIGNING" indication occurs during flight and attitude remains displayed, the attitude display is acceptable for use for flight in instrument conditions. The message will clear when the attitude solution is within the systems internal accuracy tolerances. It is recommended to maintain wings level to reduce the time for the system to align.

Attitude Aligning / Keep Wings Level

If the "ALIGNING KEEP WINGS LEVEL" indication occurs during flight, the G5 has detected an invalid attitude solution and will not display any attitude information.

1. Use standby instruments to maintain wings level flight. The system will display attitude when internal accuracy tolerances have been met.
2. If attitude does not return, seek VFR conditions or land as soon as practical.

Loss of Electrical Power to the G5 Display

In the event of a loss of aircraft electrical power to the G5 attitude display, the indicator will continue to function on its internal battery. If an internal battery is installed on the optional G5 HSI, the indicator will continue to function on the internal battery if aircraft power is lost. Internal battery endurance is indicated on the G5 display in hours and minutes. The charging symbol will be removed and the internal battery will not be charged.

In the event the G5 attitude display powers down, the optional G5 HSI will automatically revert to displaying attitude information. It will not revert back to the DG/HSI format if the G5 attitude unit regains power. The DG/HSI presentation may be selected from the G5 menu on the G5 DG/HSI unit after reversion to the attitude display.

Loss of Electrical Power to the GAD 29B/GAD 29D (If Installed)

In the event of a loss of aircraft electrical power to the optional GAD 29B/GAD 29D, the heading and course datum will be unavailable to the autopilot and the autopilot may deviate from the intended path or may disconnect. GPS flight plan course information may be displayed on the HSI and VFR will be displayed in amber text on the HSI. GPSS will be displayed in amber text, if GPSS mode is selected.

1. Deselect GPSS from the G5 menu and select a different autopilot mode.
2. Lateral GPS course guidance may only be used in VFR conditions.

Loss of Electrical Power to the GAD 13 (If Installed)

In the event of a loss of aircraft electrical power to the optional GAD 13, the OAT and TAS indications will be replaced with a red X. The Density Altitude indication will be removed, and "No Wind Data" will be displayed in the wind field.

1. Use an alternate source of outside air temperature to calculate true airspeed, density altitude, and winds.

SECTION 4 – NORMAL PROCEDURES

G5 Power Button and Knob

The G5 display will power on with the application of aircraft power. The G5 power button is used to turn the display on and off. Press and hold the power button to turn the display off.

The knob performs the following functions:

Press	Press to access the Menu. From the Menu, press to select the desired menu item. Press to accept the displayed value when editing numeric data or selecting from a list. Press to sync the heading or track bug for the HSI.
Turn	From the Menu, turn the Knob to move the cursor to the desired menu item. For the ADI, rotate to adjust the baro setting on the secondary altitude display. For the HSI, rotate to adjust the heading or track bug. Turn to select the desired value when editing numeric data or selecting from a list.

Backlight Intensity Adjustment

The power up state of the G5 backlight is in Auto adjustment mode.

To adjust the backlighting:

To select Manual mode from Auto mode:

1. While the unit is turned on, press the Power button.
2. Turn the knob to manually adjust the backlight intensity.
3. Press the knob to close the backlight page.

To select Auto mode from Manual mode:

1. While the unit is turned on, press the Power button.
2. Press the Power button again to select Auto.
3. Press the knob to close the backlight page.

Prior to Flight in Instrument Meteorological Conditions

1. Press the Power button on the G5 attitude indicator.
2. Verify the battery status indicator is green on the G5 attitude indicator.

Autopilot Operations with the G5 HSI

The G5 and optional GAD 29B/GAD 29D offer various integration capabilities dependent upon the type of autopilot installed in a particular aircraft.

The G5 Electronic Flight Instrument installation in this aircraft provides the following autopilot functions (appropriate boxes will be checked):

- ☒ This installation does not interface with the autopilot (basic wing leveling autopilot or no autopilot is installed in the aircraft).
- ☐ A GAD 29B/GAD 29D Adapter is installed in this aircraft.
  - ☐ Course / NAV Selection coupling to the autopilot.
  - ☐ Heading Bug coupling capability to the autopilot.
  - ☐ Roll Steering (GPSS) emulated via heading mode.

    OR
  - ☐ Roll Steering capable autopilot (GPSS menu function for emulation not applicable).

Course / NAV Selection Coupling to the Autopilot (If Configured)

When operating the autopilot in NAV mode, the deviation information from the installed navigation sources (i.e. GPS or NAV) is switched via the navigation source. The NAV source displayed on the HSI is the NAV source the autopilot is following. Many autopilots also use the course datum to determine the best intercept angles when operating in NAV mode.

Heading Bug Coupling Capability to the Autopilot (If Configured)

When operating the autopilot in HDG mode, the difference between the HDG bug location on the HSI and the actual aircraft heading creates an error signal which the autopilot will minimize by turning in the direction of the bug. If the bug is turned more than 180 degrees, the autopilot may turn the airplane in the opposite direction of the desired turn.

Roll Steering (GPSS) Emulated via HDG Mode (If Configured)

For autopilots that do not support digital GPSS signals, GPSS functionality may be emulated by operating the autopilot in HDG mode and selecting GPSS from the G5 menu. If the autopilot is already designed to receive roll steering information, the data is transmitted digitally from the navigator to the autopilot.

When GPSS is selected on the G5 menu, the heading bug on the HSI changes to a hollow outline and a crossed-out heading bug appears on the G5 HSI display indicating that the autopilot is not coupled to the heading bug. The bug is still controllable and may still be used for reference.

When GPSS is selected on the G5, GPSS turn commands are converted into a heading error signal to the autopilot. When the autopilot is operated in HDG mode, the autopilot will fly the turn commands from the GPS

navigator. If the GPSS data is invalid (for example, if there is no active GPS leg) or the selected HSI source on the G5 HSI is not GPS, the annunciated GPSS text will be yellow and a zero turn command will be sent to the autopilot.

HSI Source Selection (If Configured)

For aircraft configured with two navigation inputs to the G5, the desired source may be selected using the G5 knob and menu selection. Press the G5 knob to cycle between the NAV1 and NAV2 input.

HSI Portable Navigation Device GPS VFR Annunciation (If Configured)

For aircraft configured for a portable navigation device input to the G5, a GPS VFR indicated in magenta will be displayed on the HSI. When the G5 with a portable navigation device is interfaced there is not enough guidance data for IFR use.

SECTION 5 – PERFORMANCE

No change.

SECTION 6 – WEIGHT AND BALANCE

See current weight and balance data.

SECTION 7 – SYSTEM DESCRIPTION

Refer to Garmin G5 Electronic Flight Instrument Pilot's Guide for Certified Aircraft, part number 190-01112-12 Rev A (or later approved revisions), for a description of the G5 electronic flight instrument. This reference material is not required to be on board the aircraft but does contain a more in depth description of all the functions and capabilities of the G5.

The ATT circuit breaker supplies power to the G5 instrument for normal power operation and to charge the internal battery.

The DG circuit breaker supplies power to the G5 instrument for normal power operation when configured as a DG, and to charge the internal battery (if installed).

The HSI circuit breaker supplies power to the G5 instrument for normal power operation when configured as an HSI, and to charge the internal battery (if installed).

The GAD circuit breaker supplies power to the optional GAD 29B/GAD 29D adapter and optional GAD 13 adapter for normal power operation.

System Messages

The G5 has the capability to display system messages to the crew along the bottom of the display. A system message is indicated through a white ⚠ indication on the G5.

Messages can be displayed by pressing the G5 knob, and selecting the Message menu item.

(For Reference Only)

The following table shows the meaning of each message. System messages are displayed in white text.

Message	Meaning
External Power Lost	Aircraft power has been removed from the G5.
Critical battery fault! Powering off	Battery has critical fault condition and the unit is about to power off to avoid damage to the battery.
Battery fault	Battery has a fault condition – unit needs service.
Battery charger fault	Battery charger has a fault condition – unit needs service.
Low battery	Battery charge level is low.
Hardware fault	Unit has a hardware fault – unit needs service.
Power supply fault	Unit power supply fault detected – unit needs service.
Unit temperature limit exceeded	Unit is too hot or too cold.
Network address conflict	Another G5 with the same address is detected on the network (most commonly a wiring error on one of the units).
Communication error	General communication error (most commonly appears in conjunction with Network Address Conflict message).
Factory calibration data invalid	Unit calibration data not valid – unit needs service.
Magnetic field model database out of date	Internal magnetic field database is out of date - software update required.
Magnetometer Hardware fault	The magnetometer has detected a fault – unit needs service. Heading data may not be available.
Using external GPS data	GPS data from another network LRU is being used. The unit's internal GPS receiver is enabled, but unable to establish a GPS fix.
Not receiving RS-232 data	The G5 is not receiving RS-232 data from the GPS navigator – system needs service.
Not receiving ARINC 429 data	The G5 is not receiving ARINC 429 data from the navigation source – system needs service.
GPS receiver fault	The G5 on-board GPS receiver has a fault.
ARINC 429 interface configuration error	The G5 ARINC 429 port is receiving information from an incorrect source – system needs service.
Software version mismatch	The G5 attitude indicator and the G5 HSI units have different software. Cross fill of baro, heading and altitude bugs is disabled.

These messages remain while the condition persists.

650Xi

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AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the
Garmin GTN 625Xi, 635Xi, 650Xi, 725Xi, or 750Xi
GPS/SBAS Navigation System
as installed in

CESSNA 172M
Make and Model Airplane

Registration Number: N4480R Serial Number: 17263222

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02019SE-D for the installation and operation of the Garmin GTN 625Xi, 635Xi, 650Xi, 725Xi, or 750Xi GPS/SBAS Navigation System. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards. FAA approved sections of the AFMS are labeled "FAA APPROVED".
Sections not labeled "FAA APPROVED" are for guidance only.

FAA Approved by: JR Brownell

JR Brownell
ODA STC Unit Administrator
Garmin International Inc.
ODA-240087-CE

Date: 4/5/2023

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1	01/03/2020	All	Complete Supplement	Erik Frisk ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE
2	02/19/2020	1 6	Section 1.1 • Fixed Typographical Error Section 1.2 • Fixed Typographical Error	Erik Frisk ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE
3	12/11/2020	All 6 11 12 13 17	Replaced references to AC 90-105 with AC 90-105A Replaced References to FAA Order 8400.12A and 8400.33 with AC 90-105A Replaced References to AC 90-100A with AC 90-100A CHG 2 Section 1.3 • Updated reference to AC 120-76D Section 2.4 • Replaced references to Garmin WFDE Program with Garmin RAIM Prediction tool. Section 2.5 • Updated software versions Section 2.6 • Removed note Section 2.9 • Removed VOR from list of approaches not approved with GPS guidance	Erik Frisk ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE

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Revision Number	Date	Number	Description	FAA Approved
		19	Section 2.21 • Changed wording for clarity Section 2.31 • Clarified use of OBS mode	
		31	Added Section 2.33: Glide Range Ring and Best Glide Airport Indicator	
		33	Removed Section 4.8: Database Conflict Resolution	
		48	Section 7.1 • Updated Pilot's Guide revision • Removed sentence to improve clarity Added Section 7.32: Screenshots Added Section 7.33: Knob Control Added Section 7.34: Cross Side Radio Control	
		49	Added Section 7.35: Glide Range Ring and Best Glide Airport Indicator Added Section 7.36: Emergency page Added Section 7.37: Remote Database Confirmation	
4	07/23/2021	4 12	Section 1.2: Added Smart Glide Section 2.5: Updated Software versions	Charles S. Roberts For Manager NW Flight Test Section AIR-715, FAA Seattle, WA

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	Page			
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		19	Replaced Section 2.33 Glide Range Ring and Best Glide Airport Indicator with Section 2.33 Smart Glide	
		21	Section 3: Added Section Table of Contents	
		23	Added Section 3.1.2: Loss of Engine Power or Engine Failure in Flight Added Section 3.1.3: Smart Glide "Maneuver and Land / Disconnect Autopilot"	
		28	Added Section 3.2.16: Smart Glide Failure Added Section 3.2.17: Smart Glide Inadvertent Activation	
		31	Section 4: Added Section Table of Contents	
		38	Section 7.1: Updated Pilot's Guide Revision	
		43	Section 7.11: Added Smart Glide Switch	
		48	Removed previously numbered Section 7.35: Glide Range Ring and Best Glide Airport Indicator	
		49	Removed previously numbered Section 7.37: Remote Database Confirmation	
		52	Section 7.28: Updated VNAV wording for clarification	

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	Page			
Revision Number	Date	Number	Description	FAA Approved
		53	Renumbered Section 7.36 to 7.35: Emergency Page	
		54	Added Section 7.36: Smart Glide	
		63	Added Section 7.37: Single Point Database Acknowledgement	
5	12/28/2021	6	Section 1.2: Updated Document Reference	Erik Frisk ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE
		12	Section 2.5: Updated GTN Xi software versions and instructions to find software version	
		54-63	Section 7.36: Added information about G5 and G3X to smart glide section. Additional corrections and clarifications were made throughout.	

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	Page			
Revision Number	Date	Number	Description	FAA Approved
6	01/25/2023	Section 1	Updated images and layout. New systems capabilities and descriptions. Reorganized. New installer checkboxes for the aircraft. New applicable software versions.	JR Brownell ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE
		Section 2	Updated software versions, new limitations, removed systems descriptions, reorganized. RNP limitation update.	
		Section 3	Updated procedures, reorganized.	
		Section 4	Updated procedures, reorganized.	
		Section 7	New systems descriptions, reorganized. GDL 60 systems description.	
		ALL	Added "FAA APPROVED" or "NOT FAA APPROVED" to footers for all pages.	
7	04/05/2023	3	Moved Minimum Software Version Table from Section 2.4 to Section 1.2.	See page i.
		24	Rewrote Section 3.1.2 GTN Xi Smart Glide procedure for clarity. Combined Section 3.1.3 into Section 3.1.2.	
		Various	Section paragraphs and Table of Contents updated per the above changes.	

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Section 1. General

1.1 Garmin GTN Xi Navigators

The Garmin GTN Xi navigation system is a GPS system with a Satellite Based Augmentation System (SBAS), comprised of one or more Garmin TSO-C146e GTN 625Xi, 635Xi, 650Xi, 725Xi, or 750Xi navigator(s) and one or more Garmin approved GPS/SBAS antenna(s). The GTN navigation system is installed in accordance with AC 20-138D.

	GTN 625Xi	GTN 635Xi	GTN 650Xi	GTN 725Xi	GTN 750Xi
GPS SBAS Navigation: • Oceanic, enroute, terminal, and non-precision approach guidance • Precision approach guidance (LP, LPV)	X	X	X	X	X
VHF Com Radio, 118.00 to 136.990, MHz, 8.33 or 25 kHz increments		X	X		X
VHF Nav Radio, 108.00 to 117.95 MHz, 50 kHz increments			X		X
LOC and Glideslope non-precision and precision approach guidance for Cat 1 minimums, 328.6 to 335.4 MHz tuning range			X		X
Moving map including topographic, terrain, aviation, and geopolitical data	X	X	X	X	X
Display of datalink weather products, SiriusXM, FIS-B, Connext (all optional)	X	X	X	X	X
Control and display of airborne weather radar (optional)				X	X
Display of terminal procedures data (optional)				X	X
Display of traffic data, including ADS-B (optional)	X	X	X	X	X
Display of StormScope® data (optional)	X	X	X	X	X
Display of marker beacon annunciators (optional)	X*	X*	X*	X	X
Remote audio panel control (optional)				X	X
Remote transponder control (optional)	X	X	X	X	X
Remote audio entertainment datalink control (optional)	X	X	X	X	X
TSO-C151c Class B TAWS (optional)	X	X	X	X	X
Supplemental calculators and timers	X	X	X	X	X
Control of GSR 56 Iridium Satellite Phone and SMS Text	X	X	X	X	X
Control of Flight Stream 210 (optional)	X	X	X	X	X
Control of Flight Stream 510 (optional)	X	X	X	X	X

* Display of marker beacon annunciations on the GTN 6XX is only possible when installed with a Garmin GMA 350 audio panel.

Table 1-1 – GTN Functions

The GPS navigation functions, and optional VHF communication and navigation radio functions are operated by dedicated hard keys, a dual concentric rotary knob, or the touchscreen.

Although intuitive and user friendly, the GTN Xi requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid procedures in VMC. Pilot workload will be higher for pilots with limited familiarity in using the unit in an IFR environment, particularly without the autopilot engaged. Garmin provides a detailed Pilot's Guide, and a tablet trainer app. Pilots should take full advantage of these tools to enhance their familiarity with the system.

Figure 1 - GTN 750Xi Control and Display Layout

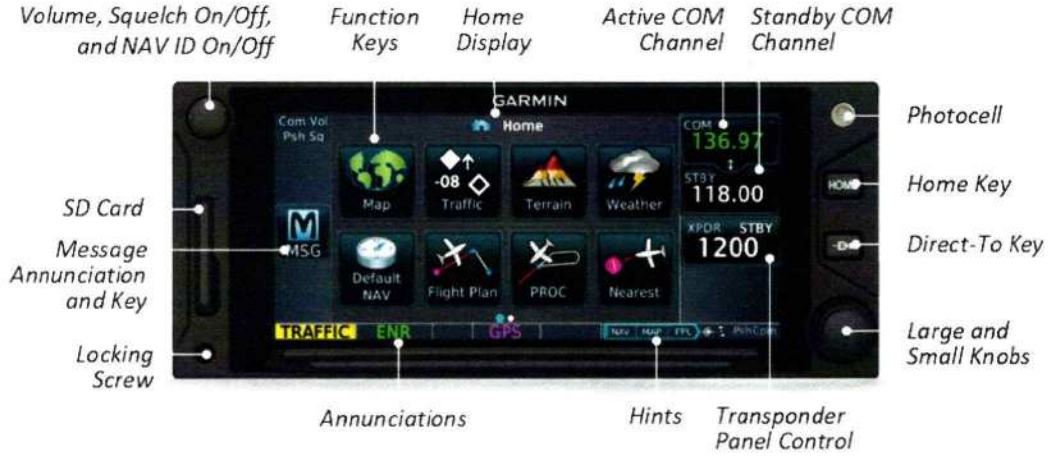

Figure 2 - GTN 635Xi/650Xi Control and Display Layout

1.2 Applicable System Software

All software versions displayed can be viewed on the System – System Status or Connext Setup pages. The following or later software versions must be installed for this AFMS revision to be applicable to the installation.

