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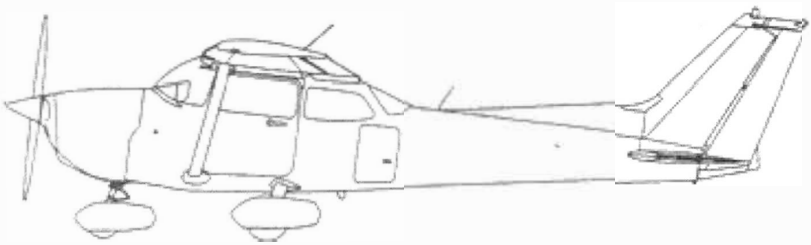
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F-HAAM

Cessna
A Textron Company

Pilot's Operating Handbook
and
FAA Approved Airplane Flight Manual



THIS PUBLICATION MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES.

The Cessna Aircraft Company

Model 172S

Serial No. 172S8743

Registration No. F-HAAM

This publication includes the material required to be furnished to the pilot by FAR Part 23 and constitutes the FAA Approved Airplane Flight Manual.

FAA APPROVAL

FAA APPROVED UNDER FAR 21 SUBPART J
The Cessna Aircraft Co
Delegation Option Manufacturer CE-1

Executive Engineer

Date: July 10, 1998

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The Cessna Aircraft Company
Wichita, Kansas USA

Member of GAMA

Original Issue - 8 July 1998

THIS MANUAL WAS PROVIDED FOR THE AIRPLANE IDENTIFIED ON THE TITLE PAGE ON 4-29-99.
SUBSEQUENT REVISIONS SUPPLIED BY THE CESSNA AIRCRAFT COMPANY MUST BE PROPERLY INSERTED.



The Cessna Aircraft Company, Aircraft Division

CONGRATULATIONS . . . .

Congratulations on your purchase and welcome to Cessna ownership! Your Cessna has been designed and constructed to give you the most in performance, value and comfort.

This Pilot's Operating Handbook has been prepared as a guide to help you get the most utility from your airplane. It contains information about your airplane's equipment, operating procedures, performance and suggested service and care. Please study it carefully and use it as a reference.

The worldwide Cessna Organization and Cessna Customer Service are prepared to serve you. The following services are offered by each Cessna Service Station:

- THE CESSNA AIRPLANE WARRANTIES, which provide coverage for parts and labor, are upheld through Cessna Service Stations worldwide. Warranty provisions and other important information are contained in the Customer Care Program Handbook supplied with your airplane. The Customer Care Card assigned to you at delivery will establish your eligibility under warranty and should be presented to your local Cessna Service Station at the time of warranty service.
- FACTORY TRAINED PERSONNEL to provide you with courteous, expert service.
- FACTORY APPROVED SERVICE EQUIPMENT to provide you efficient and accurate workmanship.
- A STOCK OF GENUINE CESSNA SERVICE PARTS are available when you need them.
- THE LATEST AUTHORITATIVE INFORMATION FOR SERVICING CESSNA AIRPLANES. Cessna Service Stations have all of the current Maintenance Manuals, Illustrated Parts Catalogs and various other support publications produced by Cessna Aircraft Company.

A current Cessna Service Station Directory accompanies your new airplane. The Directory is revised annually, and a current copy can be obtained from your nearest Cessna Service Station.

We urge all Cessna owners/operators to utilize the benefits available within the Cessna Organization.

COVERAGE

The Pilot's Operating Handbook in the airplane at the time of delivery from The Cessna Aircraft Company contains information applicable to the Model 172S airplane by serial number and registration number shown on the Title Page. This handbook is applicable to airplane serial number 172S8001 and On. All information is based on data available at the time of publication.

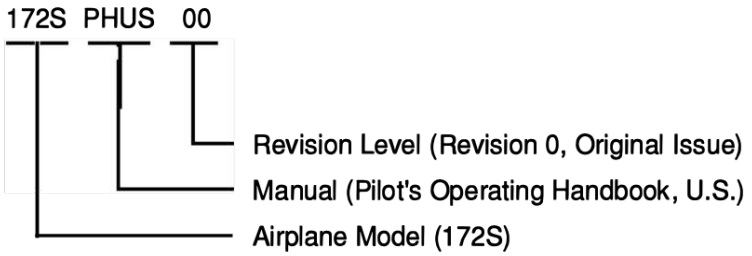
This handbook consists of nine sections that cover all operational aspects of a standard-equipped airplane. Following Section 8 are the Supplements, Section 9, which provide expanded operational procedures for the avionics equipment (both standard and optional), and provides information on special operations.

Supplements are individual documents, and may be issued or revised without regard to revision dates which apply to the POH itself. These supplements contain a Log of Effective Pages, which should be used to determine the status of each supplement.

ORIGINAL ISSUE AND REVISIONS

This Pilot's Operating Handbook and FAA Approved Airplane Flight Manual is comprised of the original issue and any subsequent revisions. To ensure that information in this manual is current, the revisions must be incorporated as they are issued. This manual was originally issued on July 8, 1998. As revisions are issued, they will be noted in the Log of Effective Pages table.

The part number of this manual has also been designed to further aid the owner/operator in determining the revision level of any POH. Refer to the example below for a breakdown:



It is the responsibility of the owner to maintain this handbook in a current status when it is being used for operational purposes. Owners should contact their local Cessna Service Station whenever the revision status of their handbook is in question.

Revisions are distributed to owners of U.S. Registered aircraft according to FAA records at the time of revision issuance, and to Internationally Registered aircraft according to Cessna Owner Advisory records at the time of issuance. Revisions should be read carefully upon receipt and incorporated in this POH.

REVISION FILING INSTRUCTIONS

REGULAR REVISIONS

Pages to be removed or inserted in the Pilots' Operating Handbook and FAA Approved Airplane Flight Manual are determined by the Log of Effective Pages located in this section. This log contains the page number and date of issue for each page within the POH. At original issue, all pages will contain the same date. As revisions to the POH occur, these dates will change on effected pages. When two pages display the same page number, the page with the latest date shall be inserted into the POH. The date on the Log Of Effective Pages shall also agree with the latest date of the page in question.

TEMPORARY REVISIONS

Under limited circumstances, temporary revisions to the POH may be issued. These temporary revisions are to be filed in the applicable section in accordance with filing instructions appearing on the first page of the temporary revision.

The recession of a temporary revision is accomplished by incorporation into the POH at revision time or by a superseding temporary revision. In order to accurately track the status of temporary revisions as they pertain to a POH, a Temporary Revision List will be located previous to this section when required. This list will indicate the date the temporary revision was incorporated into the POH, thus authorizing the recession of the temporary revision.

IDENTIFYING REVISED MATERIAL

Additions or revisions to the text in an existing section will be identified by a vertical line (revision bar) adjacent to the applicable revised area on the outer margin of the page.

When technical changes cause unchanged text to appear on a different page, a revision bar will be placed in the outer lower margin of the page, opposite the page number and date of the page, providing no other revision bar appears on the page. These pages will display the current revision date as found in the Original Issue and Revisions paragraph of this section.

When extensive technical changes are made to text in an existing section that requires extensive revision, revision bars will appear the full length of text.

New art added to an existing section will be identified by a single pointing hand indicator adjacent to the figure title and figure number. Existing art which is revised will have a pointing hand adjacent to the portion of the art which has changed.

WARNINGS, CAUTIONS AND NOTES

Throughout the text, warnings, cautions and notes pertaining to airplane handling and operations are utilized. These adjuncts to the text are used to highlight or emphasize important points.

WARNING - Calls attention to use of methods, procedures or limits which must be followed precisely to avoid injury or death to persons.

CAUTION - Calls attention to methods, procedures or limits which must be followed to avoid damage to equipment.

NOTE - Calls attention to additional procedures or information pertaining to the text.

Pilot's Operating Handbook

and

FAA Approved Airplane Flight Manual

Serial Numbers 172S8001 and On

Original Issue - 8 July 1998

Revision 5 - 19 July 2004

PART NUMBER: 172SPHUS05

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LOG OF EFFECTIVE PAGES

The following Log of Effective Pages provides the date of issue for original and revised pages, as well as a listing of all pages in the POH. Pages which are affected by the current revision will be preceeded by an asterisk with the revision level.

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1	May 30, 2000	4	Aug 12, 2003
2	Dec 30, 2000	5	July 19, 2004

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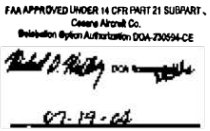
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APPROVED BY



DATE OF APPROVAL

Cessna
A Textron Company

Information Manual

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Model 172S

THIS MANUAL INCORPORATES INFORMATION ISSUED IN THE PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL AT REVISION 5 DATED 19 JULY 2004 (PART NUMBER 172SPHUS05).

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CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS USA

172SIM

PERFORMANCE - SPECIFICATIONS

*SPEED:
Maximum at Sea Level . . . . . 126 KNOTS
Cruise, 75% Power at 8500 Feet. . . . . 124 KNOTS

CRUISE: Recommended lean mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve.
75% Power at 8500 Feet . . . . . Range - 518 NM
53 Gallons Usable Fuel. . . . . Time - 4.26 HRS

Range at 10,000 Feet, 45% Power . . . . . Range - 638 NM
53 Gallons Usable Fuel. . . . . Time - 6.72 HRS

RATE-OF-CLIMB AT SEA LEVEL . . . . . 730 FPM

SERVICE CEILING . . . . . 14,000 FEET

TAKEOFF PERFORMANCE:
Ground Roll . . . . . 960 FEET
Total Distance Over 50 Foot Obstacle . . . . . 1630 FEET

LANDING PERFORMANCE:
Ground Roll . . . . . 575 FEET
Total Distance Over 50 Foot Obstacle . . . . . 1335 FEET

STALL SPEED:
Flaps Up, Power Off . . . . . 53 KCAS
Flaps Down, Power Off . . . . . 48 KCAS

MAXIMUM WEIGHT:
Ramp . . . . . 2558 POUNDS/ **1160 Kg**
Takeoff . . . . . 2550 POUNDS/ **1157 Kg**
Landing . . . . . 2550 POUNDS/ **1157 Kg**

STANDARD EMPTY WEIGHT . . . . . 1663 POUNDS/ **754 Kg**

MAXIMUM USEFUL LOAD . . . . . 895 POUNDS/ **406 Kg**

BAGGAGE ALLOWANCE . . . . . 120 POUNDS/ **54 Kg**

(Continued Next Page)

PERFORMANCE - SPECIFICATIONS (Continued)

WING LOADING: Lbs/Sq. Ft. 14.7

POWER LOADING: Lbs/HP 14.2

FUEL CAPACITY . . . . . 56 GALLONS / 212 L

OIL CAPACITY . . . . . .8 QUARTS/ 7.6 L

ENGINE: Textron Lycoming IO-360-L2A
180 BHP at 2700 RPM

PROPELLER: Fixed Pitch, Diameter . . . . . 76 INCHES

NOTE

*Speed performance is shown for an airplane equipped with speed fairings which increase the speeds by approximately 2 knots. There is a corresponding difference in range, while all other performance figures are unchanged when speed fairings are installed.