Software Item	Software Version
Main SW Version	20.30
GPS SW Version	8.2
Com SW Version	2.10
Nav SW Version	2.04
Flight Stream 210	2.90
Flight Stream 510	2.6X
GDL 60	2.21

Table 1-2 - Software Versions

1.3 System Capabilities

This Flight Manual Supplement documents the installed capabilities of the GTN Xi specific to the aircraft for which this manual is created.

The GTN Xi system and associated navigation interface in this aircraft may have the following capabilities, in addition to the core multifunction display capability:

- VHF Communication Radio
- Primary VHF Navigation
- Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below
- Primary GPS Approach Capability with Vertical Guidance (LNAV/VNAV, LPV) – See below
- TSO-C151c Terrain Awareness and Warning System – See section 2.9
- Enroute Baro-VNAV
- Smart Glide

GPS/SBAS TSO-C146e Class 3 Operation

The GTN Xi navigator installed in this aircraft is a TSO-C146e Class 3 approved GPS navigator that complies with AC 20-138D and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR enroute, terminal area, and non-precision approach operations (including those approaches titled "GPS", "or GPS", and "RNAV (GPS)" approaches). The Garmin GNSS navigation system is composed of the GTN Xi navigator and antenna and is approved for approach procedures with vertical guidance including "LPV" and "LNAV/VNAV" and without vertical guidance including "LP" and "LNAV".

The Garmin GTN Xi system as installed in this airplane complies with the equipment, performance, and functional requirements to conduct RNAV operations in accordance with the following table. This table is accurate at the time it was published. However, changes to operational rules, FAA advisory circulars, flight plan formats, etc., are possible. The pilot is responsible to ensure compliance with current operational requirements.

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
RNAV 10 RNP 10 Oceanic and Remote Areas of Operation (Class II Navigation)	GNSS FDE availability must be verified prior to flight. Maximum predicted FDE unavailability is 34 minutes.[1] Two GNSS systems required to be operational, (one GNSS system for those routes requiring only one long range navigation system). No time limit using GNSS as the primary navigation sensor. Part 91, Part 91 subpart K, 121, 125, and 135 operators require operational approval.	FAA AC 20-138D CHG 2, FAA AC 90-105A, FAA AC 91-70B, EASA AMC 20-12	R	A1	The GPS equipment as installed requires a second GNSS system for Class II navigation in oceanic and remote airspace. When installed with a second GNSS system, the GTN Xi equipment complies with the requirements for GPS primary means of Class II navigation in oceanic and remote airspace, when used in conjunction with an FDE prediction tool that satisfies the guidance of FAA AC 20-138D and AC 90-105A (or later revision).[1] Additional equipment may be required to obtain operational approval to utilize RNP-10 performance.
B-RNAV / RNAV 5 (Europe)	This does not constitute an operational approval.	FAA AC 90-96A CHG 1, EASA AMC 20-4A	R	B2	
RNP 4 Oceanic and Remote Areas of Operation (Class II	GNSS FDE availability must be verified prior to flight. Maximum predicted FDE unavailability is 25 minutes.[1]	FAA AC 20-138D CHG 2, FAA AC 90-105A, FAA AC 91-70B	R	L1	The GPS equipment as installed requires a second GNSS system for Class II navigation in oceanic and remote airspace. Additional equipment may be required to obtain

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
Navigation) .	Two operational long-range nav systems required, (or one navigation system and one GNSS sensor for those routes requiring only one long-range navigation sensor). No time limit using GNSS as the primary navigation sensor. Part 91, Part 91 subpart K, 121, 125, and 135 operators require operational approval.				operational approval to utilize RNP-4 performance.
RNAV 2	The GNSS RNAV system is installed and meets the performance and functional requirements of AC 90-100A. In accordance with AC 90-100A, CHG 2, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.	FAA AC 20-138D CHG 2, FAA AC 90-100A CHG 2	R	C2	Includes RNAV Q and T routes.

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
RNAV 1	The GNSS RNAV system is installed and meets the performance and functional requirements of AC 90-100A. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.	FAA AC 20-138D CHG 2, FAA AC 90-100A CHG 2	R	D2	Includes RNAV terminal departure, arrival procedures, and approach procedures up to the Final Approach Fix.
P-RNAV (Europe)	This does not constitute an operational approval.	FAA AC 90-96A CHG 1, JAA TGL 10 Rev 1	R	D2	ICAO flight plan code for P-RNAV no longer exists. P-RNAV utilizes RNAV 1 flight plan codes.

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
RNP 0.3	Includes RNP terminal departure and arrival procedures. When flying a RNP procedure with a radius-to fix (RF) leg, the AFCS must be operational. At a minimum, the flight director must be displayed and utilized when conducting procedures with RF legs. In accordance with AC 90-105A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-105A are authorized to fly RNP 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.	FAA AC 90-105A	R	TBD	Includes RNP terminal departure and arrival procedures, including procedures with radius-to-fix (RF) legs. Also includes approach procedures to the Final Approach Fix. AC 90-105A states that procedures with RF legs must be flown using either a flight director or coupled to the autopilot. Item 18 PBN flight plan code is still to-be-determined at time of publication of this AFMS. Garmin has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the installation complies with limitation set forth in Section 2.6.1 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
RNP 1	When flying a RNP procedure containing an RF leg, the AFCS must be operational. At a minimum, the flight director must be displayed and utilized when conducting procedures containing radius-to-fix (RF) legs. In accordance with AC 90-105A, Part 91 operators (except subpart K), following the aircraft and training guidance in AC 90-105A are authorized to fly RNP 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.	FAA AC 20-138D CHG 2, FAA AC 90-105A	R	O2	Includes RNP terminal departure and arrival procedures, including procedures with radius-to-fix (RF) legs. Also includes approach procedures to the Final Approach Fix. AC 90-105A states that procedures with RF legs must be flown using either a flight director or coupled to the autopilot. Garmin has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the installation complies with limitation set forth in Section 2.6.1 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
RNP-2 (Oceanic / Remote)	GNSS FDE availability must be verified prior to flight. Maximum predicted FDE unavailability is 5 minutes.[1] Two operational long-range nav systems required, (or one navigation system and one GNSS sensor for those routes requiring only one long-range navigation sensor). No time limit using GNSS as the primary navigation sensor. Part 91, Part 91 subpart K, 121, 125, and 135 operators require operational approval.	FAA AC 20-138D CHG2, FAA AC 90-105A FAA AC 91-70B	R	TBD	The GPS equipment as installed requires a second GNSS system for Class II navigation in oceanic and remote airspace. Additional equipment may be required to obtain operational approval to utilize RNP-2 performance. Item 18 PBN flight plan code is still to-be-determined at time of publication of this AFMS.
RNP-2 (Domestic / Offshore En route)	In accordance with AC 90-105A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-105A are authorized to fly RNP-2 domestic and offshore routes. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.	FAA AC 20-138D CHG 2, FAA AC 90-105A FAA AC 91-70B	R	TBD	Includes RNP-2 domestic and offshore routes. Item 18 PBN flight plan code is still to-be-determined at time of publication of this AFMS.

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
RNP APCH LNAV minima	When flying a RNP procedure with a radius-to-fix (RF) leg, the AFCS must be operational. At a minimum, the flight director must be displayed and utilized when conducting procedures containing RF legs. In accordance with AC 90-105A, Part 91 operators (except subpart K), following the aircraft and training guidance in AC 90-105A are authorized to fly RNP APCH LNAV minima procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.	FAA AC 20-138D CHG 2, FAA AC 90-105A, EASA AMC 20-27A	R	S1	Includes non-precision approaches based on conventional navigation aids with "or GPS" in the title and area navigation approaches titled "GPS", "RNAV-(GPS)", and "RNAV (GNSS)". This includes procedures with radius-to-fix (RF) legs. Garmin has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the installation complies with limitation set forth in Section 2.6.1 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
RNP APCH LNAV/VNAV minima	When flying a RNP procedure with a radius-to-fix (RF) leg, the AFCS must be operational. At a minimum, the flight director must be displayed and utilized when conducting procedures containing RF legs. In accordance with AC 90-105A, Part 91 operators (except subpart K), following the aircraft and training guidance in AC 90-105A are authorized to fly RNP APCH LNAV/VNAV minima procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.	FAA AC 20-138D CHG 2, FAA AC 90-105A, EASA AMC 20-27A with CM-AS-002	R	S2	Includes area navigation approaches titled "RNAV (GPS)" and "RNAV (GNSS)." This includes procedures with radius-to-fix (RF) legs. Garmin has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the installation complies with limitation set forth in Section 2.6.1 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.
RNP APCH LP minima	When flying a RNP procedure with a radius-to-fix (RF) leg, the AFCS must be operational. At a minimum, the flight director must be displayed and utilized when conducting procedures containing RF legs In accordance with AC 90-107, Part 91 operators (except subpart K),	FAA AC 20-138D CHG 2, FAA AC 90-107	N/A	N/A	Includes area navigation approaches titled "RNAV (GPS)" and "RNAV (GNSS)" including procedures with radius-to-fix (RF) legs. LP minima are available only when within SBAS coverage. Garmin has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the installation complies with limitation set forth in

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
	following the aircraft and training guidance in AC 90-107 are authorized to fly RNP APCH LP minima procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.				Section 2.6.1 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.
RNP APCH LPV minima	When flying a RNP procedure with a radius-to-fix (RF) leg, the AFCS must be operational. At a minimum, the flight director must be displayed and utilized when conducting procedures containing RF legs. In accordance with AC 90-107, Part 91 operators (except subpart K), following the aircraft and training guidance in AC 90-107 are authorized to fly RNP APCH LPV minima procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.	FAA AC 20-138D CHG 2, FAA AC 90-107, EASA AMC 20-28	B	N/A	Includes area navigation approaches titled "RNAV (GPS)" and "RNAV (GNSS)", including procedures with radius-to-fix (RF) legs. LPV minima are available only when within SBAS coverage. Garmin has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the installation complies with limitation set forth in Section 2.6.1 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
Advanced RNP See Notes for specific Advanced RNP functions.	This does not constitute an operational approval.	FAA AC 20-138D CHG 2, FAA AC 90-105A	N/A	N/A	• RNAV Holding: Supported. • RF Legs: Supported. • Parallel Offsets: RNP-4 parallel offsets as defined by AC 20-138D Chapter 10 are supported. • Advanced RNP parallel offsets as defined by AC20-138D Appendix 3 are supported. • Higher Continuity: Supported only when a second GNSS system is installed and operating. • Scalable RNP: Not supported. • Fixed Radius Transitions (FRT): Not Supported • Time of Arrival Control (TOAC): Not supported.

FDE/RAIM availability worldwide can be determined via the following:

- An FDE prediction tool that satisfies the guidance of FAA AC 20-138D and AC 90-105A (or later revision), such as the Garmin RAIM/FDE Prediction program (https://fly.garmin.com/fly-garmin/support/raim/)

Also, within the United States:

- Via the FAA's RAIM Service Availability Prediction Tool (SAPT) website: http://sapt.faa.gov.
- Contacting a Flight Service Station (not DUATS) to obtain non-precision approach RAIM.

Within Europe,

- An FDE prediction tool that satisfies the guidance of FAA AC 20-138D and AC 90-105A (or later revision)
- Europe's AUGER GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home.

This requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight.

Garmin International holds an FAA Type 2 Letter of Acceptance (LOA) in accordance with AC 20-153A for database integrity, quality, and database management practices for the Navigation database. Flight crews and operators can view the LOA status at FlyGarmin.com then select "Aviation Database Declarations".

1.4 Electronic Flight Bag

The GTN 750Xi/725Xi are operationally suitable as installed equipment, Type B EFB applications in accordance with AC 120-76D when using current FliteChart or ChartView data.

Use of the Flight Stream interface and data for the purpose of Electronic Flight Bag applications is not approved as part of this STC. Additional approval may be required to obtain operational approval for use of the Flight Stream and supplied data to supplement EFB systems.

1.5 Electronic Checklists

The GTN Xi checklist functions are designed to DO-178B software design assurance level B and support a minor failure classification. While this STC does not grant operational approval for operators requiring such approval, there are no limitations precluding operators from obtaining their own operational approval for the checklist function.

1.6 Definitions

The following terminology is used within this document:

ADF Automatic Direction Finder

ADS-B Automatic Dependent Surveillance Broadcast

AEG Aircraft Evaluation Group (FAA)

APR Approach

ASR Automated Speech Recognition

ATK Along TracK

CDI Course Deviation Indicator

DME Distance Measuring Equipment

ECAC European Civil Aviation Conference

EFB Electronic Flight Bag

EGNOS European Geostationary Navigation Overlay Service

EHSI Electronic Horizontal Situation Indicator

FPA Flight Path Angle

FIS-B Flight Information Services Broadcast

GAGAN GPS Aided GEO Augmented Navigation

GDU Garmin Display Unit

GMA Garmin Multimedia Audio

GNSS Global Navigation Satellite System

GPA Glidepath Angle

GPS Global Positioning System

GPSS GPS Roll Steering

GTN Garmin Touchscreen Navigator

HOT Hazardous Obstacle Transmission wires

HSI Horizontal Situation Indicator

IAP Instrument Approach Procedure

IFR Instrument Flight Rules

ILS Instrument Landing System

IMC Instrument Meteorological Conditions

LDA Localizer Directional Aid

LNAV Lateral Navigation

LNAV +V LNAV with advisory Vertical Guidance

L/VNAV Lateral/Vertical Navigation

LOC Localizer

LOC-BC Localizer Backcourse

LP Localizer Performance

LPV Localizer Performance with Vertical Guidance

LP +V Localizer Performance with Advisory Vertical Guidance

MLS Microwave Landing System

MMC Multi-Media Card

NOTAM Notice to Air Missions

OBS Omni Bearing Selector

PED Portable Electronic Device

PTC Push-To-Command

RAIM Receiver Autonomous Integrity Monitoring

RF Leg Radius-To-Fix Leg of a Charted Instrument Procedure

RFL Reverse Frequency Lookup

RMT Remote

RNAV Area Navigation

RNP Required Navigational Performance

SAR Search and Rescue

SBAS Satellite Based Augmentation System

SD Secure Digital

SDF Simplified Directional Facility

SUSP Suspend

TACAN Tactical Air Navigation System

TAS Traffic Awareness System

TAWS Terrain Awareness and Warning System

TCAS Traffic Collision Avoidance System

TCH Threshold Crossing Height

TFR Temporary Flight Restriction

TIS Traffic Information Service

VHF Very High Frequency

VFR Visual Flight Rules

VGSI Visual Glide-Slope Indicator

VLOC VOR/Localizer

VMC Visual Meteorological Conditions

VNAV Vertical Navigation

VOR VHF Omnidirectional Range

VRP Visual Reporting Point

WAAS Wide Area Augmentation System

WFDE WAAS Fault Data Exclusion

XFR Transfer

1.7 Installation Description

The following describes the GTN installation and configuration for this aircraft. Reference this section when using the Normal or Emergency Procedures in Sections 3 and 4. A function or installed feature is applicable to this aircraft only when the corresponding box is checked.

The major components are protected with resettable circuit breakers available to the pilot. The breakers installed in the aircraft are checked below.

	Description	Derivative	Circuit Breaker Label(s)
☒	GTN #1	☐750 (GPS/COM/NAV) ☐735 (GPS/COM) ☐725 (GPS Only) ☒650 (GPS/COM/NAV) ☐635 (GPS/COM) ☐625 (GPS Only)	☒ GPS 1 ☒ NAV/GPS 1 ☐ COM ☐ COM 1
☐	GTN #2	☐750 (GPS/COM/NAV) ☐735 (GPS/COM) ☐725 (GPS Only) ☐650 (GPS/COM/NAV) ☐635 (GPS/COM) ☐625 (GPS Only)	☐ GPS 2 ☐ NAV/GPS 2 ☐ COM ☐ COM 2
☐	Integrated Audio Panel	GMA 35	AUDIO
☐	Streaming Device	Flight Stream 210	BT LINK
☐	Wireless Access	GDL 60	CNXT CNXT BATT

1.7.1 Installed Controllers and Annunciators

	Description
☐	Remote TAWS Annunciator
☐	Remote GPS Annunciator

1.7.2 Interfaces and Connections

The following describes the functionality present in the aircraft based on the external interfaces to the GTN Xi.

1.7.2.1 Heading

☒ This installation *has* a heading source. The GTN Xi will provide roll steering on heading legs for the autopilot.

☐ This installation *does not have* a heading source. The crew cannot use the GTN Xi roll steering to fly heading legs with the autopilot.

1.7.2.2 Altitude

☒ This installation *has* a barometric corrected altitude source. The GTN Xi will automatically sequence altitude legs.

☐ This installation *does not have* a barometric corrected altitude source. The flight crew will be prompted to manually sequence altitude legs.

1.7.2.3 Autopilot

☐ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

☐ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

☐ The installation *does not* support any vertical capture or vertical tracking.

☐ This installation is equipped and configured to provide VNAV display and autopilot coupling.

☐ This installation is equipped and configured to provide VNAV *display only*.

☐ This installation *does not* support VNAV display or coupling.

☐ This installation is configured with VNAV Transition to Approach.

1.7.2.4 Traffic Systems

☐ No traffic system is interfaced to the GTN Xi.

☐ A TAS/TCAS I traffic system is interfaced to the GTN Xi.

☐ A TIS traffic system is interfaced to the GTN Xi.

☐ A TCAD traffic system is interfaced to the GTN Xi.

☒ A Garmin ADS-B traffic system is interfaced to the GTN Xi.

☐ A Garmin ADS-B traffic system is interfaced to the GTN Xi. The ADS-B traffic system is also interfaced to an on-board traffic system.

1.7.3 Navigation Capabilities

☐ This installation is equipped to support autopilot coupled RF leg navigation up to RNP 1.0.

☒ This installation is equipped to support hand-flown RF leg navigation at RNP 1.0.

☐ This installation is equipped to support autopilot coupled RF leg navigation at RNP 0.3 and has received required installer approval for such procedures.

☐ This installation *does not* support RF leg navigation.

1.7.4 Cold Weather Compensation

☐ This installation supports cold weather compensated intermediate approach and minimums altitudes.

☒ This installation supports cold weather compensated *intermediate approach altitudes and missed approach altitudes only*.

☐ This installation does not support cold weather compensation.

1.7.5 Terrain Awareness

☐ This installation supports *Terrain Proximity*. *No aural or visual alerts* for terrain or obstacles are provided. Terrain Proximity *does not* satisfy the TAWS requirement of 91.223.

☒ This installation supports *Terrain Alerting*. Aural and visual alerts are provided. Terrain Alerting *does not* satisfy the TAWS requirement of 91.223.