The above performance figures are based on airplane weights at 2550 pounds, standard atmospheric conditions, level, hard-surfaced dry runways and no wind. They are calculated values derived from flight tests conducted by Cessna Aircraft Company under carefully documented conditions and will vary with individual airplanes and numerous factors affecting flight performance.

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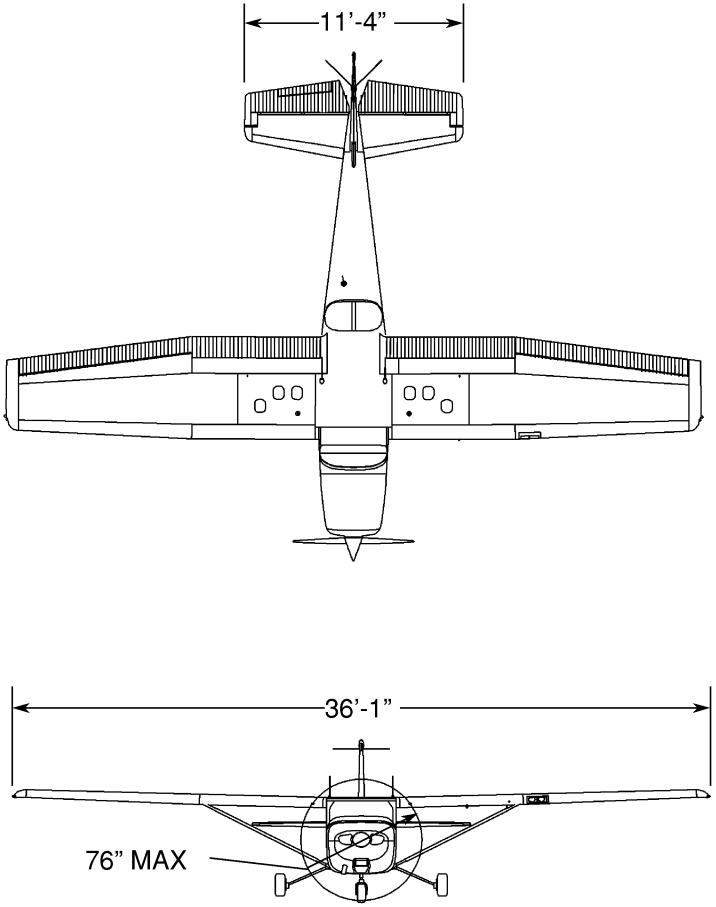
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GENERAL

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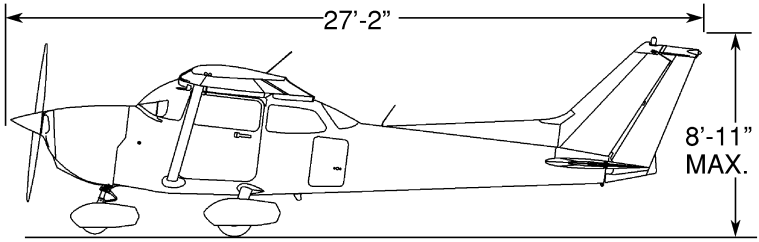
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0510T1005
0510T1005

Figure 1-1. Three View - Normal Ground Attitude (Sheet 1 of 2)



NOTE 1: WING SPAN SHOWN WITH STROBE LIGHTS INSTALLED.

NOTE 2: WHEEL BASE LENGTH IS 65".

NOTE 3: PROPELLER GROUND CLEARANCE IS 11 1/4".

NOTE 4: WING AREA IS 174 SQUARE FEET.

NOTE 5: MINIMUM TURNING RADIUS (* PIVOT POINT TO OUTBOARD WING TIP) IS 27'-5 1/2".

NOTE 6: NORMAL GROUND ATTITUDE IS SHOWN WITH NOSE STRUT SHOWING APPROXIMATELY 2" OF STRUT, AND WINGS LEVEL.

0510T1005

Figure 1-1. Three View - Normal Ground Attitude (Sheet 2)

INTRODUCTION

This handbook contains 9 sections, and includes the material required to be furnished to the pilot by FAR Part 23. It also contains supplemental data supplied by Cessna Aircraft Company.

Section 1 provides basic data and information of general interest. It also contains definitions or explanations of symbols, abbreviations, and terminology commonly used.

DESCRIPTIVE DATA

ENGINE

Number of Engines: 1.
Engine Manufacturer: Textron Lycoming.
Engine Model Number: IO-360-L2A.
Engine Type: Normally aspirated, direct drive, air-cooled, horizontally opposed, fuel injected, four cylinder engine with 360 cu. in. displacement.
Horsepower Rating and Engine Speed: 180 rated BHP at 2700 RPM.

PROPELLER

Propeller Manufacturer: McCauley Propeller Systems.
Propeller Model Number: 1A170E/JHA7660.
Number of Blades: 2.
Propeller Diameter: 76 inches.
Propeller Type: Fixed pitch.

FUEL

⚠ WARNING

USE OF UNAPPROVED FUELS MAY RESULT IN DAMAGE TO THE ENGINE AND FUEL SYSTEM COMPONENTS, RESULTING IN POSSIBLE ENGINE FAILURE.

Approved Fuel Grades (and Colors):
100LL Grade Aviation Fuel (Blue).
100 Grade Aviation Fuel (Green).

NOTE

Isopropyl alcohol or diethylene glycol monomethyl ether (DiEGME) may be added to the fuel supply. Additive concentrations shall not exceed 1% for isopropyl alcohol or 0.10% to 0.15% for DiEGME. Refer to Section 8 for additional information.

Fuel Capacity:

Total Capacity:	56.0 U.S. gallons.	212 Litres
Total Usable:	53.0 U.S. gallons.	200 Litres
Total Capacity Each Tank:	28.0 U.S. gallons.	106 Litres
Total Usable Each Tank:	26.5 U.S. gallons.	98 Litres

NOTE

To ensure maximum fuel capacity and minimize cross-feeding when refueling, always park the airplane in a wings-level, normal ground attitude and place the fuel selector in the Left or Right position. Refer to Figure 1-1 for normal ground attitude dimensions.

OIL

Oil Specification:

MIL-L-6082 or SAE J1966 Aviation Grade Straight Mineral Oil: Used when the airplane was delivered from the factory and should be used to replenish the supply during the first 25 hours. This oil should be drained and the filter changed after the first 25 hours of operation. Refill the engine with MIL-L-6082 or SAE J1966 Aviation Grade Straight Mineral Oil and continue to use until a total of 50 hours has accumulated or oil consumption has stabilized.

MIL-L-22851 or SAE J1899 Aviation Grade Ashless Dispersant Oil: Oil conforming to the latest revision and/or supplements to Textron Lycoming Service Instruction No. 1014, **must be used** after first 50 hours or once oil consumption has stabilized.

Recommended Viscosity for Temperature Range:

Temperature	MIL-L-6082 or SAE J1966 Straight Mineral Oil SAE Grade	MIL-L-22851 or SAE J1899 Ashless Dispersant SAE Grade
Above 27°C (80°F)	60	15W-50, 20W-50 or 60
Above 16°C (60°F)	50	40 or 50
-1°C (30°F) to 32°C (90°F)	40	40
-18°C (0°F) to 21°C (70°F)	30	30, 40 or 20W-40
Below -12°C (10°F)	20	30 or 20W-30
-18°C (0°F) to 32°C (90°F)	20W-50	20W-50 or 15W-50
All Temperatures	---	15W-50 or 20W-50

NOTE

When operating temperatures overlap, use the lighter grade of oil.

Oil Capacity:
Sump: 8 U.S. Quarts
Total: 9 U.S. Quarts

MAXIMUM CERTIFICATED WEIGHTS

Ramp Weight	Normal Category:	2558 lbs.	**1160 Kg**
	Utility Category:	2208 lbs.	**1001 Kg**
Takeoff Weight	Normal Category:	2550 lbs.	**1157 Kg**
	Utility Category:	2200 lbs.	**998 Kg**
Landing Weight	Normal Category:	2550 lbs.	**1157 Kg**
	Utility Category:	2200 lbs.	**998 Kg**

Weight in Baggage Compartment, Normal Category:

Baggage Area 1 (Station 82 to 108): 120 lbs. See note below.
Baggage Area 2 (Station 108 to 142): 50 lbs. See note below.

NOTE

The maximum combined weight capacity for Baggage Area 1 and Baggage Area 2 is 120 lbs.

Weight in Baggage Compartment, Utility Category:

In this category, the rear seat must not be occupied and the baggage compartment must be empty.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight:	1663 lbs. **754 Kg**
Maximum Useful Load, Normal Category	895 lbs. **406 Kg**
Maximum Useful Load, Utility Category:	545 lbs. **247 Kg**

CABIN AND ENTRY DIMENSIONS

Detailed dimensions of the cabin interior and entry door openings are illustrated in Section 6.

BAGGAGE SPACE AND ENTRY DIMENSIONS

Dimensions of the baggage area and baggage door opening are illustrated in detail in Section 6.

SPECIFIC LOADINGS

Wing Loading: 14.7 lbs./sq. ft.
Power Loading: 14.2 lbs./hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

KCAS	**Knots Calibrated Airspeed** is indicated airspeed corrected for position and instrument error and expressed in knots. Knots calibrated airspeed is equal to KTAS in standard atmosphere at sea level.
KIAS	**Knots Indicated Airspeed** is the speed shown on the airspeed indicator and expressed in knots.
KTAS	**Knots True Airspeed** is the airspeed expressed in knots relative to undisturbed air which is KCAS corrected for altitude and temperature.
V_A	**Maneuvering Speed** is the maximum speed at which full or abrupt control movements may be used without overstressing the airframe.
V_{FE}	**Maximum Flap Extended Speed** is the highest speed permissible with wing flaps in a prescribed extended position.
V_{NO}	**Maximum Structural Cruising Speed** is the speed that should not be exceeded except in smooth air, then only with caution.
V_{NE}	**Never Exceed Speed** is the speed limit that may not be exceeded at any time.
V_S	**Stalling Speed or the minimum steady flight speed** is the minimum speed at which the airplane is controllable.
V_{SO}	**Stalling Speed or the minimum steady flight speed** is the minimum speed at which the airplane is controllable in the landing configuration at the most forward center of gravity.
V_X	**Best Angle-of-Climb Speed** is the speed which results in the greatest gain of altitude in a given horizontal distance.
V_Y	**Best Rate-of-Climb Speed** is the speed which results in the greatest gain in altitude in a given time.