☐ This installation supports *TAWS B*. Aural and visual alerts *will be* provided. This installation *does* support the TAWS requirement of 91.223.

1.7.6 Go-Around Functionality

☒ This installation *will* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed.

☐ This installation *will not* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed.

1.7.7 Smart Glide Configuration

☐ Smart Glide is configured in this installation with the following parameters:

MAX Desired Gust Speed _____KT

Desired Effective Runway Length _____ft

Supported Runway Surface Type:

- ☐ HARD
- ☐ HARD & SOFT
- ☐ AMPHIBIOUS (ANY)
- ☐ WATER ONLY

☒ Smart Glide is not configured in this installation

Section 2. LIMITATIONS

2.1 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations.

2.2 Minimum Equipment

The GTN Xi must have the following system interfaces fully functional to be used for primary navigation during IFR operations:

Interfaced Equipment	Number installed	Number Required for IFR
External HSI/CDI/EHSI	1 or more	1
External GPS Annunciator	See Note 1	1

Table 2-1 – Required Equipment

Note 1: Certain installations require an external GPS annunciator panel. If installed, this annunciator must be fully functional to use the GTN Xi GPS navigation for IFR operations.

Single engine piston aircraft under 6,000 lbs. maximum takeoff weight:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Xi Navigator

All other aircraft:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Xi Navigator plus a second source of GPS navigation or a separate source of VHF navigation. The separate source of VHF navigation must not be the primary GTN Xi, but it may be a secondary GTN.

Operation in remote or oceanic operation requires two sources of GPS navigation.

2.3 System Use

The moving map and CDI depiction on the GTN Xi display must not be used for primary course guidance.

2.4 Navigation Database

GPS/SBAS based IFR operations are prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

2.5 Ground Operations

Using SafeTaxi, FliteCharts, and ChartView functions as the sole basis for ground maneuvering is prohibited.

2.6 RNAV Procedures

Instrument flight procedures must be loaded from the GTN Xi navigation database.

When conducting instrument approaches referenced to true North, the NAV Angle on the System -Units page must be set to **True**.

When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions. Pilots are prohibited from flying any approach path that contains manually entered waypoints.

IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GTN Xi and/or the CDI.

2.6.1 RF Legs

The following limitations apply to RNP 1 procedures with RF legs:

- Aircraft is limited to 180 KIAS while on the RF leg
- Hand-flown RF legs are limited to RNP 1 procedures. RNP AR is not approved
- Primary navigation guidance on RF legs must be shown on an EHSI indicator with auto-slew capability turned ON
- GTN Xi Moving Map, EHSI Map, or Distance to Next Waypoint information must be displayed to the pilot during the RF leg when flying without the aid of the autopilot or flight director.
- The active waypoint must be displayed in the pilot's primary field of view.

The following limitations apply to RNP 0.3 procedures with RF legs:

- Two RF leg RNP 0.3 capable navigators are required and must be crossfilled
- Two installed ADAHRS (or ADC/AHRS combination) sources are required
- The aircraft must have a Garmin GFC 500 or GFC 600 autopilot installed and in use during RNP 0.3 operations
- CDI scaling must be manually set to 0.3NM during RNP 0.3 operations
- Primary navigation guidance on RF legs must be shown on an EHSI indicator with auto-slew capability turned ON
- RNP 0.3 is only approved on RF legs prior to the FAF
- Operational approval is limited to FAA AC 90-105 A-RNP NavSpec only. RNP-AR not allowed.
- Installation must be approved for coupled RF capability by installer
- The operator must obtain the necessary LOA or OpSpec approval from the appropriate regulatory agency

2.7 QFE Barometric Setting

When flying procedures requiring the use of QFE barometric settings, the pilot must ensure that the barometric setting for the source interfaced with the GTN Xi is set to QFE as appropriate. GTN Xi does not support barometric VNAV for QFE operations.

2.8 Terrain Alerting Function (All Units)

Maneuvers and navigation must not be based solely on the display of terrain, obstacles, or wires on the moving map terrain displays.

2.9 TAWS Function (Optional)

Flight crews are authorized to deviate from their current ATC clearance to the extent necessary to comply with TAWS warnings. Navigation must not be predicated upon the use of TAWS.

TAWS shall be inhibited when landing at an airport that is not included in the airport database or is not designated as a User Airport in the GTN Xi.

If an external TAWS annunciator panel is installed in the aircraft, this annunciator panel must be fully functional to use the TAWS system.

2.10 Polar Operations

Use of the GTN Xi for primary navigation for latitudes above 89.00° N and below 89.00° S is prohibited.

2.11 Datalink Weather Display (Optional)

Use of datalink weather information as the sole means for maneuvering in, near, or around areas of hazardous weather is prohibited. Use of datalink services as the primary means to provide Temporary Flight Restriction (TFR) or Notice to Air Missions (NOTAM) information is prohibited.

2.12 Traffic Display (Optional)

Use of traffic display as the sole basis for maneuvering to avoid traffic is prohibited.

2.13 Demo Mode

Demo mode is prohibited in flight.

2.14 Wire Obstacle Database

Use of the "Obstacle/Wire" database is prohibited.

2.15 Database Updates

In-flight database transfers or updates are prohibited.

2.16 OBS Mode

Use of OBS mode for flight plan segments greater than 250NM is prohibited.

2.17 Advisory Visual Approaches

Use of advisory visual approaches in IMC is prohibited.

2.18 Smart Glide

Engaging Smart Glide is prohibited for One-Engine Inoperative operations in multi-engine aircraft. Smart Glide usage for multi-engine aircraft is limited to dual engine failure situations.

Section 3. EMERGENCY PROCEDURES

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3.1.1 TAWS Alerting

Red annunciator and aural "PULL UP":

Autopilot ..... **DISCONNECT**
Aircraft Controls ..... **INITIATE MAXIMUM POWER CLIMB**
Airspeed ..... **BEST ANGLE OF CLIMB SPEED**

After Warning Ceases:

Altitude ..... **CLIMB AND MAINTAIN SAFE ALTITUDE**
Advise ATC of Altitude Deviation, if appropriate.

NOTE

Only vertical maneuvers are recommended, unless either operating in visual meteorological conditions (VMC), or the flight crew determines, based on all available information, that turning in addition to the vertical escape maneuver is the safest course of action, or both.

NOTE

TAWS annunciators external to the GTN Xi may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.1.2 LOSS OF ENGINE POWER or ENGINE FAILURE IN-FLIGHT

NOTE

This procedure only applies if SMART GLIDE is enabled on the GTN Xi. If it is not, refer to the aircraft POH or AFM for emergency procedures.

If the aircraft cannot maintain altitude:

Smart Glide ..... **ACTIVATE IF DESIRED**
If smart glide is activated:
Autopilot ..... **AS DESIRED**
Aircraft Emergency Procedures ..... **ACCOMPLISH**

NOTE

Some autopilots may be unable to hold best glide speed. Failure to fly at best glide speed may affect glide performance.

Red annunciator and aural "Disconnect Autopilot":

Autopilot ..... **DISENGAGE**

NOTE

When Smart Glide alerts "Maneuver and Land, Disconnect Autopilot" the GTN will no longer provide course guidance to the glide airport.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GTN Xi will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GTN by an amber "DR" and/or "LOI".

If the LOI annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight. If GPS position is lost, the GTN may display DR depending on flight plan and phase of flight conditions.

If the DR annunciation is displayed, the map will continue to be displayed with an amber "DR" overwriting the ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods such as heading and airspeed inputs and the last known winds. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation ..... **USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation ..... **USE GTN Xi**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE (no DR annunciated on the GTN Xi):

Navigation .....**FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "NO GPS POSITION" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a LPV, LP +V, LNAV/VNAV, or LNAV +V approach, if GPS accuracy requirements cannot be met by the GPS receiver, the GTN Xi will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation to LNAV. The approach may be continued using the LNAV only minimums. If the VISUAL approach is downgraded, the GTN Xi will remove the vertical deviation indication from the VDI but continue to annunciate VISUAL in amber.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GTN Xi will flag all CDI guidance and display a system message "ABORT APPROACH-GPS approach no longer available". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:

Communications ..... **USE ALTERNATE COM**

If no alternate COM is available:

COM RMT XFR key (if installed).....**PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GTN Xi. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

3.2.4 LOSS OF AUDIO PANEL FUNCTIONS (GMA 35 Only)*

Audio Panel Circuit Breaker ..... **PULL**

NOTE

This procedure will force the audio panel into fail safe mode which provides only the pilot with communications and only on a single COM radio. If any non GTN 750Xi COM is installed, communication will be only on that radio. If only a GTN 750Xi is installed in the aircraft, then the pilot will have only the GTN 750Xi COM available. No other audio panel functions including aural alerting and the crew and passenger intercom will function.

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* Includes GMA 35 and GMA 35c Audio Panels

3.2.5 TAWS CAUTION (Terrain or Obstacle Ahead, Sink Rate, Don't Sink)

When a TAWS CAUTION occurs, take corrective action until the alert ceases. Stop descending or initiate either a climb or a turn, or both as necessary, based on analysis of all available instruments and information.

NOTE

TAWS annunciators external to the GTN Xi may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2.6 TAWS INHIBIT

The TAWS Forward Looking Terrain Avoidance (FLTA) and Premature Descent Alerts (PDA) functions may be inhibited to prevent alerting, if desired. Refer to GTN Xi Series Pilot's Guide for additional information.

To Inhibit TAWS:

Home Hardkey ..... **PRESS**
Terrain Button ..... **PRESS**
Menu Button ..... **PRESS**
TAWS Inhibit Button ..... **PRESS TO ACTIVATE**

3.2.7 TER N/A and TER FAIL

If the amber **TER N/A** or **TER FAIL** status annunciator is displayed, the system will no longer provide TAWS alerting or display relative terrain and obstacle elevations. The crew must maintain compliance with procedures that ensure minimum terrain and obstacle separation.

3.2.8 DATA SOURCE - HEADING SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a heading source to the GTN Xi, the following limitations apply:

- Roll steering will not be provided to the autopilot for heading legs. The autopilot must be placed in HDG mode for heading legs.
- Map cannot be oriented to Heading Up.
- Overlaying traffic data from a TAS/TCAS I or Garmin ADS-B-IN unit interfaced to an on-board traffic system will not be displayed on the main map display. The flight crew must use the dedicated traffic page on the GTN system to display TAS/TCAS I or Garmin ADS-B-IN traffic data.
- All overlaying StormScope® data on the main map display will be removed. The flight crew must use the dedicated StormScope® page on the GTN system to display StormScope® data.
- Onboard weather radar overlay on the main map will not be displayed. The flight crew must utilize the dedicated weather radar page on the GTN system to view weather radar data from the onboard weather radar.

StormScope® must be operated in accordance with Section 7.8 when no heading is available.

3.2.9 ASR (VOICE COMMAND) SYSTEM FAILURES

In the event the ASR system fails and there is a need to disable the voice command inputs to the GTN Xi:

To Disable ASR:

Home Hardkey ..... **PRESS**
System Button ..... **PRESS**
Voice Commands Button ..... **PRESS**
Voice Commands Enable Button ..... **TOGGLE OFF**

3.2.10 LOSS OF GTN TOUCH CONTROL

In the event the GTN Xi becomes unusable due to uncommanded page changes, the ASR function may be the source.

To Disable ASR:

Audio Panel Circuit Breaker ..... **PULL**
Home Hardkey ..... **PRESS**
System Button ..... **PRESS**
Voice Commands Button ..... **PRESS**
Voice Commands Enable Button ..... **TOGGLE OFF**
Audio Panel Circuit Breaker ..... **PUSH**

3.2.11 DATA SOURCE – PRESSURE ALTITUDE SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

If the GTN Xi is being used to forward pressure altitude to a transponder, the transponder will not be receiving pressure altitude from the GTN while that message is present.

3.2.12 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

Remove power from all equipment which is not necessary for flight, including GTN #2 (NAV/GPS 2, COM 2) and the Flight Stream 210 (BT LINK), if installed.

3.2.13 IN-AIR RESTART OF GTN

In the event of a GTN Xi restart in the air, the crew should utilize the CANCEL button if presented with the database update screen after the GTN Xi is restarted. This will ensure restoration of the navigation functions as soon as possible.

3.2.14 BARO-ALT INPUT FAILURE

Barometric altitude is required for descent VNAV functionality and automatic sequencing of altitude terminated legs. If the BARO altitude input to the GTN Xi has failed, enroute barometric VNAV will not be available. The pilot will also be required to manually sequence any altitude terminated legs.

3.2.15 TEMPERATURE INPUT FAILURE

Temperature input is required for the VNAV Transition to Approach functionality. In the event of a temperature input failure, VNAV transition to approach should be disregarded. The crew must ensure that vertical guidance from descent VNAV to approach guidance is appropriate and that if an autopilot is in use, the crew intercepts the approach vertical guidance from below.

3.2.16 SMART GLIDE FAILURE

AHRS, ADC, Terrain Database, Navigation Database, and GPS are all required for Smart Glide. If any of those systems fail, Smart Glide cannot be activated. If those systems fail when Smart Glide is active, a system message will inform the pilot, and an aural alert "SMART GLIDE FAILURE, CONSIDER ALTERNATE LANDING AREA" will be generated.

Alternate Landing Site ..... **CONSIDER**

3.2.17 SMART GLIDE INADVERTANT ACTIVATION

If Smart Glide activates without pilot action:

Autopilot (GFC 500 or GFC 600 only) ..... **DISCONNECT**
Smart Glide ..... **CANCEL**
Smart Glide Activation ..... **DISABLE**
Go to the GTN Emergency Page, press the MENU button and select DISABLE.

If Smart Glide does not disable:
GTN #1 Circuit Breaker ..... **PULL**
If GTN#1 is providing audio panel control, the audio panel will revert to reversionary functionality when the GTN power is removed.

Once Smart Glide is disabled:
Autopilot ..... **AS DESIRED**
GTN Flight Plan ..... **ACTIVATE DESIRED LEG**
Altitude Preselector (PFD) ..... **SET**

3.2.18 BLANK SCREEN

Panel Lighting Dimmer ..... **INCREASE BRIGHTNESS**

If the installed equipment in the aircraft includes a GDL 60 Wireless Access unit:
Screen ..... **PRESS**
Knobs ..... **ROTATE ONE CLICK EACH**

If the display returns:
CNXT and CNXT BATT circuit breakers ..... **OPEN**

If the display is still blank, consider the GTN inoperative.

3.3 Warning Messages

Alert Type	Alert Annunciation	Aural Message	Pilot Action
FLTA Terrain Warning	PULL UP	"Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"* Or "Terrain, Terrain; Pull Up, Pull Up"	Immediately execute a climb at obstacle clearance speed
FLTA Obstacle Warning	PULL UP	Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"* or "Obstacle, Obstacle; Pull Up, Pull Up"	Immediately execute a climb at obstacle clearance speed
FLTA Wire Warning	PULL UP	"Wire Ahead Pull Up, Wire Ahead Pull Up"	Immediately execute a climb at obstacle clearance speed

3.4 Caution Messages

Alert Type	Alert Annunciation	Aural Message	Pilot Action
FLTA Terrain Caution	TERRAIN	"Terrain Ahead; Terrain Ahead"* or "Caution, Terrain; Caution Terrain"	Execute a climb at obstacle clearance speed
FLTA Obstacle Caution	OBSTCL	Obstacle Ahead; Obstacle Ahead"* or "Caution, Obstacle; Caution, Obstacle"	Execute a climb at obstacle clearance speed
FLTA Wire Caution	WIRE	"Wire Ahead"	Execute a climb at obstacle clearance speed
Premature Descent Alert	TERRAIN	"Too Low, Terrain"	Execute a climb at obstacle clearance speed
Traffic Alert	TRAFFIC	"Traffic"	Visually acquire the traffic to see and avoid.

** Alerts with multiple messages are configurable at installation and are installation dependent. Alerts for the default configuration are indicated with asterisks.*

3.5 Failure Messages

Failure Message	Alert Location	Cause	Pilot Action
"No GPS Position"	Displayed on all pages with a moving map	Loss of GPS position	Use other sources of navigation
Dead Reckoning	Displayed on all pages with a moving map	Loss of GPS position	Use other sources of navigation
LOI	Status Bar	Loss of GPS position	Use other sources of navigation
Red "X"	Over affected equipment interface	Loss of data from equipment	Use inoperative equipment procedures
TAWS N/A TAWS FAIL TER N/A TER FAIL	Status Bar	Loss of GPS Position Or Terrain Database Error	Use vigilance, Terrain Alerts no longer provided.

Section 4. NORMAL PROCEDURES

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Refer to the GTN Xi Pilot's Guide defined in Section 7.1 for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, VHF communication and navigation, traffic, data linked weather, StormScope®, TAWS, and Multi-Function Display information.

The GTN Xi requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Databases ..... **REVIEW DATES AND REGIONS**
Self-Test ..... **VERIFY OUTPUTS TO NAV INDICATORS**
Self-Test - TAWS Remote Annunciator (if installed):
- PULL UP ..... **ILLUMINATED**
- TERR ..... **ILLUMINATED**
- TERR N/A ..... **ILLUMINATED**
- TERR INHB ..... **ILLUMINATED**

Self-Test - GPS Remote Annunciator (if installed):
- VLOC ..... **ILLUMINATED**
- GPS ..... **ILLUMINATED**
- LOI or INTG ..... **ILLUMINATED**
- TERM ..... **ILLUMINATED**
- WPT ..... **ILLUMINATED**
- APR ..... **ILLUMINATED**
- MSG ..... **ILLUMINATED**
- SUSP or OBS ..... **ILLUMINATED**

4.2 Before Takeoff

System Messages and Annunciators ..... **CONSIDERED**

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GTN Xi the pilot should rotate the course pointer as prompted on the GTN Xi.

If an EHSI is used to display navigation data from the GTN Xi the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

See Section 4.5 for RF leg capabilities related to EHSI.

4.4 Autopilot Operation

The GTN Xi may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GTN Xi system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in a roll steering mode.

The GTN Xi supports autopilot roll steering for heading legs when an approved heading source is interfaced to the GTN Xi. This heading interface can also provide map orientation, traffic and StormScope heading data and wind calculations.

CAUTION

The GTN Xi does not provide course deviation to the autopilot for heading legs. Some autopilots do not allow the use of roll steering when course deviation is not provided.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GTN, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GTN. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

To couple an approach using manual APR outputs:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will issue a flashing message indication.

Flashing Message Button ..... **PRESS**
"Enable APR Output" Button..... **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot.....**ENGAGE APPROACH MODE**

To couple an approach using autopilot approach mode:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will enable vertical guidance.