METEOROLOGICAL TERMINOLOGY

OAT	**Outside Air Temperature** is the free air static temperature. It may be expressed in either degrees Celsius or degrees Fahrenheit.
Standard Temperature	**Standard Temperature** is 15°C at sea level pressure altitude and decreases by 2°C for each 1000 feet of altitude.
Pressure Altitude	**Pressure Altitude** is the altitude read from an altimeter when the altimeter's barometric scale has been set to 29.92 inches of mercury (1013 mb).

ENGINE POWER TERMINOLOGY

BHP	**Brake Horsepower** is the power developed by the engine.
RPM	**Revolutions Per Minute** is engine speed.
Static RPM	**Static RPM** is engine speed attained during a full throttle engine runup when the airplane is on the ground and stationary.
MAP	**Manifold Absolute Pressure** is the absolute pressure measured in the engine induction system. MAP is measured in units of inches of mercury (inHG).
Lean Mixture	Decreased proportion of fuel in the fuel-air mixture supplied to the engine. As air density decreases, the amount of fuel required by the engine decreases for a given throttle setting. Adjusting the fuel-air mixture to provide a smaller portion of fuel is known as "leaning" the mixture.
Rich Mixture	Increased proportion of fuel in the fuel-air mixture supplied to the engine. As air density increases, the amount of fuel required by the engine increases for a given throttle setting. Adjusting the fuel-air mixture to provide a greater portion of fuel is known as "richening" the mixture.
Full Rich	Mixture control full forward (pushed in, full control travel, toward the panel).
Idle Cutoff	Mixture control full aft (pulled out, full control travel, away from the panel).

ENGINE POWER TERMINOLOGY (Continued)

Full Throttle	Throttle full forward (pushed in, full control travel, toward the panel) Also known as "full open" throttle.
Closed Throttle	Throttle full aft (pulled out, full control travel, away from the panel). Also known as the throttle "idle" position.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Demonstrated Crosswind Velocity	**Demonstrated Crosswind Velocity** is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting.
Usable Fuel	**Usable Fuel** is the fuel available for flight planning.
Unusable Fuel	**Unusable Fuel** is the quantity of fuel that can not be safely used in flight.
GPH	**Gallons Per Hour** is the amount of fuel consumed per hour.
NMPG	**Nautical Miles Per Gallon** is the distance which can be expected per gallon of fuel consumed at a specific engine power setting and/or flight configuration.
g	**g** is acceleration due to gravity.
Course Datum	**Course Datum** is the compass reference used by the autopilot, along with course deviation, to provide lateral control when tracking a navigation signal.

WEIGHT AND BALANCE TERMINOLOGY

Reference Datum	**Reference Datum** is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	**Station** is a location along the airplane fuselage given in terms of the distance from the reference datum.
Arm	**Arm** is the horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	**Moment** is the product of the weight of an item multiplied by its arm. (Moment divided by the constant 1000 is used in this handbook to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	**Center of Gravity** is the point at which an airplane, or equipment, would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	**Center of Gravity Arm** is the arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	**Center of Gravity Limits** are the extreme center of gravity locations within which the airplane must be operated at a given weight.
Standard Empty Weight	**Standard Empty Weight** is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.
Basic Empty Weight	**Basic Empty Weight** is the standard empty weight plus the weight of optional equipment.
Useful Load	**Useful Load** is the difference between ramp weight and the basic empty weight.
MAC	**MAC (Mean Aerodynamic Chord)** is the chord of an imaginary rectangular airfoil having the same pitching moments throughout the flight range as that of the actual wing.

WEIGHT AND BALANCE TERMINOLOGY (Continued)

Maximum Ramp Weight	**Maximum Ramp Weight** is the maximum weight approved for ground maneuver, and includes the weight of fuel used for start, taxi and runup.
Maximum Takeoff Weight	**Maximum Takeoff Weight** is the maximum weight approved for the start of the takeoff roll.
Maximum Landing Weight	**Maximum Landing Weight** is the maximum weight approved for the landing touchdown.
Tare	**Tare** is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.

METRIC / IMPERIAL / U.S. CONVERSION CHARTS

The following charts have been provided to help international operators convert U.S. measurement supplied with the Pilot's Operating Handbook into metric and imperial measurements.

The standard followed for measurement units shown, is the National Institute of Standards Technology (NIST), Publication 811, "Guide for the Use of the International System of Units (SI)."

Please refer to the following pages for these charts.

(Kilograms × 2.205 = Pounds) (Pounds × .454 = Kilograms)

KILOGRAMS INTO POUNDS
KILOGRAMMES EN LIVRES

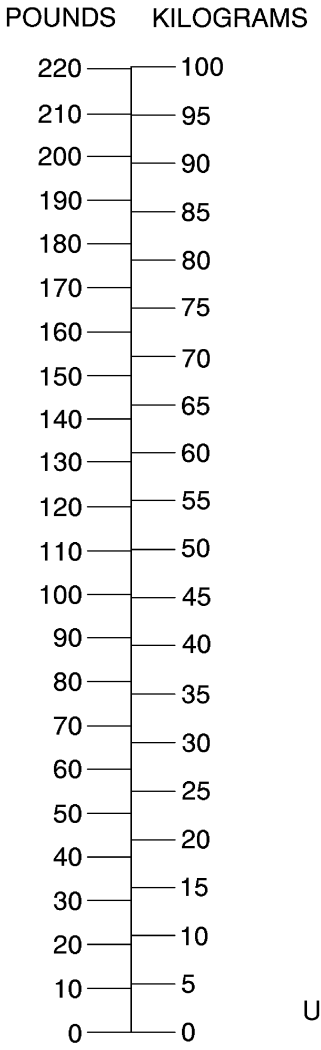
kg	0	1	2	3	4	5	6	7	8	9
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
0		2.205	4.409	6.614	8.819	11.023	13.228	15.432	17.637	19.842
10	22.046	24.251	26.456	28.660	30.865	33.069	35.274	37.479	39.683	41.888
20	44.093	46.297	48.502	50.706	52.911	55.116	57.320	59.525	61.729	63.934
30	66.139	68.343	70.548	72.753	74.957	77.162	79.366	81.571	83.776	85.980
40	88.185	90.390	92.594	94.799	97.003	99.208	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26
100	220.46	222.67	224.87	227.08	229.28	231.49	233.69	235.90	238.10	240.30

POUNDS INTO KILOGRAMS
LIVRES EN KILOGRAMMES

lb.	0	1	2	3	4	5	6	7	8	9
	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
0		0.454	0.907	1.361	1.814	2.268	2.722	3.175	3.629	4.082
10	4.536	4.990	5.443	5.897	6.350	6.804	7.257	7.711	8.165	8.618
20	9.072	9.525	9.979	10.433	10.886	11.340	11.793	12.247	12.701	13.154
30	13.608	14.061	14.515	14.969	15.422	15.876	16.329	16.783	17.237	17.690
40	18.144	18.597	19.051	19.504	19.958	20.412	20.865	21.319	21.772	22.226
50	22.680	23.133	23.587	24.040	24.494	24.948	25.401	25.855	26.303	26.762
60	27.216	27.669	28.123	28.576	29.030	29.484	29.937	30.391	30.844	31.298
70	31.752	32.205	32.659	33.112	33.566	34.019	34.473	34.927	35.380	35.834
80	36.287	36.741	37.195	37.648	38.102	38.555	39.009	39.463	39.916	40.370
90	40.823	41.277	41.731	42.184	42.638	43.091	43.545	43.999	44.452	44.906
100	45.359	45.813	46.266	46.720	47.174	47.627	48.081	48.534	48.988	49.442

Figure 1-2. Weight Conversions (Sheet 1 of 2)

(Kilograms × 2.205 = Pounds) (Pounds × .454 = Kilograms)



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Figure 1-2 . Weight Conversions (Sheet 2)

(Meters × 3.281 = Feet) (Feet × .305 = Meters)

METERS INTO FEET
METRES EN PIEDS

m	0	1	2	3	4	5	6	7	8	9
	feet	feet	feet	feet	feet	feet	feet	feet	feet	feet
0	- - -	3.281	6.562	9.842	13.123	16.404	19.685	22.956	26.247	29.528
10	32.808	36.089	39.370	42.651	45.932	49.212	52.493	55.774	59.055	62.336
20	65.617	68.897	72.178	75.459	78.740	82.021	85.302	88.582	91.863	95.144
30	98.425	101.71	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.95
40	131.23	134.51	137.79	141.08	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.32	170.60	173.86	177.16	180.45	183.73	187.01	190.29	193.57
60	195.85	200.13	203.41	206.69	209.97	213.25	216.53	219.82	223.10	226.38
70	229.66	232.94	236.22	239.50	242.78	246.06	249.34	252.62	255.90	259.19
80	262.47	265.75	269.03	272.31	275.59	278.87	282.15	285.43	288.71	291.58
90	295.27	298.56	301.84	305.12	308.40	311.68	314.96	318.24	321.52	324.80
100	328.08	331.36	334.64	337.93	341.21	344.49	347.77	351.05	354.33	357.61

FEET INTO METERS
PIEDS EN METRES

ft	0	1	2	3	4	5	6	7	8	9
	m	m	m	m	m	m	m	m	m	m
0	- - -	0.305	0.610	0.914	1.219	1.524	1.829	2.134	2.438	2.743
10	3.048	3.353	3.658	3.962	4.267	4.572	4.877	5.182	5.486	5.791
20	6.096	6.401	6.706	7.010	7.315	7.620	7.925	8.230	8.534	8.839
30	9.144	9.449	9.754	10.058	10.363	10.668	10.973	11.278	11.582	11.887
40	12.192	12.497	12.802	13.106	13.411	13.716	14.021	14.326	14.630	14.935
50	15.240	15.545	15.850	16.154	16.459	16.754	17.069	17.374	17.678	17.983
60	18.288	18.593	18.898	19.202	19.507	19.812	20.117	20.422	20.726	21.031
70	21.336	21.641	21.946	22.250	22.555	22.860	23.165	23.470	23.774	24.079
80	24.384	24.689	24.994	25.298	25.603	25.908	26.213	26.518	26.822	27.127
90	27.432	27.737	28.042	28.346	28.651	28.956	29.261	29.566	29.870	30.175
100	30.480	30.785	31.090	31.394	31.699	32.004	32.309	32.614	32.918	33.223

Figure 1-3. Length Conversions (Sheet 1 of 2)

(Meters × 3.281 = Feet) (Feet × .305 = Meters)