Vertical Guidance.....**CONFIRM AVAILABLE**
Autopilot.....**ENGAGE APPROACH MODE**

4.6 Coupling the Autopilot for Descent VNAV

The GTN Xi outputs VNAV deviations to properly configured Garmin G500/600 GDU, G500/600/700TXi GDU, GI275, or G5 displays. To provide autopilot coupling to the baro VNAV guidance, the interface must also include either a Garmin GFC500 or GFC600 with VNAV capability. If VNAV is enabled on the GTN Xi in these installations, VNAV guidance may be coupled to the autopilot using the VNAV function of the GFC.

4.7 Coupling the Autopilot during Search and Rescue Operations

Search and Rescue (SAR) patterns created in the GTN Xi flight plan may include turns that cannot be accomplished with standard autopilot turn rates. Monitor autopilot performance relative to the desired path if coupled when using Search and Rescue patterns.

4.8 Cold Weather Compensation

The GTN Xi can compute altitudes for cold weather compensation for applicable IFR approaches. If the instrument approach chart requires temperature compensation, the pilot should enter the destination airport temperature into the GTN Xi. Approach altitudes provided on the map and flight plan are adjusted based on the pilot entered temperature and the altitudes on the flight plan page are appended with a snowflake icon.

Pilots must coordinate with ATC when flying temperature compensated procedures.

Pilots must manually adjust the approach minimums as applicable. The GTN Xi does not provide temperature compensated approach minimum values. Garmin G500/600/700TXi systems can provide compensated minimum values when interfaced with a GTN Xi.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

The Garmin GTN Xi Series Pilot's Guide, part number and revision listed below, contain additional information regarding GTN system description, control, and function.

- GTN Xi Series Pilot's Guide P/N 190-02327-03 Rev E or later

7.2 Navigation

The following section describes some of the GTN navigation functionality and provides details on the expected use and limits of the features.

7.2.1 Flight Plan Leg Sequencing

If a barometric corrected altitude source is not interfaced to the GTN Xi, a popup will appear prompting the flight crew to manually sequence the leg once the altitude prescribed in the procedure is reached.

7.2.2 Auto ILS CDI Capture

Auto ILS CDI Capture can automatically switch the CDI from GPS to VLOC before the Final Approach fix. This feature is only available on installations that meet any of the following conditions:

- Equipped with GFC 500 or 600
- GTN CDI key enabled

On these installations the auto-switching will only occur if the following conditions are met:

- ILS Autoswitch setting enabled on GTN
- ILS/LOC approach loaded and activated
- Correct nav frequency tuned on GTN NAV radio
- Aircraft established on the final approach course

Auto ILS CDI Capture will not automatically switch from GPS to VLOC for LOC-BC or VOR approaches.

7.2.3 User Defined Waypoints

When a User Defined Waypoint is created, a default name will automatically be provided, and the pilot is given the option to enter a different name for the waypoint. Pages which have the autofill function will prevent some waypoint names from being used. If it is desired to name the waypoint with a subset of the name of an existing waypoint in the database then this must be accomplished on the Waypoint Info / User Waypoints page.

Waypoints which are created when a Search and Rescue pattern is created are not considered User Waypoints and therefore functions associated with User Waypoints are not provided for these waypoints.

7.2.4 Direct-To Operations

When conducting Direct-To operations the Flight Plan tab provides a list of waypoints in the flight plan for which Direct-To is available. Some entries in the flight plan such as holds, and course reversals are not eligible for Direct-To and the pilot must instead select the associated waypoint if Direct-To operation is desired.

7.2.5 Holding Patterns

The GTN can provide holding guidance for user holds or procedure-based holds. For each hold there are two associated waypoints. If there is more than one published altitude for an approach hold, there will be three waypoints associated with the hold. The pilot can edit or activate the hold as needed for user holds. Holds on the initial, intermediate, or final approach cannot be edited except for the hold altitude constraints. Missed approach holds can be edited.

NOTE

If the aircraft position is outside of the depicted GTN hold, the system may not allow lateral NAV captures with certain autopilots. In this case, the pilot should fly the hold manually or with the HDG mode of the autopilot until they are inside the depicted holding pattern in which case normal NAV captures should be available.

NOTE

If the GTN is in the missed approach hold, the pilot can change or remove the approach procedure and the hold will remain the active navigation. If the GTN active navigation is a hold and the flight plan is deleted, the holding pattern will also be removed, removing active navigation.

7.2.6 Descent BARO VNAV

The GTN can provide multi-waypoint descent baro-VNAV guidance for the enroute and initial approach phases of flight. Altitudes associated with instrument procedures are retrieved from the navigation database when the procedure is added to the flight plan.

Altitudes in cyan on the GTN Xi are valid VNAV guidance waypoints and the GTN Xi will provide vertical guidance based on the displayed altitude constraints and default flight path angle (FPA). Altitude colored white are advisory only.

The following are recommendations for using descent VNAV:

- The pilot should verify all altitudes for procedures after loading the procedure into the flight plan.
- When the GTN Xi is installed with multiple TXi PFDs, it is highly recommended that GDU BARO SYNC be enabled and used during all VNAV operations.

In aircraft where there are multiple GDUs and two GTNs, VNAV will use the barometer setting from the pilot's side GDU for both GTNs. In the event the pilot's side GDU has failed, the GTNs will use the co-pilot's GDU barometer setting.

Descent VNAV is limited to flight path angles (FPA) between -1° and -5°, and a vertical speed required (VSR) descending at less than 4000 fpm. If a flight plan change is made during a VNAV descent, VNAV will be recalculated and could result in active VNAV path changes. If the current VNAV FPA is less than -1°, a new VNAV path may be computed during a flight plan change and result in a new Top of Descent point. This can also occur during VNAV Direct-To operations.

VNAV constraints are not allowed inside the FAF. VNAV altitudes are not saved in the flight plan catalog.

When VNAV is disabled by the pilot, it will be automatically re-enabled when the pilot initiates a lateral Direct-To to a waypoint.

7.2.7 Along Track Waypoints

The GTN Xi allows for the creation of flight plan waypoints that are based off an offset distance from a waypoint in the flight and places the new along track waypoint (ATK) in the flight plan. Once placed in the flight plan, the pilot may navigate using that waypoint in the same manner as other flight plan waypoints.

Along track waypoints cannot be created on a Vectors to Final (VTF) approach and are limited to the lateral constraints of the flight plan. This means that the pilot cannot place an ATK before the first waypoint of a flight plan or after the last waypoint of a flight plan.

ATKs are fixed once placed and will not move if the referenced waypoint is changed or removed from the flight plan. ATKs are not saved in the flight plan catalog. ATKs cannot reference another ATK in the flight plan.

7.2.8 Advisory Visual Approaches

The GTN Xi will provide advisory visual approaches to many runways in the aviation database. Lateral guidance for the visual approach is aligned with the runway bearing. Vertical guidance is provided for those runways with VGSI information for distances up to 4.0NM from the runway. If a terrain database is installed in the GTN Xi, the GTN Xi provides vertical guidance up to 28NM from the runway end unless the computed glideslope would impact terrain or obstacles from the database. If the projected impact point is under 28NM and greater than 4NM, the flight plan line for the approach is shortened to indicate where vertical guidance is active for the approach. If the terrain impact point is less than 4NM from the runway and there is no VGSI data available, vertical

guidance is not provided for that approach. Lateral guidance is still available when vertical guidance is removed.

CDI and VDI indications are equivalent to those of other GPS-based approaches (e.g.- LPV or LNAV+V). The GTN Xi annunciates "VISUAL" in the annunciator bar to indicate a visual approach is active.

When loading, or activating the approach, the GPA and TCH information for that approach will be displayed on a popup. If there is no vertical guidance available, the popup will display "(NO VERTICAL GUIDANCE)".

All advisory visual approaches shall be conducted in VMC. Visual approaches are intended to be used as an aid to situational awareness. Visual approaches are advisory in nature and do not guarantee terrain and obstacle clearance for the approach runway.

7.3 Terrain Proximity, Terrain Alerting, and TAWS

CAUTION

Not all obstacles and wires are contained in the Obstacle/HOT Line database. The system provides depiction (and alerts if TAWS is installed) only for obstacles and wires contained in the database.

NOTE

The area of coverage may be modified as additional terrain data sources become available.

Terrain on the dedicated terrain page or main map overlay is depicted in the following manner:

- Terrain more than 1,000 feet below the aircraft is not depicted or depicted as black.
- Terrain between 1,000 feet and 100 feet below the aircraft is depicted as amber.
- Terrain within 100 feet below the aircraft, or above the aircraft, is depicted as red.

Obstacles and wires on the dedicated terrain page or main map are depicted in the following manner:

- Obstacles and wires more than 2,000 feet below the aircraft are not depicted.
- Obstacles and wires between 2,000 feet and 1,000 feet below the aircraft are depicted as white.
- Obstacles and wires between 1,000 feet and 100 feet below the aircraft are depicted as amber.
- Obstacles and wires within 100 feet below the aircraft, or above the aircraft, are depicted as red.

Multiple obstacles may be depicted using a single obstacle icon and an asterisk to indicate obstacle grouping is occurring. The color of the asterisk indicates the relative altitude of the tallest obstacle in the group. The asterisk does not indicate any information about the relative altitude or number of obstacles not being displayed in the obstacle group.

The Garmin GTN Xi Series Pilot's Guide provides additional information regarding terrain and obstacle colors and grouped obstacle icons.

7.4 GMA 35/35c Audio Panel (Optional)

The GTN 725Xi and 750Xi can interface to a GMA 35/35c remotely mounted audio panel and marker beacon receiver. Controls for listening to various radios, activating the cabin speaker, clearance playback control, and marker beacon are accessed by pressing the "Audio Panel" button on the GTN display screen. Optional Bluetooth pairing functionality can be accessed from the associated System /Connext Setup page (GMA 35c only). Volume controls for the audio panel are accessed by pressing the "Intercom" button on the GTN Xi display screen.

Aircraft alerting audio may be routed through the GMA 35/35c audio panel. There are no pilot controls for alert audio volumes. In the event of a loss of GMA35/35c function alert audio routed through the audio panel may not be heard.

7.5 StormScope® (Optional)

When optionally interfaced to a StormScope® weather detection system, the GTN Xi may be used to display the StormScope® information. Weather information supplied by the StormScope® will be displayed on the StormScope® page of the GTN Xi system. For detailed information about the capabilities and limitations of the StormScope® system, refer to the documentation provided with that system.

Heading Up mode:

If the GTN Xi system is receiving valid heading information, the StormScope® page will operate in the heading up mode as indicated by the label "HDG UP" presented at the upper right corner of the display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft and *is* automatically rotated to the correct relative position as the aircraft turns.

Heading Not Available mode:

If the GTN Xi system is not receiving valid heading information, either because a compatible heading system is not installed, or the interfaced heading system has malfunctioned, the StormScope® page will continue to operate without a heading source and indicate "HDG N/A" in the upper right corner of the GTN Xi display. In this mode, information provided by the StormScope® system

is displayed relative to the nose of the aircraft but *is not* automatically rotated to the correct relative position as the aircraft turns. When operating in this mode, StormScope® strikes must be cleared after each turn the aircraft performs.

7.6 External Switches

External switches may be installed and interfaced to the GTN Xi. These switches may be stand alone or integrated with a TAWS or GPS annunciator. Table 7-1 lists the switches and function they perform:

Switch Label	Function
CDI	Toggles between GPS / VLOC sources. This switch may be part of an external annunciator panel.
COM CHAN DN	Toggles down through the preset com frequencies.
COM CHAN UP	Toggles up through the preset com frequencies.
COM RMT XFR	Transfers the COM active / standby frequencies.
NAV RMT XFR	Transfers the NAV active / standby frequencies.
OBS	Performs an OBS or SUSP function. This switch is part of an external annunciator panel and is placarded with the following: "Green OBS indicates OBS or SUSP mode – GTN Xi annunciator bar indicates which is active. Push OBS button to change OBS or SUSP mode."
OBS/SUSP	Performs an OBS or SUSP function.
TERR INHB	Toggles the TAWS Inhibit function on/off. This switch is part of an external annunciator panel. The terrain display is still presented if TAWS is Inhibited.
PTC	Push-to-Command switch for Voice Command input to the GMA and the GTN Xi.
SMART GLIDE	Optional toggle switch used to activate and cancel Smart Glide.

Table 7-1 – External Switches

7.7 Airspace Depiction and Alerts

The GTN Xi aides the flight crew in avoiding certain airspaces with Smart Airspace and airspace alerts. Smart Airspace de-emphasizes depicted airspace that is not near the aircraft's current altitude. Airspace Alerts provide a message indication to the flight crew when the aircraft's current ground track will intercept an airspace type that has been selected for alerting.

NOTE

Smart Airspace and Airspace Alerts are separate features. Turning on/off Smart Airspace does not affect Airspace Alerts, and vice versa.

7.8 Garmin ADS-B Traffic System Interface (Optional)

A Garmin ADS-B traffic system may be interfaced to the GTN Xi. The *nose* of the ownship symbol on both the GTN Xi main map page and dedicated traffic page serves as the actual location of your aircraft. The *center* of the traffic target icon serves as the reported location for the target aircraft. Motion vectors for traffic may be displayed in either absolute or relative motion. The location of the traffic targets relative to the ownship are the same, regardless of the selected motion vector.

Traffic targets displayed on the dedicated traffic page may be selected to obtain additional information about a traffic target or to view all targets in a grouped target. When a grouped target is selected, the "Next" button on the dedicated traffic page will cycle through all targets located near where the screen has been touched.

Traffic may be displayed on the GTN Xi when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems can provide traffic monitoring and alerting to the flight crew. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

Absolute motion vectors are colored either cyan or white, depending on unit configuration. Absolute motion vectors depict the reported track of the traffic target referenced to the ground. An absolute motion vector pointed towards your ownship symbol *does not* necessarily mean the traffic target is getting closer to your aircraft.

Relative motion vectors are always colored green and depict the motion of the traffic target relative to your ownship symbol. The direction the traffic target is pointed may vary greatly from the motion vector and a target may be getting closer to your aircraft independent of the direction the target is pointed. A green relative motion vector pointed towards your ownship indicates that the traffic target *is* converging on your aircraft.

If more than one target is occupying the same area of the screen, the GTN Xi will combine the two or more traffic targets into one traffic group. The presence of an asterisk to the left of a target indicates that traffic has been grouped. The highest priority traffic target in the group is displayed to the pilot. When applied to airborne targets the asterisk will be displayed in white or cyan depending on the traffic depiction color used in the installation. The asterisk will be brown for grouped ground targets. The asterisk will not turn amber, even if an alerted target is included in the group.

An alerted target may be placed in the same group as non-alerted targets. In this case, the alerted target will be displayed. Two alerted targets will not be placed in the same group. All alerted targets will be displayed on the screen.

Traffic is displayed in feet regardless of the unit settings for altitude. If the units for altitude are different than feet, a "FT" label will appear on the traffic icon on and main map page, and the dedicated traffic page will include an "ALT IN FT" notification.

7.9 GWX 70/75 Weather Radar (Optional)

The GWX 70/75 Weather Radar uses Doppler technology to optionally provide advanced features to the flight crew such as turbulence detection and ground clutter suppression. Turbulence detection can detect turbulence up to 40nm from the aircraft and will be displayed at radar ranges of 160nm or less.

NOTE

Turbulence detection does not detect all turbulence especially that which is occurring in clear air. The display of turbulence indicates the possibility of severe or greater turbulence, as defined in the Aeronautical Information Manual.

7.10 Charts (Optional)

The GTN 750Xi/725Xi can display both procedure charts and weather data on the main map page at the same time. When datalink NEXRAD or Precipitation is overlaid on the main map page, the weather data is displayed *below* an overlaid procedure chart. When airborne weather radar is overlaid on the main map page, the radar data is displayed *above* an overlaid procedure chart.

SafeTaxi and ChartView functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD).

7.11 Transponder Control (Optional)

The GTN Xi can be interfaced to a Garmin transponder for control and display of squawk code, mode, and additional transponder functions. The activation of the "Enable ES" button on the transponder page does not indicate the aircraft is in full compliance with an ADS-B Out solution in accordance with TSO-C166b (1090ES). Consult your transponder documentation for additional information.

7.12 Telephone Audio (Optional)

Telephone audio distribution to the crew defaults to OFF on each power cycle of the GTN Xi. Prior to utilizing the telephone function, the crew must distribute telephone audio to the desired recipients. If the crew is utilizing the telephone function it is required that the telephone audio be turned off upon completing telephone usage.

7.13 Terrain, Wires, and Obstacles

Terrain, point obstacle, and wire obstacle information appears on the map and terrain display pages as red and amber terrain, obstacles, or wires and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain, obstacle, and wire information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

7.13.1 Dedicated Terrain Page

The dedicated Terrain page will always depict point obstacles at zoom scales of 10 nm or less and depict wire obstacles at zoom scales of 5 nm or less. The obstacle or wire overlay icon (see Figure 3) will be shown near the bottom of the display when the obstacle or wire depiction is active based on the zoom scale.

NOTE

Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Terrain page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

Figure 3 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.13.2 Map Page

The Map page may be configured to depict point obstacles and wire obstacles at various zoom scales by the pilot by using the Map page menu. The obstacle or wire overlay icon (see Figure 4) will be shown near the bottom of the display when the obstacle or wire overlay is active based on the current zoom scale and setting selected by the pilot.

The settings chosen by the pilot on the Map page menu (including obstacle and wire display ranges) are saved over a power cycle.

NOTE

Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Map page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

NOTE

The Map page may be configured by the pilot to not show any obstacles or wires at any zoom scale.

Figure 4 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.14 Map Page

7.14.1 Configuration

The moving map and weather pages can display a large quantity and variety of data. Map data is layered to ensure that data which is typically more critical is drawn above less critical data, however at some zoom scales and configurations the map may be cluttered with large amounts of data. Controls are provided on the Map and Weather pages for the pilot to select which data displayed, the declutter level, and the zoom scales at which data is added to or removed from the display. It is the responsibility of the pilot to select settings for the map page that will provide the display of data most appropriate to the operation being conducted.

7.14.2 Flight Plan Depiction

The map page depicts the current active flight plan. When an off-route Direct To is active the flight plan will no longer be depicted on the map.

7.14.3 Fuel Range Ring

The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes at the current aircraft groundspeed by default. The pilot may change the fuel reserve time value on the map setup menu. Changes to the fuel reserve time are persisted over GTN Xi power cycles.

Visibility of the fuel range ring may be affected by the underlying map data selectable by the pilot. The pilot may make changes to the topographic or terrain data in order or more clearly observe the fuel range ring at any time.

Fuel range data is derived from the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

7.15 Times and Distances

Time and Distance data to the next waypoint is always calculated from the present position to that waypoint and does not account for the path which may be flown (such as intercepting a course) to reach the waypoint.

When navigating using GPS guidance most legs are TO type legs where distance to the next waypoint decreases along the route. However, some procedures include FROM type legs. When navigating on a leg that is a FROM leg indications that it is a FROM leg include the TO/FROM flag indicating FROM and distances increasing in distance fields.

7.16 GTN Xi-GTN (Xi) Crossfill

Specific data will sync between GTNs when installed in a dual GTN configuration. If data is not included in this list, it is not crossfilled. The following data will crossfill between the two GTNs with CROSSFILL ON or OFF:

- User Waypoints
- FPL Catalog
- Traffic Alerts
- Missed Approach Popups
- Altitude Leg Popups
- Heading
- Date/Time Conventions
- CDI Scale
- Default FPA

The following unit changes will crossfill:

- Temperature
- NAV Angle
- Fuel

The following items are crossfilled only when the GTNs are set to CROSSFILL ON:

- User Holds
- Approaches
- Flight Plan Changes
- Direct-To
- Selected OBS Course Changes

When the GTN is interfaced with other non-GTN Xi Garmin navigators, there will likely be minor discrepancies in the flight plan, course depictions, and turn annunciations based on the differences in the two navigators, even when crossfill is enabled. In such cases it is advisable to utilize the GTN Xi navigator as the primary navigator and if the discrepancy is such that the pilot workload is affected, crossfill should be turned off, and the flight plan on the non-GTN Xi navigator removed.

7.17 Automatic Speech Recognition (ASR)

ASR allows the pilot to interact with the GMA and GTN Xi via voice commands. Commands are constructed around the "Verb – Noun – (Suffix)" syntax for most ASR commands.

- **"SHOW"** Commands – Used to show pages or data fields on the GTN Xi
- **"SAY"** Commands – Used to instruct the ASR engine to say certain phrases related to the flight
- **"TUNE"** Commands – Used to tune certain frequencies into the standby position of the ASR GTN Xi (usually GTN #1)

The "Page" suffix is used in conjunction with the "Show" phrase to command pages to be displayed on the GTN. (e.g.- "Show Main Map Page")

Audio Panel commands are available to switch audio sources.

- **"SELECT"** to choose which radio the MIC will be selected
- **"TOGGLE"** to toggle the monitor of a specific NAV/COM radio
- **"DISTRIBUTE"** to change the source of audio for the respective seat positions
- **"MUTE"** to mute audio inputs on the audio panel for the respective seat positions

Supplemental commands that allow map zooming, and page navigation are also available.

- **"BACK"**
- **"CANCEL"**
- **"ZOOM IN"**
- **"ZOOM OUT"**

Each command is initiated via the Push-to-Command (PTC) switch. Aural tones will indicate to the pilot the status of the command. A positive tone (low to high) will indicate the system executed a command. A negative tone (high to low) will indicate the system did not understand the command or could not execute due to system state or configuration. "SAY" commands do not provide aural tones as feedback.

The pilot must maintain vigilance regarding ASR command information. Due to the nature of voice recognition, there are times when ASR will interpret a command differently than the pilot intended. The pilot should always cross check the ASR response to the information contained within the GTN Xi as appropriate to ensure in-flight information is accurately understood. If a conflict exists between information gathered via ASR and that available in the GTN Xi system, the pilot should defer to the GTN Xi system information.

Prior to using ASR, the pilot must complete the ASR Qualification Procedure from the GTN Xi Series Pilot's Guide.

The Command History Page details the commands received by ASR for that power cycle. A full list of commands and guidance for using ASR can be found in the *GTN 6XX/7XX Telligence Voice Command Guide,* 190-01007-50.

When using ASR for "TUNE" commands, it is recommended that the pilot enable Reverse Frequency Lookup (RFL) on the associated GTN Xi.

7.18 European Visual Reporting Points

If the GTN Xi is interfaced with a G500/600 PFD/MFD, and a flight plan in the GTN Xi contains a VRP, the G500/600 must have a database that contains the VRP to appropriately display the VRP on the MFD map. If the database on the PFD/MFD does not contain the VRP, the VRP will display on the MFD map as an intersection.

7.19 Screenshots

The GTN Xi can save screenshots to the removable SD card. To take a screenshot, press and hold the dual concentric knob while pressing the home key. A small camera icon will briefly appear in the bottom right corner of the screen indicating that the screenshot was successful.

7.20 Knob Page Navigation

Knob page navigation is a feature which allows quick navigation to select pages using the dual concentric knob. This feature is similar to the page navigation on Garmin G500/G600 TXi displays. Pages shown in the knob control menu can be customized from the "Page Shortcuts" menu found on the System page. Switching between Knob Control and radio tuning is accomplished by pressing the dual concentric knob.

The default knob behavior can be changed from Page Navigation to COM Radio based on pilot preference. Navigate to the System > Setup > COM/NAV menu and change the "Knob Control Default" setting as desired. After 30 seconds of inactivity, the knob function will return to the selected default behavior.

7.21 Remote Radio Control (Optional)

Remote radio control is a feature which allows each GTN in a dual-GTN installation to control all GTN communication and navigation radios. The feature adds a radios page which can be accessed via a user field or via the menu bar when a radio frequency keyboard is selected. If the user selects "Local and Remote" for Knob Control Radios in the System > Setup > COM/NAV menu, all radios can be accessed by pressing the dual concentric knob.

The pilot can send frequencies from Airport and waypoint information pages directly to either the communication or navigation radios.

7.22 Emergency Page (Optional)

The GTN Xi has an emergency page that will only appear if Smart Glide is enabled for the installation or when interfaced with a G500TXi or G600TXi with an emergency page. The emergency page allows emergency modes to be activated from the GTN Xi. Current supported emergency functions are Smart Glide and Emergency Descent Mode.

7.23 Smart Glide (Optional)

Smart Glide is an emergency assistance feature that quickly configures Garmin avionics to assist during an emergency loss of power with a single pilot action.

Overview

The purpose of Smart Glide is to reduce the workload and increase the situational awareness of a pilot during an emergency. The GTN Xi does this by constantly computing the aircraft glide range and best glide airport in the background.

When activated, the system will provide the following functionality:

Aircraft Equipment	Suitable Airport in Glide Range	No Glide Airport
GTN Xi	Provide navigation guidance and information to the nearest suitable airport within the glide range. Declutter the map display. Provide aural alerts upon activation, the airport distance and clock direction. Switch the CDI to GPS for navigator #1. Tune the airport CTAF or TOWER frequency in the standby for COM #1. (if equipped) CDI scale is set to 0.3NM.	Declutter the map display. Provide aural alerts indicating there are no glide airports within range. Tune the emergency frequency 121.5 in the standby for COM #1. (if equipped)
G500/600 TXi - or - GI 275	Annunciate "GLIDE" Altitude preselector is cleared.	Annunciate "GLIDE" Altitude preselector is cleared.
G3X	Annunciate "GLIDE"	Annunciate "GLIDE"

Aircraft Equipment	Suitable Airport in Glide Range	No Glide Airport
	CDI switches to GPS 1	CDI switches to GPS 1
G5	CDI switches to GPS 1	CDI switches to GPS 1
(optional) GFC 500 - or - GFC 600	IAS to greater of published best glide speed or minimum engagement speed GPS lateral mode. Selected altitude capture is disabled If the aircraft is >2NM from the glide airport and autopilot is not engaged an aural alert will announce "Engaging Autopilot" and the AP will engage.	IAS to greater of published best glide speed or minimum engagement speed ROL lateral mode with level attitude reference. Selected altitude capture is disabled If the autopilot is not engaged an aural alert will announce "Engaging Autopilot" and the AP will engage.

Table 7-2: Smart Glide Functional Description

Smart Glide Usage

Smart Glide is intended to be used both in emergency situations and during training. To get the most out of Smart Glide, it is recommended to practice for an emergency using Smart Glide so that the pilot can understand the benefits and limitations of the system prior to an actual emergency.

It is important to remember that Smart Glide is just a tool and the pilot in command is the final authority with respect to the safety of the flight. Therefore, it is the pilot in command's responsibility to decide whether Smart Glide should be used in a given emergency and to deviate from the route suggested by Smart Glide if a better landing area is available.

Smart Glide is designed to be most helpful at altitudes where the pilot has enough time to complete an emergency checklist before landing. Smart Glide is not suggested for use during takeoff or landing phases of flight or for use in the traffic pattern. Smart Glide is disabled on the ground and after takeoff until the aircraft reaches 1000ft AGL.

If at any time the "Maneuver and Land" aural and visual annunciation is presented, the pilot should truncate the emergency procedures and focus on making a safe landing.

If at any time the "Airport out of range" aural and visual annunciation is presented, the pilot should determine the best course of action, whether to divert to an alternate landing field or continue to the suggested glide airport.

Alternate Airport Selection

Alternate glide destination selection for Smart Glide may be done by selecting an airport on the map page and pressing the "Glide to Airport" button. A secondary method is to use the "Alternate Airport" button on the Emergency Glide page. This page displays available airports in a list. The maximum number of glide airports supported is 25. Airports ranked lower than the top 25 will not be available until the number of airports in the glide ring is reduced. Activating any other form of navigation will cause smart glide to cancel. If activating a direct-to, smart glide will automatically cancel and the direct-to will be active. Activating any procedure including a visual approach will prompt the user to cancel smart glide before proceeding.

Smart Glide Activation/Deactivation

The system can be activated by a discrete momentary switch if equipped or by a two-second press of the Direct-To button. These methods of activation are mutually exclusive. The Direct-To press and hold is disabled when a discrete activation switch is installed. All aircraft have a secondary method to activate Smart Glide via a button on the GTN Xi emergency page.

The GTN Xi indicates that smart glide is active by the appearance of the Yellow GLIDE button in the menu bar and by the Smart Glide status bar when viewing the emergency page.

When deactivated, the system will return back to normal operational modes including the flight plan that was in the GTN Xi prior to Smart Glide activation. The pilot will need to verify the active flight plan leg and set autopilot modes, airspeed bug, and altitude pre-selector as desired.

In certain situations, crossfill may be turned on or off when Smart Glide is activated. Verify the crossfill status is set as desired after the system is deactivated.

In aircraft equipped with a Garmin GFC autopilot, autopilot and flight director modes including airspeed references may be changed when activating and cancelling smart glide. Always verify the autopilot modes are set as desired after smart glide is cancelled. In certain situations when Smart Glide is cancelled, re-loading of the previous flight plan may cause the active navigation to change abruptly and in some situations the autopilot may begin following this new navigation immediately.

Map Page

The Glide Range Ring and Best Glide Airport Indicator are overlays on the map page. The Glide Range Ring and Best Glide Airport Indicator can be enabled and disabled individually in normal mode.

The Glide Range Ring provides the pilot with an estimated glide range in the event of a loss of engine power. The Glide Range Ring accounts for terrain, obstacles, and winds if wind data is available. If no wind data is available, the pilot will be notified when the glide range ring is displayed. In some cases, glide range ring may rely on datalink wind data which may not reflect current wind conditions.

Glide Range Ring

In normal operation the Glide Range Ring is displayed in cyan. This indicates that the displayed glide range is based on the published glide ratio for the aircraft. See the POH or AFM for the aircraft configuration and conditions required to achieve this range. In normal operation, the Glide Range Ring and Best Glide Indicator update at approximately 5 second intervals. Because of these limitations, the Glide Range Ring is only an estimate and should only be used for situational awareness.

When Smart Glide is active, the cyan Glide Range Ring is replaced with a yellow Smart Glide Range Ring. This range ring does not use a fixed value for glide ratio but instead updates approximately once per second using real-time glide performance. This range ring also accounts for terrain, obstacles, and wind just like the normal range ring. This ring will dynamically change size to reflect changes in glide performance that occur for any reason. The ring is most accurate when the glide is stabilized. Changes in glide ratio due to changes in aircraft configuration, changes in engine power, or un-accounted for changes in wind can cause the glide range ring to change size more rapidly. Because of these limitations, the Smart Glide Range Ring is only an estimate and should only be used for situational awareness.

Arrival AGL

The arrival AGL flag is automatically displayed when Smart Glide is active. This value is calculated based on the Smart Glide Range Ring data and the direct-to course to the glide airport. If the aircraft is further than 2NM from the glide airport the course and arrival AGL will automatically be recalculated when the CDI reaches ½ scale deflection. If the aircraft is within 2NM of the glide airport, the arrival AGL flag will be removed when the aircraft leaves the direct-to course for landing and the course will not be recalculated. The arrival AGL is updated approximately once per second and has the same limitations as the Smart Glide Range Ring on which the data is based.

Best Glide Airport Indicator

The Best Glide Airport Indicator is depicted as cyan chevrons on the map page which point the pilot toward the "best" airport to glide to in the event of loss of engine power. When the best glide airport indicator is enabled, it will be shown if there are any airports within the glide range ring that meet the configured criteria. If there are no airports that meet the criteria, the indicator will not be displayed even when it is enabled. The "best" glide airport is selected based on runway surface type, distance from present position, runway length, and weather

if weather data is available. Additionally, public airports are prioritized over private airports. Because of this fixed determination and the limited information available to the avionics, the best glide airport is a suggestion, and the pilot is responsible for choosing the most favorable landing site in the event of an emergency.

When Smart Glide is activated, the system will use the same logic as the best glide airport indicator to pick a glide destination. The system may choose a different airport when activated if the solution has changed since the best glide indicator was last updated. However, once the glide destination is selected, it will not change while smart glide is active unless modified by the pilot.

Emergency Glide Page

The emergency page on the GTN Xi, G500/600 TXi, and G3X automatically becomes the emergency glide page when Smart Glide is active. This page can be accessed quickly while Smart Glide is active by pressing the yellow GLIDE icon in the menu bar. This page displays information about Smart Glide status, pertinent airport information, and shortcut buttons for common actions during glide. A map shortcut button is always displayed on the emergency glide page. A Squawk 7700 button will be displayed on the controlling unit if a transponder is being controlled by the GTN or G3X.

Nearest Airport Page

The Nearest Airport Page indicates which airports are within the glide range ring by displaying the word "Glide" with a green checkmark.

The GTN Xi uses data about the airport and installer configured data to determine the best suitable glide airport. The airports within the glide range that are of the surface type designated by the installer will be ranked according to:

1. Weather Category (LIFR, IFR, MVFR, VFR) if available.
2. Distance from the aircraft.
3. Runway length.
4. Public vs Private (Public is preferred)

The highest ranked airport will be selected as the glide destination. If no public airports meet the requirements for desired runway length and weather, airports with shorter runway lengths, airports with IFR/LIFR weather, airports with winds above the max desired gust speed, and private airports may be selected. If no airports within the glide range meet the surface type criteria, the system will advise that there are no airports within glide range.

Glide Prediction

When active, the system will continuously monitor the aircraft glide performance and adjust the yellow Smart Glide Range Ring as necessary. If the currently selected airport falls out of glide range as measured by the system, the system will alert the pilot with visual and aural alerts. The pilot has the option to choose an alternate glide airport from the map or the "Alternate

Airport" button on the Emergency Glide page of the GTN Xi. Only airports that are eligible to be glide airports can be selected. Sudden changes in aircraft performance while the system is active will cause a degradation in the accuracy of the glide range estimation.

System Requirements

Smart Glide requires the following to function:

- Valid GPS position fix
- Valid data from a compatible Garmin PFD
- Terrain and Navigation database installed on GTN Xi

Visual/Aural Alerts

The following describes how the system functions as the aircraft approaches the glide airport or off-airport landing areas.

With a Glide Airport Selected

4NM from the Glide Airport

An "Approaching Airport" aural and visual alert is generated.

2NM from the Glide Airport

A "Maneuver and Land" aural and visual alert is generated along with a distance and clock position callout. If the autopilot is still engaged after 10 seconds and the aircraft altitude is low, another aural alert will remind the pilot to "Disconnect Autopilot". Once the aircraft is within 2NM of the glide airport, the pilot must take full control of the aircraft. At this point Smart Glide will no longer provide range alerts and GPS guidance will not recalculate.

500' AGL

At 500' above the ground, a "500" aural alert is generated as a reminder to prepare for touchdown.

With No Glide Airport

Altitude AGL Callouts

At 2000', 1000', and 500' above the ground, an associated aural alert is generated as a reminder to prepare for touchdown. No GPS course guidance is given.

CAUTION

This system is intended to aid the crew in the initial avionics setup during a glide emergency, and if possible, to aid the pilot in finding and navigating to a suitable airport within the glide range of the aircraft. The pilot must make every effort to ensure the system guidance is as desired. Other or more suitable airports or off-airport landing areas may be available but unknown to the Smart Glide system. The pilot must evaluate all options and choose the most appropriate course of action given the conditions.

Alert	Description
"Smart Glide Disabled. Low Altitude"	Smart glide cannot be activated below 1000' AGL.
"Smart Glide Disabled."	Smart Glide cannot be activated, but the switch was used to attempt to activate. NOTE: If Smart Glide was manually disabled using the Emergency Page menu, this aural alert will not play.
"Smart Glide Active"	Smart Glide is active and functional.
"Smart Glide Canceled"	Smart Glide was canceled by the pilot.
"Engaging Autopilot"	Smart Glide has engaged the autopilot in GLIDE mode.
"Disconnect Autopilot"	Reminder to the crew that the system is no longer navigating, and the crew should take over for the landing or descent maneuver.
"Airport X o'clock X miles	The glide airport distance and bearing are given relative to the aircraft at the time the alert was generated. Distance is given in nautical miles.
Altitude Aurals	Alert the pilot when at specified altitude AGL. A "Five Hundred" callout is standard. Additional "Two Thousand" and "One Thousand" callouts are issued when there is no airport in range.
"No Airports Within Glide Range"	The GTN cannot find an airport for Smart Glide. Consider airports not available in the GTN Xi, or other off-airport landing sites.
"Approaching Airport"	The aircraft is within 4NM of the glide airport.
"Maneuver and Land"	The aircraft is within 2NM of the glide airport. The pilot should maneuver the aircraft for landing.
"Airport Out of Range"	The glide airport is no longer in the predicted glide range.
"Smart Glide Failure, consider alternate landing site."	The Smart Glide system has failed due to loss of data input or system failure. Smart Glide guidance is not available. The pilot should consider all available alternatives, including continuing to the previously chosen airport, and not rely on the GTN Xi for glide information.
"ALTN Airport Out of Range"	If an alternate airport is selected that is on the edge of the glide range ring, the airport may go out of range while the system is recalculating. If this occurs, the guidance to the current airport will be maintained (if available) and the "ALTN Airport Out of Range" message will be displayed for five seconds.