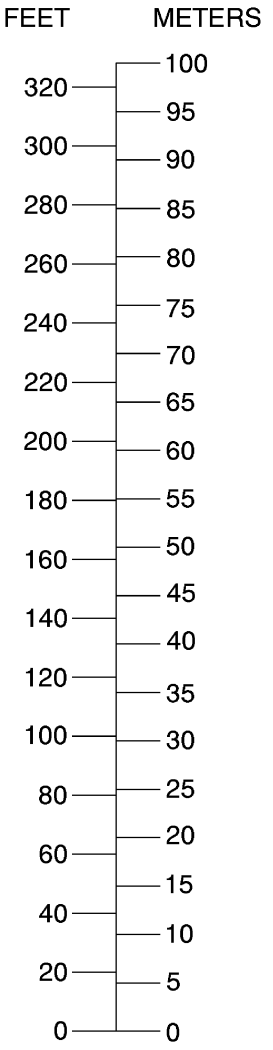


Figure 1-3 . Length Conversions (Sheet 2)

(Centimeters × .394 = Inches) (Inches × 2.54 = Centimeters)

CENTIMETERS INTO INCHES
CENTIMETRES EN POUCES

cm	0	1	2	3	4	5	6	7	8	9
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
0	- - -	0.394	0.787	1.181	1.575	1.969	2.362	2.756	3.150	3.543
10	3.937	4.331	4.724	5.118	5.512	5.906	6.299	6.693	7.087	7.480
20	7.874	8.268	8.661	9.055	9.449	9.843	10.236	10.630	11.024	11.417
30	11.811	12.205	12.598	12.992	13.386	13.780	14.173	14.567	14.961	15.354
40	15.748	16.142	16.535	16.929	17.323	17.717	18.110	18.504	18.898	19.291
50	19.685	20.079	20.472	20.866	21.260	21.654	22.047	22.441	22.835	23.228
60	23.622	24.016	24.409	24.803	25.197	25.591	25.984	26.378	26.772	27.164
70	27.559	27.953	28.346	28.740	29.134	29.528	29.921	30.315	30.709	31.102
80	31.496	31.890	32.283	32.677	33.071	33.465	33.858	34.252	34.646	35.039
90	35.433	35.827	36.220	36.614	37.008	37.402	37.795	38.189	38.583	38.976
100	39.370	39.764	40.157	40.551	40.945	41.339	41.732	42.126	42.520	42.913

INCHES INTO CENTIMETERS
POUCES EN CENTIMETRES

in.	0	1	2	3	4	5	6	7	8	9
	cm	cm	cm	cm	cm	cm	cm	cm	cm	cm
0	- - -	2.54	5.08	7.62	10.16	12.70	15.24	17.78	20.32	22.96
10	25.40	27.94	30.48	33.02	35.56	38.10	40.64	43.18	45.72	48.26
20	50.80	53.34	55.88	58.42	60.96	63.50	66.04	68.58	71.12	73.66
30	76.20	78.74	81.28	83.82	86.36	88.90	91.44	93.98	96.52	99.06
40	101.60	104.14	106.68	109.22	111.76	114.30	116.84	119.38	121.92	124.46
50	127.00	129.54	132.08	134.62	137.16	139.70	142.24	144.78	147.32	149.86
60	152.40	154.94	157.48	160.02	162.56	165.10	167.64	170.18	172.72	175.26
70	177.80	180.34	182.88	185.42	187.96	190.50	193.04	195.58	198.12	200.66
80	203.20	205.74	208.28	210.82	213.36	215.90	218.44	220.98	223.52	226.06
90	228.60	231.14	233.68	236.22	238.76	241.30	243.84	246.38	248.92	251.46
100	254.00	256.54	259.08	261.62	264.16	266.70	269.24	271.78	274.32	276.86

Figure 1-4. Length Conversions (Sheet 1 of 2)

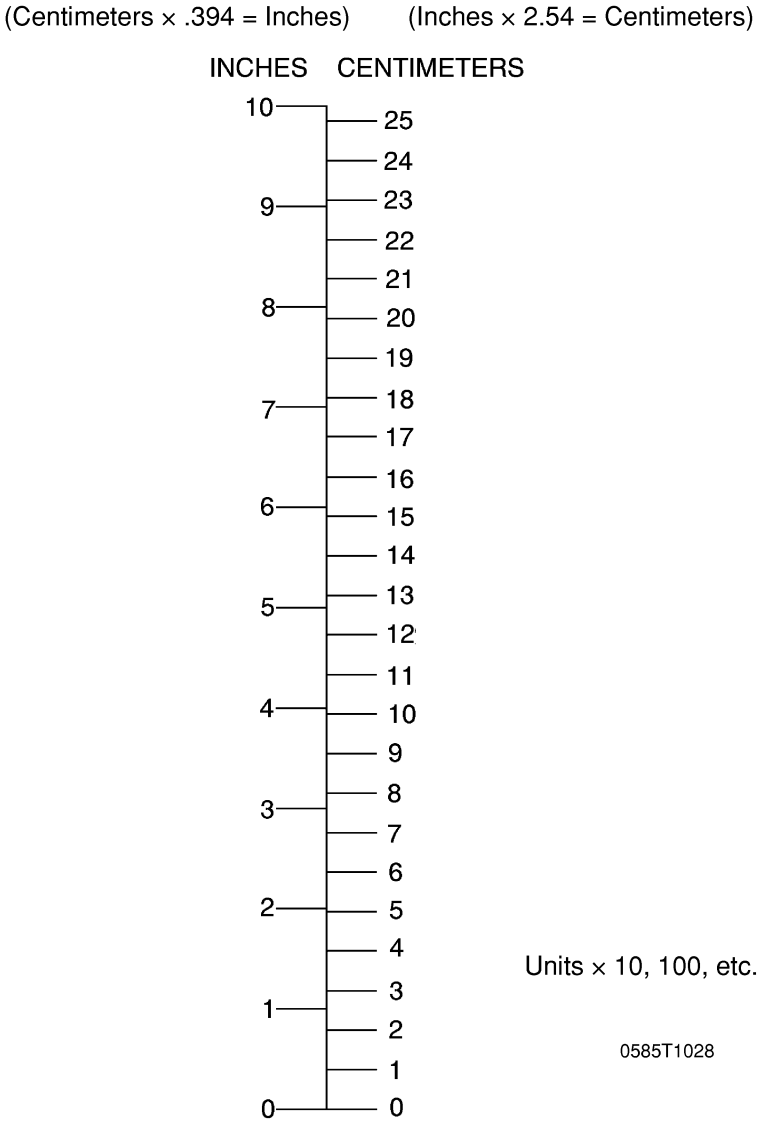


Figure 1-4. Length Conversions (Sheet 2)

(Statute Miles ×1.609=Kilometers) (Kilometers ×.622=Statute Miles)
(Statute Miles ×.869=Nautical Miles) (Nautical Miles ×1.15=Statute Miles)
(Nautical Miles ×1.852=Kilometers) (Kilometers ×.54=Nautical Miles)

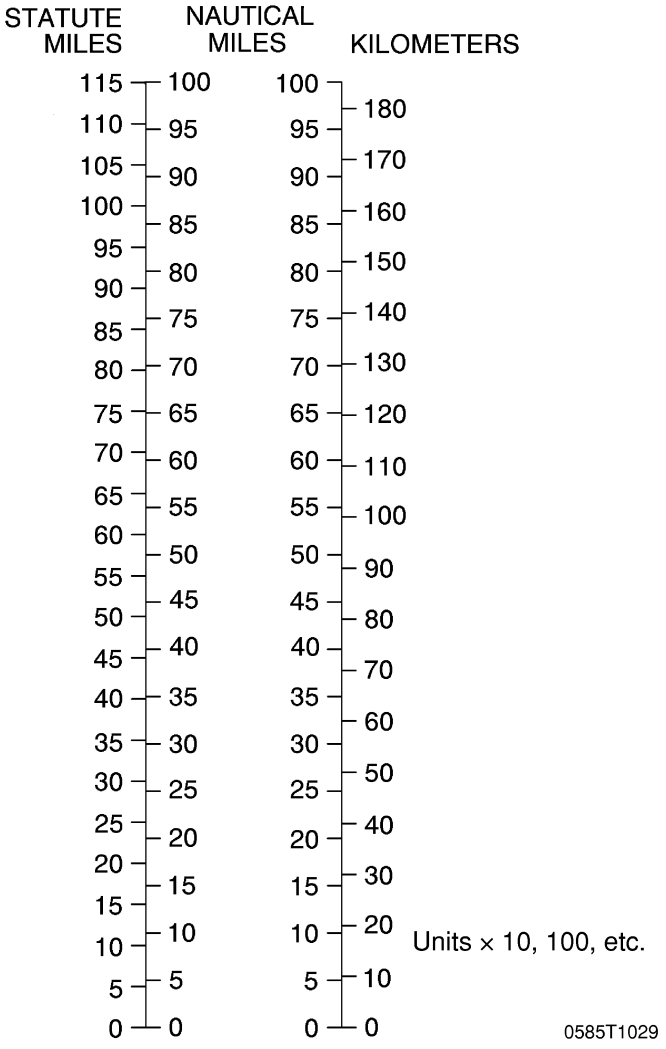


Figure 1-5. Distance Conversions

(Imperial Gallons × 4.546 = Liters) (Liters × .22 = Imperial Gallons)

LITERS INTO IMPERIAL GALLONS
LITRES EN GALLONS IMPERIAL

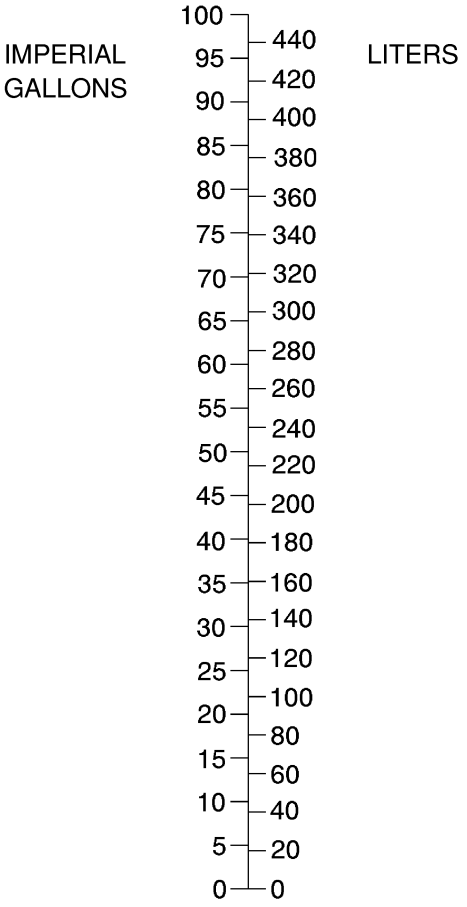
Lt	0	1	2	3	4	5	6	7	8	9
	IG	IG	IG	IG	IG	IG	IG	IG	IG	IG
0	- - -	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.960	4.180
20	4.400	4.620	4.840	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.699	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.779
50	10.999	11.219	11.439	11.659	11.879	12.099	12.319	12.539	12.759	12.979
60	13.199	13.419	13.639	13.859	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.038	18.258	18.478	18.698	18.918	19.138	19.358	19.578
90	19.798	20.018	20.238	20.458	20.678	20.898	21.118	21.338	21.558	21.778
100	21.998	22.218	22.438	22.658	22.878	23.098	23.318	23.537	23.757	23.977