Table 7-3: Smart Glide Alerts

TXi Integration
Smart Glide is fully compatible with the G500/G600 TXi if a PFD or MFD is configured. When Smart Glide is active, a yellow GLIDE button will appear on the MFD or PFD if no MFD is visible. Pressing the GLIDE button will bring up the emergency glide menu. The G500/G600 MFD map page will mirror the information on the GTN map page when smart glide is active. While information can be viewed on TXi, changing the glide airport can only be done on the GTN Xi.

G3X Touch Integration
Smart Glide is fully compatible with the G3X Touch system if a PFD or MFD is installed. When Smart Glide is active, a yellow GLIDE button will appear on the bottom of the PFD and MFD. Pressing the GLIDE button will bring up the emergency glide page. If displayed, the G3X Touch *Glide Range Ring* will be removed when smart glide is active. Refer to GTN Xi glide range ring display. While information can be viewed on G3X Touch, changing the glide airport can only be done on the GTN Xi.

GI 275 Integration
The GI 275 will indicate when smart glide is active by yellow "GLIDE" text on the top of the altitude tape. When the GI 275 controls a GFC 500, this indication will also indicate when IAS glide mode is active.

GFC Integration
When select Garmin GFC autopilots are interfaced to the system, the autopilot will automatically modify its behavior to assist the pilot when Smart Glide is active. The following table describes compatible GFC 500 and 600 software versions that have Smart Glide compatibility:

GFC Model	Software Version
GFC 600	v2.80 or later. Check the GFC 600 AFMS to determine Smart Glide compatibility and configuration.
GFC 500	GI 275 version: v2.40 or later G3X: v9.00 or later G5: v8.00 or later

Table 7-4: Smart Glide Software Compatibility

If the airplane is more than 2NM from the best glide airport when smart glide is activated, the autopilot will automatically engage the servos and set the flight director to GPS and IAS modes. IAS mode will automatically target best glide speed or autopilot minimum engagement speed if best glide is less than the minimum engagement speed. If the airplane is within 2NM of the best glide airport, the flight director will still be activated in GPS and IAS modes but the autopilot servos will not be engaged. If no airport is within glide range when

Smart Glide is activated, the autopilot will engage servos and the flight director will be set to ROL mode with a wings level reference and IAS mode.

When Smart Glide is active, the behavior of IAS mode is modified so that the airspeed reference initially targets best glide speed or autopilot minimum engagement speed if best glide is less than the minimum engagement speed. The airspeed reference and vertical mode may be changed by the pilot at any time, but if IAS mode is selected again, it will set the airspeed reference back to the initial smart glide speed. This behavior is indicated by the presence of the "GLIDE" indication on GTN and on GFC 600 by "GLIDE" being annunciated on the GMC 605. As soon as Smart Glide is cancelled, IAS mode reverts to its normal function.

Smart glide only engages the autopilot servos on initial activation when further than 2NM from the best glide airport. It is the pilot's responsibility to manage the autopilot and disconnect it at the appropriate time. There is no automated autopilot disconnect. If the pilot later selects a new glide destination, the flight director modes will be switched to GPS and IAS modes, however the autopilot servos will not be automatically engaged. The pilot may manually engage the autopilot servos by pressing the AP button on the autopilot mode controller.

When Smart Glide is cancelled, autopilot mode changes may occur. It is the pilot's responsibility to disconnect the autopilot or verify the flight director modes are as desired after cancelling Smart Glide.

7.24 Autopilot Coupling

It is possible to create flight plan waypoint sequences, including Search and Rescue patterns, which exceed the autopilot's bank angle capabilities. The pilot shall monitor autopilot performance regarding flight path deviation.

7.24.1 RNP 1.0 RF Leg Types

This STC does not grant operational approval for RF leg navigation for those operators requiring operational approval. Additional FAA approval may be required for those aircraft intending to use the GTN Xi to provide RNP 1 or RNP 0.3 navigation in accordance with FAA Advisory Circular AC 90-105A.

AC 90-105A states that procedures with RF legs must be flown using either a flight director or coupled to the autopilot.

This STC has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the GTN Xi installation complies with limitation set forth in Section 2.6.1 of this document. It is recommended to couple the autopilot for RNP 1.0 RF procedures, if available, but it is not required to do so.

7.24.2 RNP 0.3 RF Leg Types

This STC has demonstrated acceptable crew workload and Flight Technical Error for coupled procedures with RF legs when the GTN Xi installation complies with limitation set forth in Section 2.6.1 of this document. It is required to couple the autopilot for RNP 0.3 RF procedures.

7.25 StormScope® Display (Optional)

StormScope® lightning information displayed by the GTN Xi is limited to supplemental use only. The use of the StormScope® lightning data on the display for hazardous weather (thunderstorm) penetration is prohibited. StormScope® lightning data on the display is intended only as an aid to enhance situational awareness of hazardous weather, not penetration. It is the flight crew's responsibility to avoid hazardous weather using official weather data sources.

When the GTN Xi StormScope® page is operating without a heading source, as indicated by the "HDG N/A" label at the upper right corner of the StormScope® page, strikes must be cleared after each heading change.

7.26 Flight Planner/Calculator Functions

The Fuel Planning page uses Fuel on Board or Fuel Flow as received from an on-board fuel totalizer, as entered by the pilot at system startup, or as entered by the pilot when on the Fuel Planning page. This *is not* a direct indication of actual aircraft fuel flow or fuel on board and those values are only used for the Fuel Planning page. The fuel required to destination is only a calculated and predicted value based on the data entered into the planner. It is not a direct indication of how much fuel the aircraft will have upon reaching the destination.

7.27 Fuel Range Rings

The fuel range rings displayed on the moving map are intended for situational awareness and do not represent a direct indication of endurance or fuel remaining. The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes by default. The reserve value can be changed from the GTN Xi map setup menu.

Fuel range data is derived by the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

7.28 Glove Use / Covered Fingers

No glove or covered fingers may be used to operate the GTN Xi touchscreen unless the Glove Qualification Procedure located in the GTN Xi Series Pilot's Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GTN 725Xi, 750Xi or GTN 625Xi, 635Xi, 650Xi combinations.

7.29 Active Weather Radar

Radar is broadcasting energy while in Weather or Ground mapping modes. If the GTN 750Xi/725Xi system is configured to control an airborne weather radar unit, observe all safety precautions, including:

- Do not operate in the vicinity of refueling operations.
- Do not operate while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.

CAUTION

If a radar system is installed, it generates microwave radiation and improper use, or exposure, may cause serious bodily injury. Do not operate the radar equipment until you have read and carefully followed the safety precautions and instructions in the weather radar user manual and/or pilot's guide.

7.30 Telephone Audio

Telephone audio must not be distributed to the pilot or co-pilot unless a phone call is active.

CAUTION

Failure to turn off telephone audio when the telephone is not in use may result in telephone ringer or text message aural notifications being received during critical phases of flight.

7.31 Multi Crew Aircraft (GMA 35 Only)[2]

For aircraft type certified with more than one required pilot, or operations requiring more than one pilot, the "Group Co-Pilot with Passenger" audio panel option shall not be activated. This option is found in the Intercom Setup Menu when a Garmin GMA 35 audio panel is installed.

Additionally, when the GTN Xi and TXi are installed in the same cockpit, it is recommended that the GTN Xi and TXi have the same chart types and cycles to ensure appropriate lookup and chart syncing/streaming functionality.

7.32 Automatic Speech Recognition

Pilots may not use the ASR function to operate the GTN Xi/GMA unless they have completed the ASR Qualification Procedure located in the GTN Xi Series Pilot's Guide successfully. The ASR Qualification Procedure is specific to each pilot / headset / aircraft combination.

[2] Includes GMA 35 and GMA 35c Audio Panels

7.33 Connext Data (Optional)

The Connext product line uses a wireless transceiver to provide data to and from a GTN Xi to personal electronic devices (PEDs).

The Flight Stream 210 is a remotely mounted unit that provides the capability to interface Portable Electronic Devices (PEDs) to the GTN Xi via Bluetooth. The Flight Stream 510 is mounted in the GTN SD card slot and includes a Bluetooth and Wi-Fi transceiver. The GDL 60 is a remote mounted wireless access point that includes Bluetooth and Wi-Fi connectivity to the PED, and LTE or Wi-Fi connectivity to Garmin services on the ground.

Data such as traffic, flight plan, datalink weather, entertainment audio information, and attitude information are sent from the Flight Stream or GDL 60 to the PED. The PED can send flight plans and databases (except Flight Stream 210) to the GTN Xi via the access point. Limitations regarding database operations are found in Section 2.15.

Garmin provides a list of tested and compatible devices that can be used with the Flight Stream or GDL 60. Connection to the Flight Stream or GDL 60 may be possible with devices other than those on the supported device list, but Bluetooth® and/or Wi-Fi stability and wireless data integrity cannot be guaranteed.

For details about the Garmin supported devices and apps for use with the Connext product line, please visit: http://garmin.com/connext/supported_devices

7.34 System Databases

7.34.1 Database Provided Altitudes

When the GTN Xi provides altitude data for waypoints included in IFR procedures, the altitudes provided are those shown on the procedure chart for "Turbojet" or "Jet" aircraft. If altitudes for other aircraft such as "Turboprop" or "Prop" are required, the crew must manually edit the waypoint altitude.

7.34.2 Database Sync with G500/600 or G500/600/700TXi GDUs

When a GTN Xi hosts a Flight Stream 510 for database syncing to GDUs, the GTN Xi and GDU must be configured for the same chart database type (FliteCharts or ChartView). If the GDU and GTN are not configured for the same chart type, charts database sync and Chart Streaming will not be available.

7.34.3 Databases and Flight Plan Waypoints/Procedures

Database versions (or cycles) and effective dates are displayed on the start-up database verification page immediately after power-on for those databases with an effective or expiration date. Databases with no effective or expiration date (e.g. - terrain database) are considered effective upon installation in the GTN Xi. Database information can also be viewed on the System – System Status page.

The Obstacle Database has an area of coverage that includes the United States and Europe and is updated as frequently as every 56 days. The HOT Line wire database only includes the continental United States and portions of Canada/Mexico.

Only the Obstacle/HOT Line wire database may be used in accordance with the limitation found in Section 2.14.

If a stored flight plan contains a waypoint or procedure that does not correspond to a waypoint or procedure in the navigation database in use, the waypoint or procedure will become locked (depicted as "lockd") in the flight plan. Flight plans with locked waypoints may be placed in the active flight plan portion of the system but no navigation will be provided. The locked waypoint/procedure must be resolved by removing or replacing it with the correct waypoint/procedures in the flight plan before the system will provide navigation.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

7.34.4 Single Point Database Acknowledgement

For GTN Xi units running software version 20.20 or later, the remote database confirmation feature has been replaced by single point database acknowledgement. This feature is available on all GTN Xi installations, and it gives users a quick way to verify databases on Garmin products are up to date before flight.

Upon startup GTN #1 will display a database summary page. Other Garmin products that support this feature will all skip their database confirmation pages. If all databases are up to date, GTN #1 will display a green check on the database summary page. If some databases are missing or out of date, GTN #1 will display the database details page and highlight the offending databases in yellow as before. If a database mismatch warning appears, that means that the databases are not the same on all the Garmin products. If more information is needed, the user can tap on the database mismatch label to see detailed information about a given database.

Recommendations for managing databases:

1. When downloading databases from the Fly Garmin website, always choose to use Database Sync and always choose to reinstall all databases when creating a database card.
2. If using Database Concierge on Garmin Pilot, verify that all database concierge downloads are up to date before attempting to install databases on GTN.
3. Always load databases to GTN #1 in installations with dual GTN Xi or a G500/G600 TXi. Don't load databases onto the SD cards for GTN #2 or TXi unless necessary. If databases are on the SD card, the unit will not skip the database page.
4. If a database mismatch occurs, power on all units to the home page and wait until the database sync is complete. A system message will appear while database sync is in progress. If a database mismatch still occurs check the Terrain database version on each unit and update as necessary. If the issue persists, contact Garmin Support.

7.34.5 GDL 60 (Optional)

The GDL 60 is a wireless access point for your airplane. It provides wireless access for PEDs in the aircraft similar to a FlightStream 510, automatic wireless database updates for aircraft avionics and wireless sensor data query and database downloads over LTE or wireless internet.

If wireless sensor data query is enabled in an installation, certain displays can power on when queried. During a query, the display backlight will be powered off to conserve battery.

The GDL 60 will wake up on battery power to download databases. Wireless sensor data query also uses a small amount of battery to listen for a request to wake up the avionics. It is recommended to install and use a battery tender in conjunction with the GDL 60.

If the aircraft will not be flown for an extended period without a battery tender or you are in a remote location and wish to eliminate the possibility of battery drain, open the "CNXT BATT" breaker to disable the GDL 60 live query functionality. While this breaker is open the GDL 60 will not download databases or respond to sensor queries.

7.34.6 Charts Database (Dual GTN7XX and TXi GDU)

When the aircraft installation includes 2 GTNs capable of displaying charts (GTN 725, 725Xi, 750, or 750Xi) and crossfill is enabled between the GTNs, the GTNs should have identical chart types (ChartView or FliteCharts) and charts cycles installed. Failure to have identical charts could affect the chart lookup features and automatic chart selection.

GTX 345

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the

Garmin GTX 33X and GTX 3X5 Transponders with ADS-B

as installed in

CESSNA 172M

Make and Model Airplane

Registration Number: N4480R Serial Number: 17263222

This document serves as an FAA Approved Airplane Flight Manual Supplement or Supplemental Airplane Flight Manual when the GTX 33X or GTX 3X5 with ADS-B is installed in accordance with Supplemental Type Certificate SA01714WI. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the FAA approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA approved Airplane Flight Manual, markings, or placards.

FAA Approved By: JR Brownell

JR Brownell
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 6/16/2021

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
1	05/01/2013	All	Complete Supplement	*Robert Murray* Robert Murray ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *05/01/2013*
2	03/08/2016	All	New supplement format with GTX 3X5 added.	*Michael Warren* Michael Warren ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *03/08/2016*
3	12/07/2017	All	Updated SW versions and removed section 3.2.3. Updated section 2.2 Corrected PED FAR reference and additional minor corrections.	*Erik Frisk* Erik Frisk ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *12/21/2017*
4	09/09/2019	4, 6, 7, 9, 11, 13, 14, 18	Added GTX diversity units, updated SW versions, expanded allowed remote control panels, and incorporated other minor changes	*JR Brownell* JR Brownell ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *09/09/2019*
5	06/16/2021	10, 11, 14, 18	Updated GTX 3X5 Main software to version 2.60, added GI 275 as a control display and GPS 175/GNC 355 as a GPS source	See cover page 1

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Section 1. GENERAL

1.1 GTX 33X

The Garmin GTX 33X family consists of the GTX 330 ES and GTX 33 ES (Non-Diversity Mode S Transponders) and the GTX 330D ES and GTX 33D ES (Diversity Mode S Transponders). The ES option of any of the transponders provides ADS-B extended squitter functionality.

All Garmin GTX 33X transponders are a radio transmitter/receiver that operates on radar frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses to ground-based radar on a frequency of 1090 MHz. Each unit is equipped with IDENT capability to initiate the SPI (special position identification) pulse for 18 seconds and will reply to ATCRBS Mode A, Mode C and Mode S All-Call interrogation. Interfaces to the GTX 33X are shown in the following block diagrams.