IMPERIAL GALLONS INTO LITERS
GALLONS IMPERIAL EN LITRES

IG	0	1	2	3	4	5	6	7	8	9
	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt
0	- - -	4.546	9.092	13.638	18.184	22.730	27.276	31.822	36.368	40.914
10	45.460	50.006	54.552	59.097	63.643	68.189	72.735	77.281	81.827	86.373
20	90.919	95.465	100.01	104.56	109.10	113.65	118.20	122.74	127.29	131.83
30	136.38	140.93	145.47	150.02	154.56	159.11	163.66	168.20	172.75	177.29
40	181.84	186.38	190.93	195.48	200.02	204.57	209.11	213.66	218.21	222.75
50	227.30	231.84	236.39	240.94	245.48	250.03	254.57	259.12	263.67	268.21
60	272.76	277.30	281.85	286.40	290.94	295.49	300.03	304.58	309.13	313.67
70	318.22	322.76	327.31	331.86	336.40	340.95	345.49	350.04	354.59	359.13
80	363.68	368.22	372.77	377.32	381.86	386.41	390.95	395.50	400.04	404.59
90	409.14	413.68	418.23	422.77	427.32	431.87	436.41	440.96	445.50	450.05
100	454.60	459.14	463.69	468.23	472.78	477.33	481.87	486.42	490.96	495.51

Figure 1-6. Volume Conversions (Sheet 1 of 3)

(Imperial Gallons × 4.4546 = Litres)
(Litres × .22 = Imperial Gallons)



Units × 10, 100, etc.

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Figure 1-6. Volume Conversions (Sheet 2 of 3)

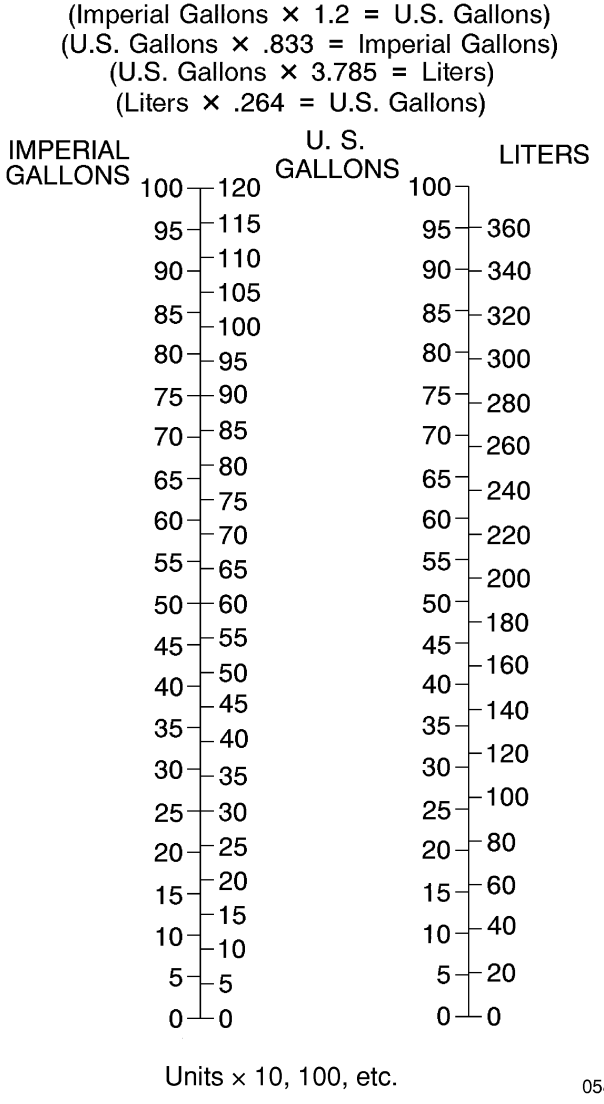
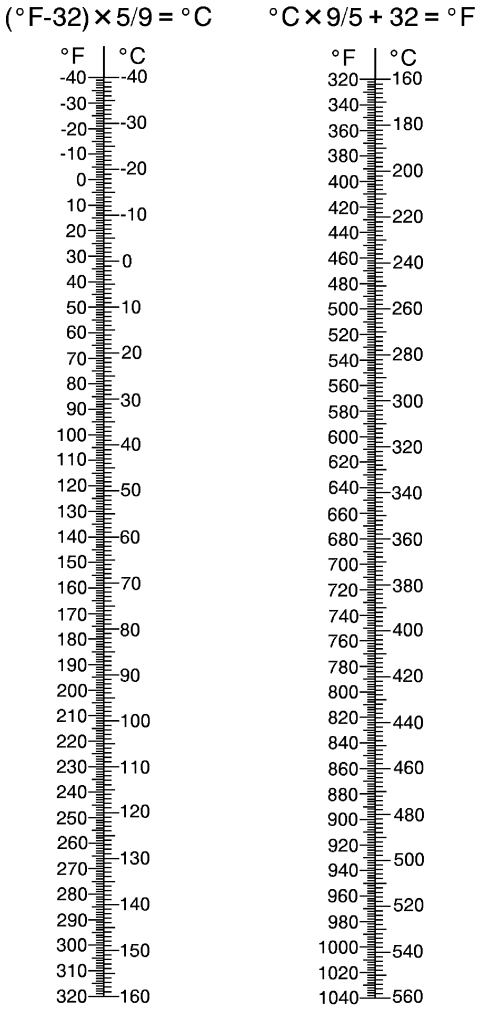


Figure 1-6. Volume Conversions (Sheet 3 of 3)

TEMPERATURE CONVERSIONS



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Figure 1-7. Temperature Conversions

PRESSURE CONVERSION
HECTOPASCALS (MILLIBARS) TO INCHES MERCURY (inHG)

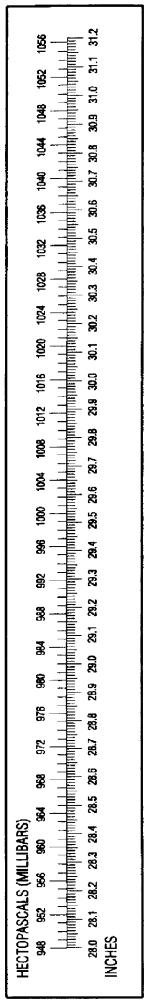
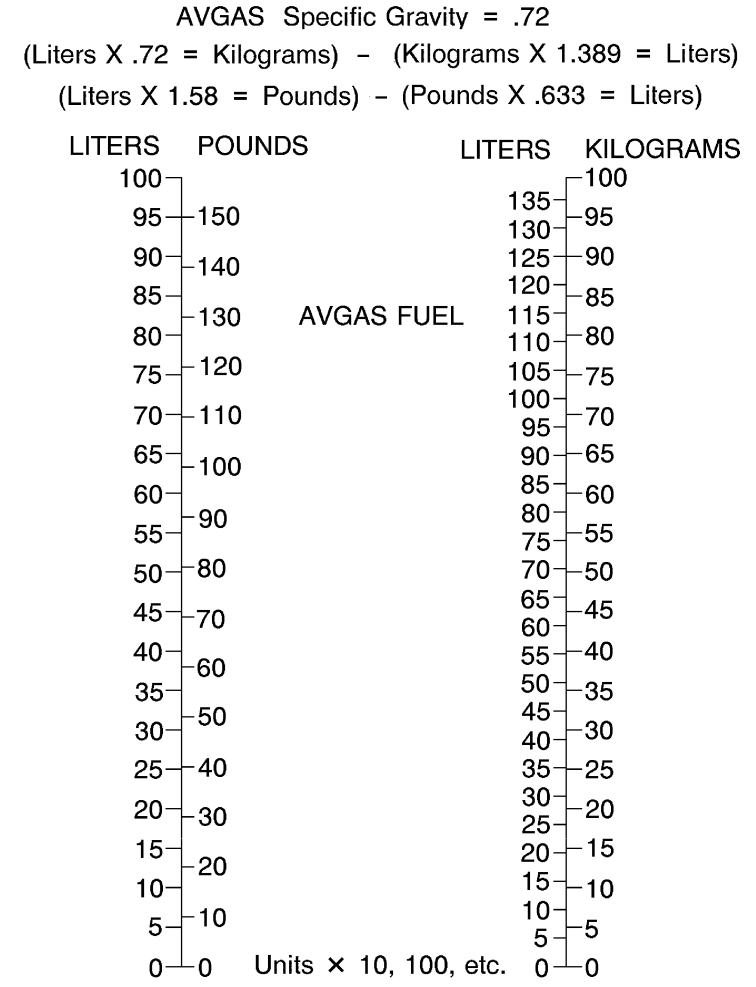


Figure 1-8. Hectopascals to Inches Mercury



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Figure 1-9. Volume to Weight Conversion

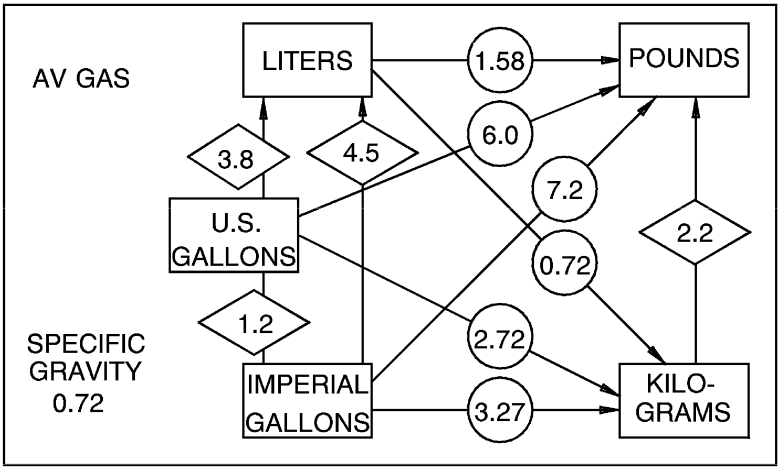


Figure 1-10. Quick Conversions

SECTION 2
LIMITATIONS

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Placards 2-12

INTRODUCTION

Section 2 includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the airplane, its engine, standard systems and standard equipment. The limitations included in this section and in Section 9 have been approved by the Federal Aviation Administration. Observance of these operating limitations is required by Federal Aviation Regulations.

NOTE

Refer to the Supplements, Section 9, of this Pilot's Operating Handbook for amended operating limitations, operating procedures, performance data and other necessary information for airplanes equipped with specific options.

NOTE

The airspeeds listed in the Airspeed Limitations chart (Figure 2-1) and the Airspeed Indicator Markings chart (Figure 2-2) are based on Airspeed Calibration data shown in Section 5 with the normal static source. If the alternate static source is being used, ample margins should be observed to allow for the airspeed calibration variations between the normal and alternate static sources as shown in Section 5.

The Cessna Model 172S is certificated under FAA Type Certificate No. 3A12.

AIRSPEED LIMITATIONS

Airspeed limitations and their operational significance are shown in Figure 2-1. Maneuvering speeds shown apply to normal category operations. The utility category maneuvering speed is 98 KIAS at 2200 pounds.

SYMBOL	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	160	163	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	126	129	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed: 2550 Pounds 2200 Pounds 1900 Pounds	 102 95 88	 105 98 90	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed: 10° Flaps 10° to 30° Flaps	 107 85	 110 85	Do not exceed this speed with flaps down.
-----	Maximum Window Open Speed	160	163	Do not exceed this speed with windows open.

Figure 2-1. Airspeed Limitations

AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their color code significance are shown in Figure 2-2.

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White Arc	40 - 85	Full Flap Operating Range. Lower limit is maximum weight V_{S_0} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	48 -129	Normal Operating Range. Lower limit is maximum weight V_{S_1} at most forward C.G. with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	129-163	Operations must be conducted with caution and only in smooth air.
Red Line	163	Maximum speed for all operations.

POWERPLANT LIMITATIONS

Engine Manufacturer: Textron Lycoming.
Engine Model Number: IO-360-L2A.
Maximum Power: 180 BHP rating.
Engine Operating Limits for Takeoff and Continuous Operations:
Maximum Engine Speed: 2700 RPM.

NOTE

The static RPM range at full throttle is 2300 - 2400 RPM.

Maximum Oil Temperature: 245°F (118°C).
Oil Pressure, Minimum: 20 PSI.
Maximum: 115 PSI.

Fuel Grade: See Fuel Limitations.
Oil Grade (Specification):
MIL-L-6082 or SAE J1966 Aviation Grade Straight Mineral Oil or MIL-L-22851 or SAE J1899 Ashless Dispersant Oil. Oil must comply with the latest revision and/or supplement for Textron Lycoming Service Instruction No. 1014.
Propeller Manufacturer: McCauley Propeller Systems.
Propeller Model Number: 1A170E/JHA7660.
Propeller Diameter : Maximum 76 inches.
: Minimum: 75 inch minimum.

POWERPLANT INSTRUMENT MARKINGS

Powerplant instrument markings and their color code significance are shown in Figure 2-3.

INSTRUMENT	RED LINE (MINIMUM)	GREEN ARC (NORMAL OPERATING)	RED LINE (MAX)
Tachometer: **Sea Level** **5000 Feet** **10,000 Feet**	----	 2100 to 2500 RPM 2100 to 2600 RPM 2100 to 2700 RPM	 2700
Oil Temperature	----	100 to 245°F	245°F
Oil Pressure	20 PSI	50 to 90 PSI	115 PSI
Fuel Quantity	0 (1.5 Gal. Unusable Each Tank)		
Fuel Flow	----	0 to 12 GPH	----
Vacuum Gage	----	4.5 - 5.5 in.Hg	----

Figure 2-3. Powerplant Instrument Markings

WEIGHT LIMITS

NORMAL CATEGORY

Maximum Ramp Weight: 2558 lbs.
Maximum Takeoff Weight: 2550 lbs.
Maximum Landing Weight: 2550 lbs.
Maximum Weight in Baggage Compartment:
Baggage Area 1 - Station 82 to 108: 120 lbs.
Baggage Area 2 - Station 108 to 142: 50 lbs.

NOTE

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

UTILITY CATEGORY

Maximum Ramp Weight: 2208 lbs.
Maximum Takeoff Weight: 2200 lbs.
Maximum Landing Weight: 2200 lbs.
Maximum Weight in Baggage Compartment: In the utility category, the baggage compartment must be empty and rear seat must not be occupied.

CENTER OF GRAVITY LIMITS

NORMAL CATEGORY

Center of Gravity Range:

Forward: 35.0 inches aft of datum at 1950 lbs. or less, with straight line variation to 41.0 inches aft of datum at 2550 lbs.

Aft: 47.3 inches aft of datum at all weights.

Reference Datum: Lower portion of front face of firewall.

UTILITY CATEGORY

Center of Gravity Range:

Forward: 35.0 inches aft of datum at 1950 lbs. or less, with straight line variation to 37.5 inches aft of datum at 2200 lbs.

Aft: 40.5 inches aft of datum at all weights.

Reference Datum: Lower portion of front face of firewall.

MANEUVER LIMITS

NORMAL CATEGORY

This airplane is certificated in both the normal and utility category. The normal category is applicable to aircraft intended for non aerobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles, and turns in which the angle of bank is not more than 60°.

NORMAL CATEGORY MANEUVERS AND RECOMMENDED ENTRY SPEED*

Chandelles	105 Knots
Lazy Eights	105 Knots
Steep Turns	95 Knots
Stalls (Except Whip Stalls)	Slow Deceleration

*** Abrupt use of the controls is prohibited above 105 KIAS.**

UTILITY CATEGORY

This airplane is not designed for purely aerobatic flight. However, in the acquisition of various certificates such as commercial 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 the utility category, the rear seat must not be occupied and the baggage compartment must be empty .

UTILITY CATEGORY MANEUVERS AND RECOMMENDED ENTRY SPEED*

Chandelles	105 Knots
Lazy Eights	105 Knots
Steep Turns	95 Knots
Spins	Slow Deceleration
Stalls (Except Whip Stalls)	Slow Deceleration

***Abrupt use of the controls is prohibited above 98 knots.**

Aerobatics that may impose high loads should not be attempted. The important thing to bear in mind in flight maneuvers is that the airplane 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.

FLIGHT LOAD FACTOR LIMITS

NORMAL CATEGORY

Flight Load Factors (Maximum Takeoff Weight - 2550 lbs.):

*Flaps Up	+3.8g, -1.52g
*Flaps Down	+3.0g

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

UTILITY CATEGORY

Flight Load Factors (Maximum Takeoff Weight - 2200 lbs.):

*Flaps Up	+4.4g, -1.76g
*Flaps Down	+3.0g

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

KINDS OF OPERATION LIMITS

The airplane as delivered is equipped for day VFR and may be equipped for night VFR and/or IFR operations. FAR Part 91 establishes the minimum required instrumentation and equipment for these operations. The reference to types of flight operations on the operating limitations placard reflects equipment installed at the time of Airworthiness Certificate issuance.

Flight into known icing conditions is prohibited.

FUEL LIMITATIONS

Total Fuel: 56 U.S. gallons (2 tanks at 28.0 gallons each).

Usable Fuel (all flight conditions): 53.0 U.S. gallons.

Unusable Fuel: 3.0 U.S. gallons (1.5 gallons each tank).

NOTE

To ensure maximum fuel capacity and minimize cross-feeding when refueling, always park the airplane in a wings-level, normal ground attitude and place the fuel selector in the Left or Right position. Refer to Figure 1-1 for normal ground attitude definition.

ADDITIONAL FUEL LIMITATIONS

Takeoff and land with the fuel selector valve handle in the BOTH position.

Maximum slip or skid duration with one tank dry: 30 seconds.

Operation on either LEFT or RIGHT tank limited to level flight only.

With 1/4 tank or less, prolonged uncoordinated flight is prohibited when operating on either left or right tank.

Fuel remaining in the tank after the fuel quantity indicator reads 0 (red line) cannot be safely used in flight.

Approved Fuel Grades (and Colors):

100LL Grade Aviation Fuel (Blue).
100 Grade Aviation Fuel (Green).

OTHER LIMITATIONS

FLAP LIMITATIONS

Approved Takeoff Range:	0° to 10°
Approved Landing Range:	0° to 30°

PLACARDS

The following information must be displayed in the form of composite or individual placards.

1. In full view of the pilot: (The "DAY-NIGHT-VFR-IFR" entry, shown on the example below, will vary as the airplane is equipped).

The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category or in the Utility Category are contained in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

Normal Category	No acrobatic maneuvers, including spins, approved.
Utility Category	No acrobatic maneuvers approved, except those listed in the Pilot's Operating Handbook. Baggage compartment and rear seat must not be occupied.
Spin Recovery	Opposite rudder - forward elevator - neutralize controls.

Flight into known icing conditions prohibited.

This airplane is certified for the following flight operations as of date of original airworthiness certificate:

DAY-NIGHT-VFR-IFR

2. On the fuel selector valve:

TAKEOFF LANDING	BOTH 53.0 GAL.	ALL FLIGHT ATTITUDES

FUEL
SELECTOR

LEFT 26.5 GAL. LEVEL FLIGHT ONLY	RIGHT 26.5 GAL. LEVEL FLIGHT ONLY

3. Near fuel tank filler cap:

FUEL
100LL/100 MIN. GRADE AVIATION GASOLINE
CAP. 26.5 U.S. GAL. USABLE
CAP 17.5 U.S. GAL USABLE TO BOTTOM
OF FILLER INDICATOR TAB

4. On flap control indicator:

0° to 10°	110 KIAS	(Partial flap range with blue color code; also, mechanical detent at 10°.)
10° to 30°	85 KIAS	(White color code; also, mechanical detent at 20°.)

5. In baggage compartment:

120 POUNDS MAXIMUM BAGGAGE
FORWARD OF BAGGAGE DOOR LATCH

50 POUNDS MAXIMUM
BAGGAGE AFT OF BAGGAGE DOOR LATCH

MAXIMUM 120 POUNDS COMBINED

FOR ADDITIONAL LOADING INSTRUCTIONS
SEE WEIGHT AND BALANCE DATA

6. A calibration card must be provided to indicate the accuracy of the magnetic compass in 30° increments.

7. On the oil filler cap:

OIL
8 QTS

8. On control lock:

CAUTION!
CONTROL LOCK
REMOVE BEFORE STARTING ENGINE

9. Near airspeed indicator:

MANEUVERING SPEED - 105 KIAS

10. On the Upper Right Side of the Aft Cabin Partition:

EMERGENCY LOCATOR TRANSMITTER
INSTALLED AFT OF THIS PARTITION
MUST BE SERVICED IN ACCORDANCE
WITH FAR PART 91.207

11. On forward face of firewall adjacent to the battery:

CAUTION 24 VOLTS D.C.
THIS AIRCRAFT IS EQUIPPED WITH ALTERNATOR
AND A NEGATIVE GROUND SYSTEM.
OBSERVE PROPER POLARITY.
REVERSE POLARITY WILL DAMAGE ELECTRICAL
COMPONENTS.