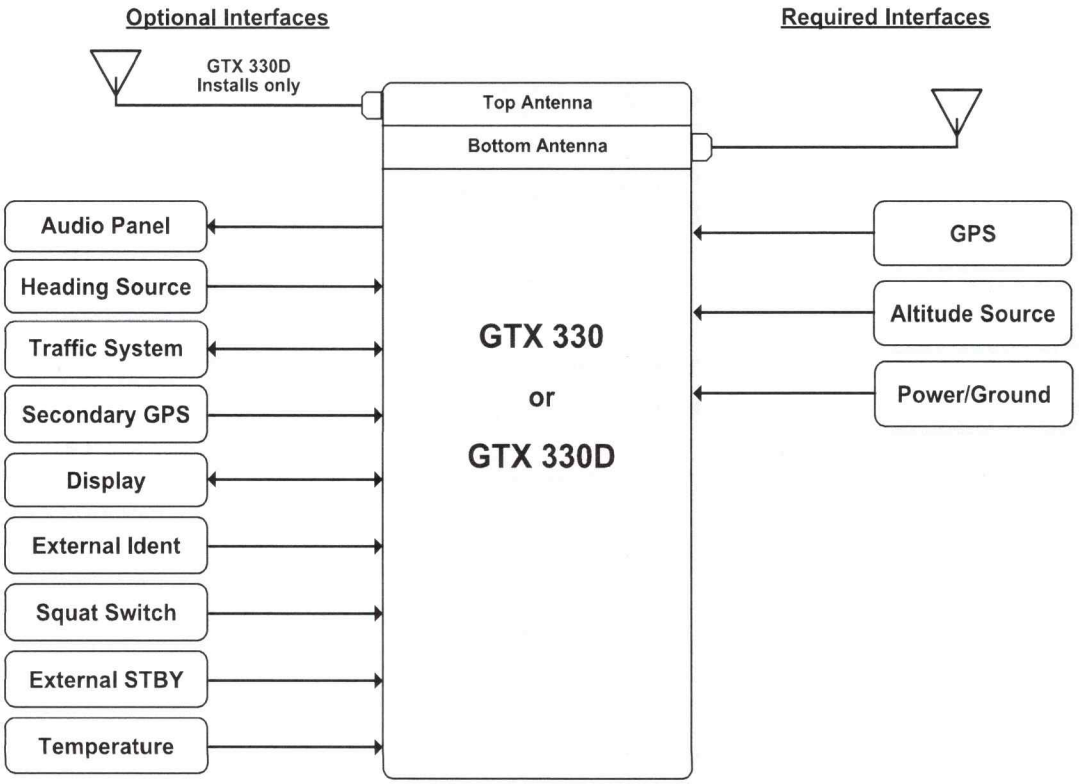

Figure 1 – GTX 330 or GTX 330D Interface Summary

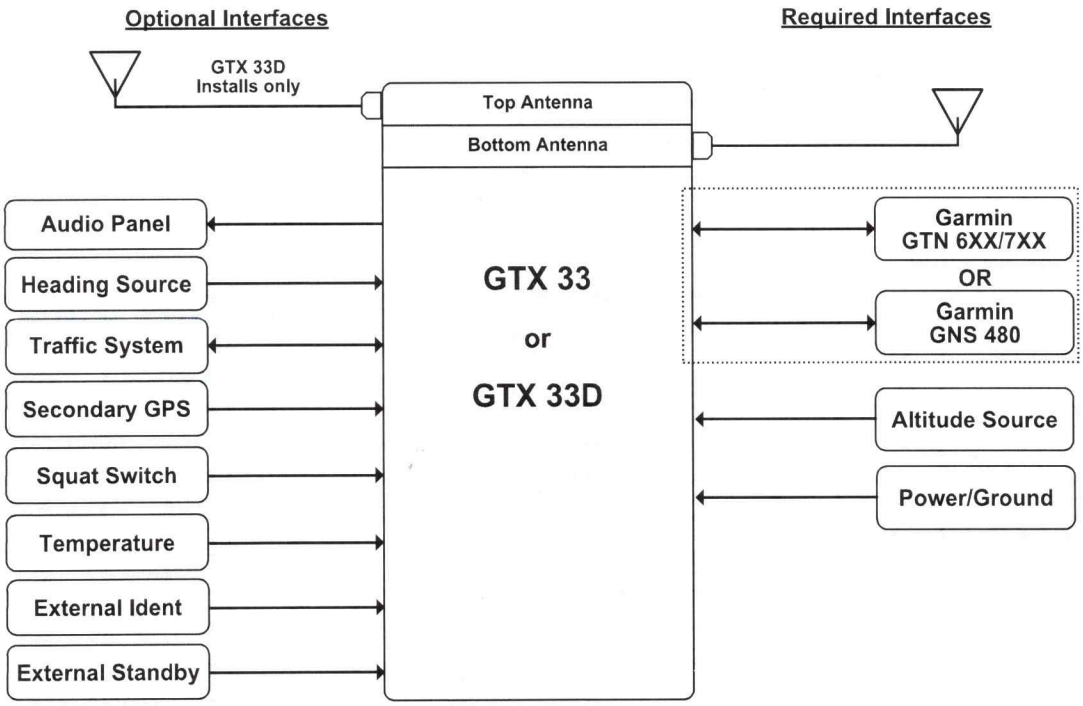

Figure 2 – GTX 33 or GTX 33D Interface Summary

The GTX 33X performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090 MHz)
  - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
    - GPS Position, Altitude, and Position Integrity
    - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
    - Air Ground Status
    - Flight ID, Call Sign, ICAO Registration Number
    - Capability and Status Information
    - Transponder Squawk Codes between 0000-7777.
    - Emergency Status
    - IDENT - initiates SPI (special position identification) pulse for 18 seconds
  - Pressure Altitude Broadcast Inhibit
- Reception of TIS-A traffic data from a ground station
- Provides TIS-A traffic alerting to the pilot via interfaced display and audio output

1.2 GTX 3X5

The Garmin GTX 3X5 family consists of the GTX 335, 335D, 335R, 335DR, 345, 345D, 345R, and 345DR transponders. The functional differences between each of these transponders are described in Table 1. Transponder models with a "D" designation are diversity capable and support both a top fuselage and bottom fuselage antenna.

Function	GTX 335/ 335D	GTX 335 w/GPS	GTX 335R/ 335DR	GTX 335R w/GPS	GTX 345/ 345D	GTX 345 w/GPS	GTX 345R/ 345DR	GTX 345R w/GPS
Panel mount	x	x			x	x		
Remote mount			x	x			x	x
Mode S	x	x	x	x	x	x	x	x
ADS-B (out)	x	x	x	x	x	x	x	x
ADS-B Traffic					x	x	x	x
FIS-B					x	x	x	x
Internal GPS		x		x		x		x
Bluetooth					x	x	x	x
Optional Garmin Altitude Encoder	x	x	x	x	x	x	x	x

Table 1 – GTX 3X5 Unit Configurations

Interfaces to the GTX 3X5 are shown in Figure 3.

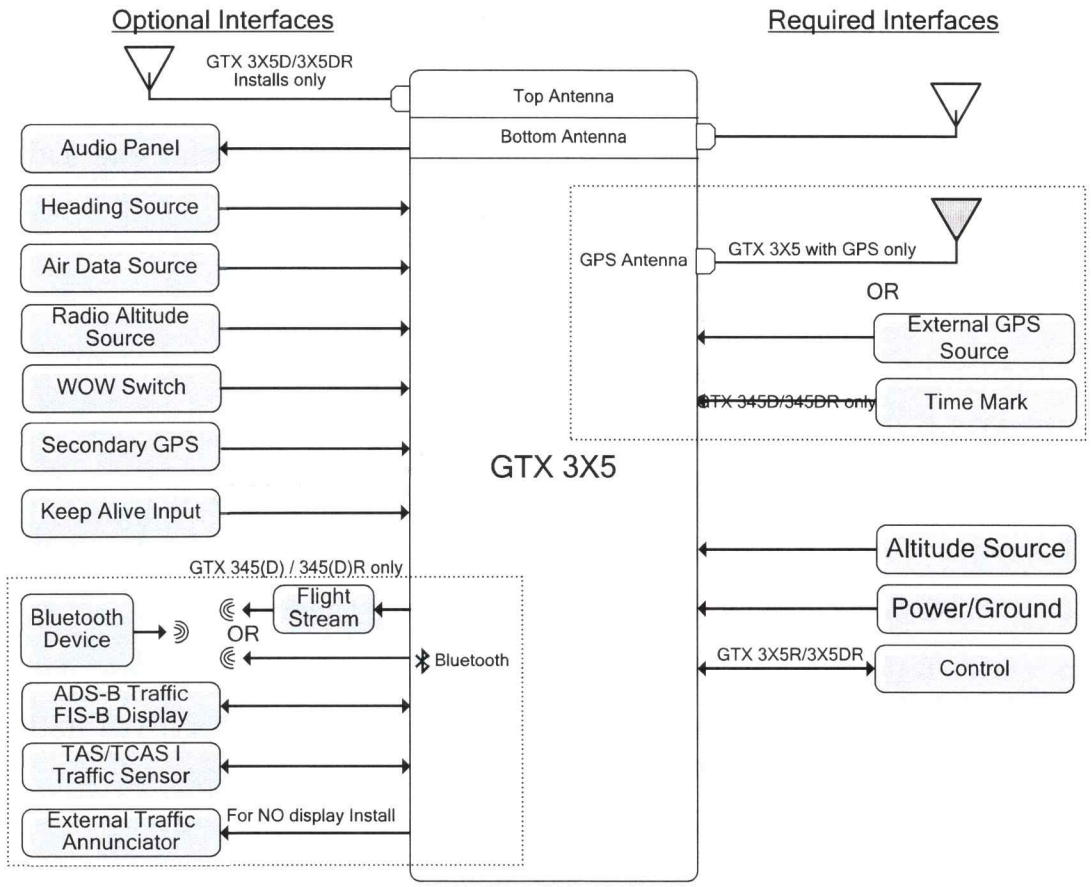

Figure 3 – GTX 3X5 Interface Summary

The GTX 3X5 performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090 MHz)
  - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
    - GPS Position, Altitude, and Position Integrity
    - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
    - Air Ground Status
    - Flight ID, Call Sign, ICAO Registration Number
    - Capability and Status Information
    - Transponder Squawk Codes between 0000-7777.
    - Emergency Status
    - IDENT - initiates SPI (special position identification) pulse for 18 seconds
  - Pressure Altitude Broadcast Inhibit

The GTX 335 performs the following additional functions:

- Reception of TIS-A traffic data from a ground station
- Provide TIS-A traffic alerting to the pilot via interfaced display and audio output.

The GTX 345 performs the following additional functions:

- Reception of ADS-B In data on 1090 MHz
  - ADS-B (Data directly from another transmitting aircraft)
  - ADS-R (Rebroadcast of ADS-B data from a ground station)
- Reception of ADS-B In data on UAT (978 MHz)
  - ADS-B (Data directly from another transmitting aircraft)
  - ADS-R (Rebroadcast of ADS-B data from a ground station)
  - TIS-B (Broadcast of secondary surveillance radar) (SSR) derived traffic information from a ground station.
  - FIS-B (Broadcast of aviation data from a ground station)
- Provide ADS-B traffic information and alerting to the pilot via an interfaced display
  - Correlation and consolidation of traffic data from multiple traffic sources
  - Aural and visual traffic alerting
- Provide FIS-B data to the pilot via an interfaced display
  - Graphical and textual weather products
    - NEXRAD
    - PIREPs
    - AIRMET/SIGMETs
    - METARs
    - TAFs
    - Winds Aloft
  - Aviation Data
    - TFRs
    - NOTAMs

1.3 Capabilities

The Garmin GTX 33X and GTX 3X5 as installed in this aircraft have been shown to meet the equipment requirements of 14 CFR § 91.227 when operating in accordance with sections 2.1 and 2.2 of this supplement.

1.4 Installation Configuration

This aircraft is equipped with a GTX 33X and/or GTX 3X5 with the following interfaces/ features:

Equipment Installed:

Transponder #1	Transponder #2 (if installed)
☐ GTX 330	☐ GTX 330
☐ GTX 330D	☐ GTX 330D
☐ GTX 33	☐ GTX 33
☐ GTX 33D	☐ GTX 33D
☐ GTX 335	☐ GTX 335
☐ GTX 335D	☐ GTX 335D
☐ GTX 335R	☐ GTX 335R
☐ GTX 335DR	☐ GTX 335DR
☒ GTX 345	☐ GTX 345
☐ GTX 345D	☐ GTX 345D
☐ GTX 345R	☐ GTX 345R
☐ GTX 345DR	☐ GTX 345DR

Interfaced GPS/SBAS Position Source(s):

GPS #1	GPS #2 (if installed)
☐ Internal	☐ Internal
☒ GTN 6XX/7XX Series	☐ GTN 6XX/7XX Series
☐ GNS 400W/500W Series	☐ GNS 400W/500W Series
☐ GNS 480	☐ GNS 480
☐ GIA 63W	☐ GIA 63W
☐ GDL 88 (GTX 330 only)	☐ GDL 88 (GTX 330 only)
☐ GPS 175/GNC 355	☐ GPS 175/GNC 355

Interfaced Pressure Altitude Source:

Pressure Altitude Source #1	Pressure Altitude Source #2 (if installed)
☐ _____	☐ _____
☒ Garmin Altitude Encoder	☐ Garmin Altitude Encoder

Interfaced Remote Control Display (Required for remotely mounted GTX variants):

Transponder #1 Remote Control Display	Transponder #2 Remote Control Display (if installed)
☒ GTN 6XX/7XX	☐ GTN 6XX/7XX
☐ GNS 480	☐ GNS 480
☐ G950/1000 Display	☐ G950/1000 Display
☐ GI 275	☐ GI 275
☐ Gables 7534 Controller	☐ Gables 7534 Controller
☐ Gables 7614 Controller	☐ Gables 7614 Controller
☐ CTL-92 Controller	☐ CTL-92 Controller
☐ CTL-92E Controller	☐ CTL-92E Controller

Interfaced Active Traffic System:

☒ None

☐ TCAD

☐ TAS/TCAS

NOTE

If the system includes all of the following components:

- GTX 345R or GTX 345DR,
- G950/1000 Display, and
- TCAD or TAS/TCAS

Then the aircraft is no longer equipped with a TSO compliant active TCAD, TAS or TCAS system. Any operational requirement to be equipped with such system is no longer met.

1.5 Definitions

The following terminology is used within this document:

ADS-B: Automatic Dependent Surveillance-Broadcast

AFM: Airplane Flight Manual

AFMS: Airplane Flight Manual Supplement

ATCRBS: Air Traffic Control Radar Beacon System

CFR: Code of Federal Regulations

ES: Extended Squitter

GNSS: Global Navigation Satellite System

GNS: Garmin Navigation System

GPS: Global Positioning System

GTX: Garmin Transponder

GTN: Garmin Touchscreen Navigator

ICAO: International Civil Aviation Organization

LRU: Line Replaceable Unit

PABI: Pressure Altitude Broadcast Inhibit

POH: Pilot Operating Handbook

SBAS: Satellite-Based Augmentation System

SW: Software

TCAS: Traffic Collision Avoidance System

TIS: Traffic Information Service

TX: Transmit

Section 2. LIMITATIONS

2.1 Minimum Equipment

The GTX 33X and GTX 3X5 must have the following system interfaces fully functional in order to be compliant with the requirements for 14 CFR 91.227 ADS-B Out operations:

Interfaced Equipment	Number Installed	Number Required
Uncorrected Pressure Altitude Source	1	1
GPS SBAS Position Source	1 or more	1
Remote Control Display (for remotely mounted transponders)	1 or more	1

Table 2 – Required Equipment

2.2 ADS-B Out

The GTX 33X and GTX 3X5 only comply with 14 CFR 91.227 for ADS-B Out when all required functions are operational. When the system is not operational, ADS-B Out transmit failure messages will be present on the remote control display interface, or the GTX 330 or GTX 3X5 panel display. If a Gables 7534 controller or Collins CTL-92/92E controller is being used the ADS-B equipment failure condition will be annunciated on the Gables or Collins display "Transponder Fail" while the ADS-B Out Position failure will be annunciated by the remotely installed "ADS-B POSN FAIL" Annunciator.

2.3 TIS Traffic Display with User Navigation Angle

Display of TIS traffic from a GTX 33/330 or GTX 335 is not permitted with an interfacing display configured for a navigation angle of "user".

2.4 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main GTX software version is displayed on the splash screen during start up for the GTX 330 and GTX 3X5 panel mounted units, and the External LRU or System page on the interfaced remote control display for remotely mounted GTX transponders.

Software Item	Software Version *(or later FAA Approved versions for this STC)*
GTX 33X Main SW Version	8.04
GTX 3X5 Main SW Version	2.60

Table 3 - Software Versions

2.5 Pressure Altitude Broadcast Inhibit (PABI)

Pressure Altitude Broadcast Inhibit shall only be enabled when requested by Air Traffic Control while operating within airspace requiring an ADS-B Out compliant transmitter. PABI is enabled by selecting the GTX to ON mode.

2.6 Datalinked Weather Display (GTX 345 Only)

Do not use datalink weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by datalink weather products may not accurately depict current weather conditions.

Do not use the indicated datalink weather product age to determine the age of the weather information shown by the datalink weather product. Due to time delays inherent in gathering and processing weather data for datalink transmission, the weather information shown by the datalink weather product may be significantly older than the indicated weather product age.

Do not rely solely upon datalink services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information.

2.7 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

No Change.

3.2 Abnormal Procedures

3.2.1 LOSS OF AIRCRAFT ELECTRICAL POWER GENERATION

XPDR Circuit Breaker..... **PULL**

Transponder and ADS-B Out functions will no longer be available.

NOTE

This guidance is supplementary to any guidance provided in the POH or AFM for the installed aircraft for loss of power generation.

3.2.2 LOSS OF GPS/SBAS POSITION DATA

When the GPS/SBAS receiver is inoperative or GPS position information is not available or invalid, the GTX will no longer be transmitting ADS-B Out data.

For GTX 330 installations:

NO ADSB annunciator illuminated:

Interfaced GPS position sources..... **VERIFY VALID POSITION**

For GTX 3X5 installations:

NO 1090ES TX annunciator illuminated:

Interfaced GPS position sources..... **VERIFY VALID POSITION**

For GTX 33 and GTX 3X5R installations:

Reference Display Device documentation for applicable annunciation:

Interfaced GPS position sources..... **VERIFY VALID POSITION**

Section 4. NORMAL PROCEDURES

The procedures described below are specific only to the panel mounted GTX 330 or GTX 3X5 transponders. Cockpit Reference Guides and Pilot Guides for interfaced remote control displays will provide additional operating information specific to the displays or other traffic systems.

ADS-B Out functionality resides within the GTX transponders thereby providing a single point of entry for Mode 3/A code, Flight ID, IDENT functionality and activating or deactivating emergency status for both transponder and ADS-B Out functions. Details on performing these procedures are located in the GTX 330/330D Pilot's Guide and GTX 3X5 Series Transponder Pilot's Guide.

4.1 Unit Power On

For GTX 330 installations:

GTX Mode..... **VERIFY ALT**
NO ADSB..... **CONSIDERED**

For GTX 3X5 installations:

GTX Mode..... **VERIFY ALT**
NO 1090ES TX ..... **CONSIDERED**

NOTE

The NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) may illuminate as the unit powers on and begins to receive input from external systems, to include the SBAS position source.

4.2 Before Takeoff

For GTX 330 installations:

ADS-B TX..... **VERIFY ON**
NO ADSB ..... **EXTINGUISHED**

For GTX 3X5 installations:

1090ES TX CTL ..... **VERIFY ON**
NO 1090ES TX ..... **EXTINGUISHED**

NOTE

The ADS-B TX or 1090ES TX CTL must be turned on and the NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) must be **EXTINGUISHED** for the system to meet the requirements specified in 14 CFR 91.227. This system must be operational in certain airspaces after January 1, 2020 as specified by 14 CFR 91.225.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

FAA APPROVED
AIRPLANE/ROTORCRAFT FLIGHT MANUAL SUPPLEMENT OR
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL (INCLUDING POH AND FAA AFM)
(FOR THOSE AIRCRAFT WITHOUT A BASIC AIRPLANE FLIGHT MANUAL)

EGT-701 TEMPERATURE INDICATOR
FOR

Single and Twin Reciprocating Engine Powered Aircraft as listed on Master Eligibility List of

STC SA2586NM.

REG. NO._____

SER. NO. _____

This Supplement must be attached to the FAA Approved Airplane/Rotorcraft Flight Manual when the J.P. Instruments EGT-701 is installed in accordance with Supplemental Type Certificate SA 2586NM. For those airplanes without a basic Airplane Flight Manual, the Supplemental AFM must be in the aircraft when the EGT-701 is installed.

The information contained in this Airplane/Rotorcraft Flight Manual Supplement/ Supplemental Aircraft Flight Manual supplements or supersedes the basic manual/ placards only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Airplane Flight manual, Markings and Placards.