12. On the upper right instrument panel:

SMOKING PROHIBITED

SECTION 3
EMERGENCY PROCEDURES

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INTRODUCTION

Section 3 provides checklist and amplified procedures for coping with emergencies that may occur. Emergencies caused by airplane or engine malfunctions are extremely rare if proper preflight inspections and maintenance are practiced. Enroute weather emergencies can be minimized or eliminated by careful flight planning and good judgment 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. Emergency procedures associated with standard avionics, the ELT, or any optional systems can be found in the Supplements, Section 9.

AIRSPEEDS

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS
Maneuvering Speed:	
2550 Lbs	105 KIAS
2200 Lbs	98 KIAS
1900 Lbs	90 KIAS
Maximum Glide	68 KIAS
Precautionary Landing With Engine Power	65 KIAS
Landing Without Engine Power:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS

EMERGENCY PROCEDURES CHECKLIST

Procedures in the Emergency Procedures Checklist portion of this section shown in **bold faced** type are immediate action items which should be committed to memory.

ENGINE FAILURES

ENGINE FAILURE DURING TAKEOFF ROLL

1. **Throttle -- IDLE.**
2. **Brakes-- APPLY.**
3. Wing Flaps -- RETRACT.
4. Mixture -- IDLE CUT OFF.
5. Ignition Switch -- OFF.
6. Master Switch -- OFF.

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

1. **Airspeed -- 70 KIAS (flaps UP).**
   65 KIAS (flaps DOWN).
2. Mixture -- IDLE CUT OFF.
3. Fuel Shutoff Valve -- OFF (Pull Full Out).
4. Ignition Switch -- OFF.
5. Wing Flaps -- AS REQUIRED.
6. Master Switch -- OFF.
7. Cabin Door -- UNLATCH.
8. Land -- STRAIGHT AHEAD.

ENGINE FAILURE DURING FLIGHT (Restart Procedures)

1. **Airspeed -- 68 KIAS.**
2. **Fuel Shutoff Valve -- ON (push full in).**
3. **Fuel Selector Valve -- BOTH.**
4. **Auxiliary Fuel Pump Switch -- ON.**
5. **Mixture -- RICH (if restart has not occurred).**
6. Ignition Switch -- BOTH (or START if propeller is stopped).

NOTE

If the propeller is windmilling, the engine will restart automatically within a few seconds. If the propeller has stopped (possible at low speeds), turn the ignition switch to START, advance the throttle slowly from idle and lean the mixture from full rich as required for smooth operation.

7. Auxiliary Fuel Pump Switch -- OFF.

NOTE

If the fuel flow indicator immediately drops to zero (indicating an engine-driven fuel pump failure), return the Auxiliary Fuel Pump Switch to the ON position.

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

1. Passenger Seat Backs -- MOST UPRIGHT POSITION.
2. Seats and Seat Belts -- SECURE.
3. Airspeed -- 70 KIAS (flaps UP).
   65 KIAS (flaps DOWN).
4. Mixture -- IDLE CUT OFF.
5. Fuel Shutoff Valve -- OFF (Pull Full Out).
6. Ignition Switch -- OFF.
7. Wing Flaps -- AS REQUIRED (30° recommended).
8. Master Switch -- OFF (when landing is assured).
9. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
10. Touchdown -- SLIGHTLY TAIL LOW.
11. Brakes -- APPLY HEAVILY.

PRECAUTIONARY LANDING WITH ENGINE POWER

1. Passenger Seat Backs -- MOST UPRIGHT POSITION.
2. Seats and Seat Belts -- SECURE.
3. Airspeed -- 65 KIAS.
4. Wing Flaps -- 20°.
5. Selected Field -- FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
6. Avionics Master Switch and Electrical Switches -- OFF.
7. Wing Flaps -- 30° (on final approach).
8. Airspeed -- 65 KIAS.
9. Master Switch -- OFF.
10. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
11. Touchdown -- SLIGHTLY TAIL LOW.
12. Ignition Switch -- OFF.
13. Brakes -- APPLY HEAVILY.

DITCHING

1. Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions and SQUAWK 7700.
2. Heavy Objects (in baggage area) -- SECURE OR JETTISON (if possible).
3. Passenger Seat Backs -- MOST UPRIGHT POSITION.
4. Seats and Seat Belts -- SECURE.
5. Wing Flaps -- 20° to 30°.
6. Power -- ESTABLISH 300 FT/MIN DESCENT AT 55 KIAS.

NOTE

If no power is available, approach at 70 KIAS with flaps up or at 65 KIAS with 10° flaps.

7. Approach -- High Winds, Heavy Seas -- INTO THE WIND.
   Light Winds, Heavy Swells -- PARALLEL TO SWELLS.
8. Cabin Doors -- UNLATCH.
9. Touchdown -- LEVEL ATTITUDE AT ESTABLISHED RATE OF DESCENT.
10. Face -- CUSHION at touchdown with folded coat.
11. ELT -- Activate.
12. Airplane -- EVACUATE through cabin doors. If necessary, open window and flood cabin to equalize pressure so doors can be opened.
13. Life Vests and Raft -- INFLATE WHEN CLEAR OF AIRPLANE.

FIRES

DURING START ON GROUND

1. **Ignition Switch -- START, Continue Cranking** to get a start which would suck the flames and accumulated fuel into the engine.

If engine starts:

2. Power -- 1800 RPM for a few minutes.
3. Engine -- SHUTDOWN and inspect for damage.

If engine fails to start:

4. **Throttle -- FULL OPEN.**
5. **Mixture -- IDLE CUT OFF.**
6. **Cranking -- CONTINUE.**
7. **Fuel Shutoff Valve -- OFF (Pull Full Out).**
8. **Auxiliary Fuel Pump Switch -- OFF.**
9. Fire Extinguisher -- ACTIVATE.
10. Engine -- SECURE.
    a. Master Switch -- OFF.
    b. Ignition Switch -- OFF
11. Parking Brake -- RELEASE.
12. Airplane -- EVACUATE.
13. Fire -- EXTINGUISH using fire extinguisher, wool blanket, or dirt.
14. Fire Damage -- INSPECT, repair damage or replace damaged components or wiring before conducting another flight.

ENGINE FIRE IN FLIGHT

1. **Mixture -- IDLE CUT OFF.**
2. **Fuel Shutoff Valve -- Pull Out (OFF).**
3. **Auxiliary Fuel Pump Switch -- OFF.**
4. **Master Switch -- OFF.**
5. Cabin Heat and Air -- OFF (except overhead vents).
6. Airspeed -- 100 KIAS (If fire is not extinguished, increase glide speed to find an airspeed - within airspeed limitations - which will provide an incombustible mixture).
7. Forced Landing -- EXECUTE (as described in Emergency Landing Without Engine Power).

WARNING: fhe fire exfinguisher has been removed

ELECTRICAL FIRE IN FLIGHT

1. **Master Switch -- OFF.**
2. **Vents, Cabin Air, Heat -- CLOSED.**
3. **Fire Extinguisher -- ACTIVATE.**
4. Avionics Master Switch -- OFF.
5. All Other Switches (except ignition switch) -- OFF.

⚠ WARNING

AFTER DISCHARGING FIRE EXTINGUISHER AND ASCERTAINING THAT FIRE HAS BEEN EXTINGUISHED, VENTILATE THE CABIN.

6. Vents/Cabin Air/Heat -- OPEN when it is ascertained that fire is completely extinguished.

If fire has been extinguished and electrical power is necessary for continuance of flight to nearest suitable airport or landing area:

7. Master Switch -- ON.
8. Circuit Breakers -- CHECK for faulty circuit, do not reset.
9. Radio Switches -- OFF.
10. Avionics Master Switch -- ON.
11. Radio/Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.

CABIN FIRE *WARNING: fhe fire exfinguisher has been removed*

1. **Master Switch -- OFF.**
2. **Vents/Cabin Air/Heat -- CLOSED** (to avoid drafts).
3. **Fire Extinguisher -- ACTIVATE.**

⚠ WARNING

AFTER DISCHARGING FIRE EXTINGUISHER AND ASCERTAINING THAT FIRE HAS BEEN EXTINGUISHED, VENTILATE THE CABIN.

4. Vents/Cabin Air/Heat -- Open when it is ascertained that fire is completely extinguished.
5. Land the airplane as soon as possible to inspect for damage.

WING FIRE

1. **Landing/Taxi Light Switches -- OFF.**
2. **Navigation Light Switch -- OFF.**
3. **Strobe Light Switch -- OFF.**
4. **Pitot Heat Switch -- OFF.**

NOTE

Perform a sideslip to keep the flames away from the fuel tank and cabin. Land as soon as possible using flaps only as required for final approach and touchdown.

ICING

INADVERTENT ICING ENCOUNTER

1. **Turn pitot heat switch ON.**
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 open defroster outlets** to obtain maximum windshield defroster airflow. Adjust cabin air control to get maximum defroster heat and airflow.
4. Watch for signs of engine-related icing conditions. An unexplained loss in engine speed could be caused by ice blocking the air intake filter, or, in extremely rare instances, ice completely blocking the fuel injection air reference tubes. Change the throttle position to obtain maximum RPM. This may require either advancing or retarding the throttle, dependent on where ice has accumulated in the system. Adjust mixture, as required, for maximum RPM.
5. Plan a landing at the nearest airport. With an extremely rapid ice build up, select a suitable "off airport" landing site.
6. With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for significantly higher stall speed and a longer landing roll.
7. 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.
8. Open left window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
9. Perform a landing approach using a forward slip, if necessary, for improved visibility.

10. Approach at 65 to 75 KIAS depending upon the amount of the accumulation.
11. Perform a landing in level attitude.

STATIC SOURCE BLOCKAGE
(Erroneous Instrument Reading Suspected)

1. **Static Pressure Alternate Source Valve -- PULL ON.**
2. Airspeed -- Consult appropriate calibration tables in Section 5.

LANDING WITH A FLAT MAIN TIRE

1. Approach -- NORMAL.
2. Wing Flaps -- 30°.
3. Touchdown -- GOOD MAIN TIRE FIRST, hold airplane off flat tire as long as possible with aileron control.
4. Directional Control -- MAINTAIN using brake on good wheel as required.