FAA APPROVED:

Donald C. Armstrong

Manager, Flight Test Branch, ANM-160L
Federal Aviation Administration
Los Angeles Aircraft Certification Office
Transport Airplane Certification Directorate

Date: Nov. 12, 1992

Revision No.	Description	Affected Pages	Approval
Original	Complete Flight Manual Supplement for EGT-701	1 thru 4	Donald Armstrong Mgr. Flt. Test Br. ANM-160L FAA, LA ACO Transport Airplane Directorate Date 11-12-92
A	Added Fuel Flow features & Switch.	2 thru 4	Donald Armstrong Mgr. Flt. Test Br. ANM-160L FAA, LA ACO Transport Airplane Directorate Date 12-13-96
B	Added RPM and Manifold Pressure features	2 thru 4	Donald Armstrong Mgr. Flt. Test Br. ANM-160L FAA, LA ACO Transport Airplane Directorate Date 6-17-99

1-GENERAL

The EGT-701 temperature indicator displays temperature digitally and in analog format. The EGT as displayed is based on probes located near the exhaust outlet for each cylinder and the TIT probe, if installed, is adjacent to the turbo charger. These probes are not necessarily collocated with the primary probes therefore, EGT-701 may not indicate the same as the aircraft primary instruments. The analog display is an electronic bar graph (vertical columns, one per cylinder) of EGT & TIT temperatures presented as a percentage of 1650°F. Below the vertical columns the specific value for EGT and CHT are displayed digitally. The dot over the column indicates which cylinder's digital information is presently displayed. The missing bars at the base of the columns indicates the hottest and coldest Cylinder Head temperature trend . During Lean Find mode the leanest cylinder is displayed along with the fuel flow (optional) at that time. Depressing the LF and STEP button simultaneously brings up the adjustable scan rate function, OAT in °C or °F. Depress the LF button will change the value of the rate or OAT in °C or °F. Exit by Depressing STEP.

If the EGT-701 buttons are not depressed for 10 minutes the system will start scanning automatically. Depressing the STEP button will stop the automatic scan and index through all the functions available. During constant power cruise, if the the LF button is depressed for five seconds the bargraph will level at mid scale. The leveled bars represent the peaks of each column. Each bar represents 10 °F and now acts as an EGT & TIT trend monitor, quickly showing an increase or decrease in temperature. Depress again to return to normal; nothing else is affected. With the fuel flow option there is a three position toggle switch. The positions are: 1) **EGT**, digital and bargraph display of temperatures, 2) **FF**, digital display of GPH, REM and USED Fuel. Temperature bargraph remains. 3) **Both**, cycles through everything installed. The data port output, sends RS232 serial data every 6-sec.

Options of Fuel Flow, TIT, OAT, IAT (induction air temp.), OIL, BAT (voltage) and are only displayed digitally with headlines after the number, as "230 OIL" or “14 GPH”. A large value (50 +) of "CLD" indicates shock cooling usually associated with rapid descents at low power. Optional functions not installed will not display. RPM is displayed constantly in the upper display with no alarms. MAP is shown in the scan display.

Alarm limits set for this instrument if different from JPI limits.

CHT_____
OIL_____
TIT_____
DIF_____
CLD_____
BAT_____
TECH_____
DATE_____

P/N EGT-701

***GENERAL** (cont.)*

An alarm causes the digital function to flash as soon as the particular limit is exceeded. Factory set alarm limits for CHT (450 °F) and OIL (230°F) are lower than the actual aircraft limits and can not be set by the pilot. The values may be adjusted to suit individual preference by a qualified technician. Other factory set alarm limits are: "BAT" Voltage 15.5/11.0 or 31.0/22.0 Hi/Lo as appropriate; "DIF" (differential Hi/Lo EGT) 500 °F, "TIT" 1650 °F Hi; "OIL" Lo 90 °F; "CLD" (Rate of change of cylinder head temperature in degrees per minute) -60 degrees/minute. The pilot should be aware of the setting of each alarm for his particular aircraft. An alarm is "Canceled" by holding the step button in for 5 seconds and seeing the word "OFF". Then, only that particular alarm is canceled. Canceled alarms will not appear again until the power has been removed and reapplied to the EGT-701. The entire display dims automatically depending on the ambient lighting.

The Cylinder Head with the Gasket probe and oil temperature will indicate generally higher temperatures than instruments provided by the aircraft manufacturer because the EGT-701 sensing thermocouples are not collocated with the primary instrument sensing probes. Therefore, airplane flight manual limitations based on primary instrument indication take precedence over those of the EGT-701

II OPERATING LIMITATIONS

A. The EGT-701 may not replace any existing instrument or indicator required by the aircraft type design or operating limits.

B. The EGT-701 display may not be used in lieu of, or to supersede, engine operating limitations established by the airframe or engine manufacturer during certification.

III. EMERGENCY PROCEDURES

No change

IV. NORMAL PROCEDURES

CAUTION

Comply with manufacturer's Airplane
Flight Manual leaning procedure.
Do not exceed applicable engine
or aircraft limitations.

After establishing desired cruise power depress the LF button to activate the Lean Find Mode. As the mixture is leaned, one column on the EGT-701 display will begin blinking, indicating the exhaust gas temperature for that cylinder has peaked showing its digital value along with the fuel flow (option) at that time. Continue with the leaning procedure as recommended by the aircraft manufacturer while monitoring the primary engine instruments and the EGT-701 display. Once the leaning procedure has been completed, depress the Step button briefly to exit the Lean Find Mode and enter the Monitor Mode.

FAA APPROVED 6/17/99

CO Guardian LLC
1951 E. Airport Dr.
Tucson, AZ 85706

Document NO. 01-2510-03

FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT

to the

CESSNA 172R AND 172S

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

AERO 452 CO DETECTOR

STC NO. SA01428LA

Airplane S/N _____ Airplane Reg. No. _____

This supplement is applicable to Cessna Model 172R airplanes, Serial Numbers 17280001 and subsequent; and Cessna Model 172S airplanes, Serial Numbers 172S8001 and subsequent.

This supplement must be attached to the Pilot's Operating Handbook and FAA Airplane Flight Manual (POH/AFM), Cessna 172R P/N 17SRHUS00 or POH/AFM Cessna 172S P/N 172SPHUS00, or later FAA Approved revisions, when the airplane is modified by the installation of a CO Guardian Aero 452 Carbon Monoxide Detector in accordance with STC No: SA01428LA.

The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this appendix, consult the basic Airplane Flight Manual.

FAA Approved _____

Manager, Flight Test Branch, ANM-160L
Federal Aviation Administration
Los Angeles Aircraft Certification Office
Transport Airplane Directorate

DATE January 10, 2003

CO Guardian LLC
1951 E. Airport Dr.
Tucson, AZ 85706

AFM SUPPLEMENT TO
CESSNA 172R and 172S
STC No. SA01428LA

Document NO. 01-2510-03

LOG OF REVISIONS

REV NO.	PAGE NO.	DATE	DESCRIPTION	APPROVAL
IR	1 To 6	01/10/03	Installation of the Aero 452-101-004	Mgr., Flight Test Branch, ANM-160L Los Angles Aircraft Cert. Office Federal Aviation Administration Transport Airplane Directorate Date 1/10/03

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Section 7: AIRPLANE & SYSTEMS DESCRIPTIONS ----------6

Section 8: AIRPLANE HANDLING, SERVICE AND MAINTENANCE--6

Section 1. GENERAL INTRODUCTION

The CO Guardian 452-101-004 Carbon Monoxide Detector is designed to detect, measure, and provide both a visual and aural alert, to the pilot of piston engine type airplane, before the level of carbon monoxide (CO) reaches a critical level.

The installation consists of a single carbon monoxide detector indicator with 28V DC power being the interface to the airplane. The airplane supplied power and airplane wiring is protected by a resetable, trip free, two-ampere type circuit breaker labeled "CO Detector". The Carbon Monoxide Detector is installed in the existing airplane instrument panel within view and reach of the pilot.

The CO Detector unit contains a self-test/alert/mute button labeled "TEST/RESET", a Status light LED (green) labeled "STATUS", an alert light LED (amber) labeled "ALERT", and an aural caution (buzzer). In addition, a remote (amber) CO ALERT light is installed. The carbon monoxide alert level is calibrated to provide both an aural and visual alert within 5 minutes or less whenever the carbon monoxide level reaches 50 parts per million (PPM) by volume. The unit will become active after three-minute (3) sensor warm-up period after initial startup. The caution time is shortened at higher levels of CO concentrations and becomes almost instantaneous should the carbon monoxide level reach 400 PPM or above.

In case of a carbon monoxide alert, the pilot can acknowledge the caution and silence the aural by pressing the Test/Reset button while maintaining the visual alert light until the carbon monoxide level is again reduced below the alert level. The indicator is automatically reset to green when the CO level drops below 50 PPM.

Section 2. Limitations

The Aero 452 may not replace any existing instrument or indicator required by the airplane type design or operating limits.

Section 3. Emergency procedures

If the CO alert activates, press TEST/RESET button to silence the aural alert and complete the unit self test. If the alert light continues to illuminate:

- Shut off the heater, air conditioning or any other opening to the engine compartment.
- Open a fresh air source immediately.
- Don't smoke.
- Use 100% oxygen if possible.
- Land as soon as conditions permit
- Be sure the source of the contamination is corrected before further flight

Section 4. NORMAL PROCEDURES

When the airplane master battery switch is selected on, the Aero-452 goes thought a self-test routine. The test checks for functionality of critical components such as the CO sensor, temperature sensor, pressure sensor, and the integrity of the system. You will notice the following test sequence:

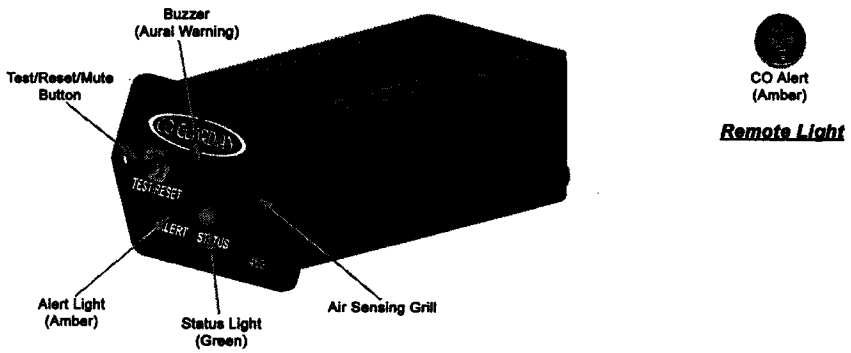
An aural alert will beep twice; the Green STATUS light flashes twice in quick succession; then the Amber ALERT light flashes twice in Self-Check routine; then the aural alert will beep once, and the Green STATUS light will illuminate steady.

The external remote CO ALERT light, will flash once before the above sequence and once after the above sequence and then the remote CO ALERT light will remain off until there is a CO alert or a failure of the unit.

These indications will occur if there is a malfunction / failure inside the CO detector of any of the following:

A failure of the CO Sensor, Temperature Sensor, or the Micro-controller will result in the following failure indications

- Amber ALERT light will flash once in approximately 1 second.
- Remote CO ALERT light, will illuminate once in 4 seconds.



Section 5. PERFORMANCE

No Change

Section 6. WEIGHT AND BLANCE/EQUIPMENT LIST

The CO Guardian Aero 452 CO Detector installation weights 0.109 lbs located at Sta.17.5.

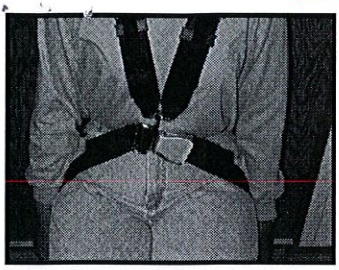
Section 7. AIRPLANE & SYSTEMS DESCRIPTIONS

See General Introduction, Section 1 and Normal Procedures, Section 4 of this document.

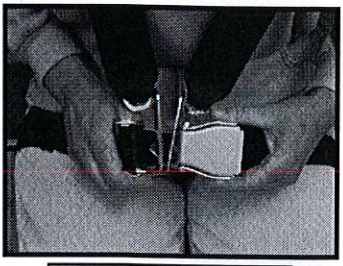
Section 8. AIRPLANE HANDLING, SERVICE AND MAINTENANCE

See CO Guardian Carbon Monoxide Detector Model 452 Installation and Operational Manual Document No. 01-2510-02, Revision A, dated 11/23/02, or later Revision.

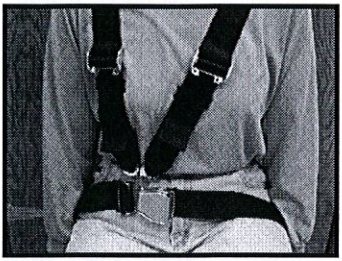
ATTENTION:
CHECK REEL OPERATION BEFORE EACH FLIGHT



Incorrect: Buckle Too High

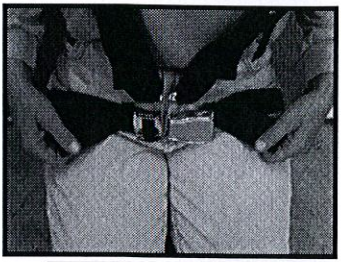


Utility Float Plane Buckle

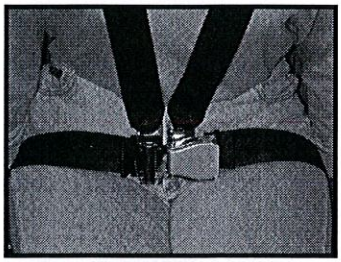


Incorrect: Buckle Must Be Centered

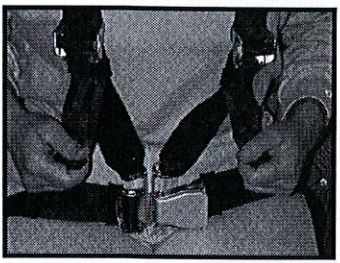
Lift Buckle Latch For Removal !



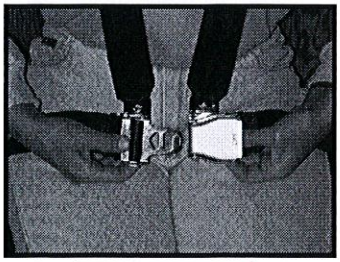
Pull Belt Ends To Tighten



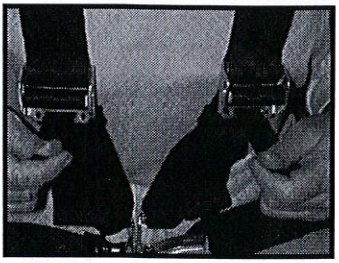
Correct: Pull Down Snug



Pull Strap Ends To Tighten 190/195 & Luscombe



Standard Buckle



Pull Tabs to Loosen 190/195 & Luscombe

Scott and Kim Huntington
409 Ventura Road
Santa Maria, CA 93455

Supplement No: 1

FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT / SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for

CESSNA 210 Series. 172/172RG Series. 175 Series, 182/R182 Series, 180 Series, 185 Series, 206 Series Airplanes

Aircraft S/N 17263222 Aircraft Reg. No. N4480R

This supplement must be attached to the FAA Approved Aircraft Flight Manual or Approved Pilot Operating Handbook or this is a Supplemental Airplane Flight Manual, when the aircraft is modified by the installation of Ace® Brand Pilot Door Window Lock. Pilot Door and Baggage Door Locks in accordance with STC SA 01447LA.

The information contained herein supplements or supersedes the basic manuals only in those areas listed herein. For limitations. procedures. and performance information not contained in this supplement, consult the basic Airplane Flight Manual, Pilot Operating Handbook, or Placards.

FAA Approved Patrick Power

Manager, Flight Test Branch, ANM-160L
Federal Aviation Administration
Los Angeles Aircraft Certification Office
Transport Airplane Directorate

Date: February 10, 2006

Scott and Kim Huntington
409 Ventura Road
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AFMS or SAFS to Cessna
210, 172/172RG, 175, 182/R182,
180, 185 and 206 Series Airplanes
STC SA 01447LA

Supplement No: 1

LOG OF REVISIONS

Revision	Pages.	Description	FAA APPROVED
Original	All	Complete Airplane Flight Manual Supplement / Supplemental Airplane Flight Manual	Patrick Power Patrick Power. Manager Flight Test Branch. ANM-160L FAA, Los Angeles ACO Transport Airplane Directorate Date: February 10, 2006

Scott and Kim Huntington
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AFMS or SAFS to Cessna
210, 172/172RG, 175, 182/R182,
180, 185 and 206 Series Airplanes
STC SA 01447LA

Supplement No: 1

Section 1 General – No Change

Section 2 Limitations – **Airplane operation with WINDOW LOCKED is prohibited.**

Placard outside door under window lock: **UNLOCK WINDOW BEFORE FLIGHT**

Section 3 Emergency Procedures - No Change

Section 4 Normal Procedures – **PREFLIGHT INSPECTION**
Left Window -- Unlocked.

Section 5 Performance - No Change

Section 6 Weight & Balance / Equipment List – No Change

Section 7 Airplane & Systems Descriptions – No Change

Section 8 Airplane Handling, Service & Maintenance – No Change

FAA Approved Date: 2 / 10 / 2006

Section 7. SYSTEM DESCRIPTION

The Garmin GTX 330 and GTX 3X5 Pilot's Guides, part numbers, and revisions listed below contain additional information regarding GTX system description, control, and function.

Title	Part Number	Revision
GTX 330 Pilot's Guide GTX 3X5 Pilot's Guide	190-00207-00 190-01499-00	Rev. G (or later) Rev. A (or later)

Pilot's Guides for interfaced displays, part numbers and revisions listed below, provide additional operating information for the Garmin GTX 33 and GTX 3X5R.

Title	Part Number	Revision
Garmin GTN 725/750 Pilot's Guide	190-01007-03	Rev. E (or later)
Garmin GTN 625/635/650 Pilot's Guide	190-01004-03	Rev. E (or later)
GNS 480 Pilot's Guide	190-00502-00	Rev. D (or later)
GTX 3X5 Series Transponder G1000 Pilot's Guide	190-01499-01	Rev. A (or later)
Garmin GI 275 Pilots's Guide	190-02246-01	Rev. F (or later)
Garmin GPS 175/GNC 355/GNX 375 Pilot's Guide	190-02488-01	Rev. B (or later)

7.1 GTX TIS Behavior

The TIS Standby/Operate controls for GTX 33/330 and GTX 335/335D units only function when the aircraft is airborne.

7.2 GTX 345R/345DR and G950/1000 No Bearing Traffic Alerts

No visual indication is provided for no bearing traffic alerts. Only an aural indication of the no bearing traffic alert is provided. If an aural alert for no bearing traffic has been previously issued, a "no bearing traffic clear" aural indication will be provided once all traffic alerts are resolved.

All aural alerts are inhibited below 500' AGL, therefore a "no bearing traffic clear" aural may not be heard in a landing or touch and go flight scenario.