LANDING WITH A FLAT NOSE TIRE

1. Approach -- NORMAL.
2. Flaps -- AS REQUIRED.
3. Touchdown -- ON MAINS, hold nose wheel off the ground as long as possible.
4. When nose wheel touches down, maintain full up elevator as airplane slows to stop.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

AMMETER SHOWS EXCESSIVE RATE OF CHARGE (Full Scale Deflection)

1. Alternator -- OFF.

⚠ CAUTION

WITH THE ALTERNATOR SIDE OF THE MASTER SWITCH OFF, COMPASS DEVIATIONS OF AS MUCH AS 25° MAY OCCUR.

2. Nonessential Electrical Equipment -- OFF.
3. Flight -- TERMINATE as soon as practical.

LOW VOLTAGE ANNUNCIATOR (VOLTS) ILLUMINATES DURING FLIGHT (Ammeter Indicates Discharge)

NOTE

Illumination of "VOLTS" on the annunciator panel may occur during low RPM conditions with an electrical load on the system such as during a low RPM taxi. Under these conditions, the annunciator will go out at higher RPM. The master switch need not be recycled since an overvoltage condition has not occurred to deactivate the alternator system.

1. Avionics Master Switch -- OFF.
2. Alternator Circuit Breaker (ALT FLD) -- CHECK IN.
3. Master Switch -- OFF (both sides).
4. Master Switch -- ON.
5. Low Voltage Annunciator (VOLTS) -- CHECK OFF.
6. Avionics Master Switch -- ON.

If low voltage annunciator (VOLTS) illuminates again:

7. Alternator -- OFF.
8. Nonessential Radio and Electrical Equipment -- OFF.
9. Flight -- TERMINATE as soon as practical.

VACUUM SYSTEM FAILURE

Left Vacuum (L VAC) Annunciator or Right Vacuum (VAC R) Annunciator Illuminates.

⚠ CAUTION

IF VACUUM IS NOT WITHIN NORMAL OPERATING LIMITS, A FAILURE HAS OCCURRED IN THE VACUUM SYSTEM AND PARTIAL PANEL PROCEDURES MAY BE REQUIRED FOR CONTINUED FLIGHT.

1. **Vacuum Gage -- CHECK** to ensure vacuum within normal operating limits.

WARNING: the Vaccum system has been removed

AMPLIFIED EMERGENCY PROCEDURES

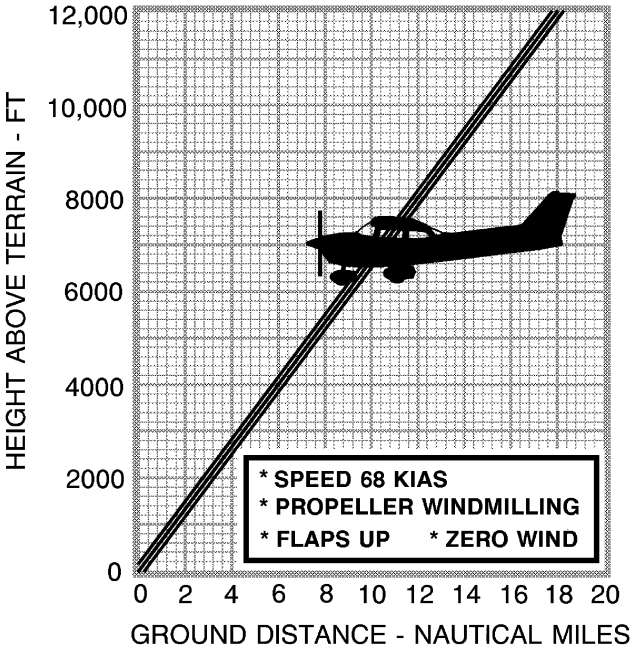
The following Amplified Emergency Procedures elaborate upon information contained in the Emergency Procedures Checklists portion of this section. These procedures also include information not readily adaptable to a checklist format, and material to which a pilot could not be expected to refer in resolution of a specific emergency. This information should be reviewed in detail prior to flying the airplane, as well as reviewed on a regular basis to keep pilot's knowledge of procedures fresh.

ENGINE FAILURE

If an engine failure occurs during the takeoff roll, the most important thing to do is stop the airplane on the remaining runway. Those extra items on the checklist will provide added safety after a failure of this type.

Prompt lowering of the nose to maintain airspeed and establish a glide attitude is the first response to an engine failure after takeoff. In most cases, the landing should be planned straight ahead with only small changes in direction to avoid obstructions. Altitude and airspeed are seldom sufficient to execute a 180° gliding turn necessary to return to the runway. The checklist procedures assume that adequate time exists to secure the fuel and ignition systems prior to touchdown.

After an engine failure in flight, the most important course of action is to continue flying the airplane. Best glide speed as shown in Figure 3-1 should be established as quickly as possible. While gliding toward a suitable landing area, an effort should be made to identify the cause of the failure. If time permits, an engine restart should be attempted as shown in the checklist. If the engine cannot be restarted, a forced landing without power must be completed.



0585C1011

Figure 3-1. Maximum Glide

FORCED LANDINGS

If all attempts to restart the engine fail and a forced landing is imminent, select a suitable field and prepare for the landing as discussed under the Emergency Landing Without Engine Power checklist. Transmit Mayday message on 121.5 MHz giving location and intentions and squawk 7700.

Before attempting an "off airport" landing with engine power available, one should fly over the landing area at a safe but low altitude to inspect the terrain for obstructions and surface conditions, proceeding as discussed under the Precautionary Landing With Engine Power checklist.

Prepare for ditching by securing or jettisoning heavy objects located in the baggage area and collect folded coats for protection of occupants' face at touchdown. Transmit Mayday message on 121.5 MHz giving location and intentions and squawk 7700. Avoid a landing flare because of difficulty in judging height over a water surface. The checklist assumes the availability of power to make a precautionary water landing. If power is not available, use of the airspeeds noted with minimum flap extension will provide a more favorable attitude for a power off ditching.

In a forced landing situation, do not set the AVIONICS MASTER switch or the airplane MASTER switch to the OFF position until a landing is assured. When these switches are in the OFF position, the airplane electrical systems are de-energized.

Before performing a forced landing, especially in remote and mountainous areas, activate the ELT transmitter by positioning the cockpit-mounted switch to the ON position. For complete information on ELT operation, refer to the Supplements, Section 9.

LANDING WITHOUT ELEVATOR CONTROL

Trim for horizontal flight (with an airspeed of approximately 65 KIAS and flaps set to 20°) by using throttle and elevator trim controls. Then **do not change the elevator trim control setting;** control the glide angle by adjusting power exclusively.

At the landing flare (round-out), the nose down moment resulting from power reduction is an adverse factor and the airplane may land on the nose wheel. Consequently, at flare, the elevator trim control should be adjusted toward the full nose up position and the power adjusted so that the airplane will rotate to the horizontal attitude for touchdown. Close the throttle at touchdown.

FIRES

Although engine fires are extremely rare in flight, the steps of the appropriate checklist should be followed if one is encountered. After completion of this procedure, execute a forced landing. Do not attempt to restart the engine.

The initial indication of an electrical fire is usually the odor of burning insulation. The checklist for this problem should result in elimination of the fire.

EMERGENCY OPERATION IN CLOUDS (Total Vacuum System Failure)

If both the vacuum pumps fail in flight, the directional indicator and attitude indicator will be disabled, and the pilot will have to rely on the turn coordinator if he inadvertently flies into clouds. If an autopilot is installed, it too may be affected. Refer to Section 9, Supplements, for additional details concerning autopilot operation. The following instructions assume that only the electrically powered turn coordinator is operative, and that the pilot is not completely proficient in instrument flying.

EXECUTING A 180° TURN IN CLOUDS

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

1. Note the compass heading.
2. Using the clock, 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 over controlling by keeping the hands off the control wheel as much as possible and steering only with rudder.

EMERGENCY DESCENT THROUGH CLOUDS

If conditions prevent return to VFR flight by a 180° turn, a descent through a cloud deck to VFR conditions may be appropriate. 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 letdown condition as follows:

1. Apply full rich mixture.
2. Reduce power to set up a 500 to 800 ft/min rate of descent.
3. Adjust the elevator trim for a stabilized descent at 70-80 KIAS.
4. Keep hands off the control wheel.
5. Monitor turn coordinator and make corrections by rudder alone.
6. Check trend of compass card movement and make cautious corrections with rudder to stop the turn.
7. Upon breaking out of clouds, resume normal cruising flight.

RECOVERY FROM SPIRAL DIVE IN THE CLOUDS

If a spiral is encountered in the clouds, proceed as follows:

1. Retard throttle to idle position.
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 airspeed to 80 KIAS.
4. Adjust the elevator trim control to maintain an 80 KIAS glide.
5. Keep hands off the control wheel, using rudder control to hold a straight heading.
6. Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
7. Upon breaking out of clouds, resume normal cruising flight.

INADVERTENT FLIGHT INTO ICING CONDITIONS

Flight into icing conditions is **prohibited** and extremely dangerous. An inadvertent encounter with these conditions can best be handled using the checklist procedures. The best procedure, of course, is to turn back or change altitude to escape icing conditions.

During these encounters, an unexplained loss in engine speed could be caused by ice blocking the air intake filter, or, in extremely rare instances, ice completely blocking the fuel injection air reference tubes. In either case, the throttle should be positioned to obtain maximum RPM (in some instances, the throttle may need to be retarded for maximum power). The mixture should then be adjusted, as required, to obtain maximum RPM.

STATIC SOURCE BLOCKED

If erroneous readings of the static source instruments (airspeed, altimeter and vertical speed) are suspected, the static pressure alternate source valve should be pulled ON, thereby supplying static pressure to these instruments from the cabin.

When using the alternate static source, refer to the Alternate Static Source Airspeed Calibration table in Section 5, Performance, for additional information.

Maximum airspeed and altimeter variation from normal is 4 knots and 30 feet over the normal operating range with the window(s) closed. See Section 5, Performance, for additional airspeed calibration data.

SPINS

Should an inadvertent spin occur, the following recovery procedure should be used:

1. RETARD THROTTLE TO IDLE POSITION.
2. PLACE AILERONS IN NEUTRAL POSITION.
3. APPLY AND **HOLD** FULL RUDDER OPPOSITE TO THE DIRECTION OF ROTATION.
4. JUST **AFTER** THE RUDDER REACHES THE STOP, MOVE THE CONTROL WHEEL **BRISKLY** FORWARD FAR ENOUGH TO BREAK THE STALL. Full down elevator may be required at aft center of gravity loadings to assure optimum recoveries.
5. **HOLD** THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the control inputs may extend the recovery.
6. AS ROTATION STOPS, NEUTRALIZE RUDDER, AND MAKE A SMOOTH RECOVERY FROM THE RESULTING DIVE.

NOTE

If disorientation precludes a visual determination of the direction of rotation, the symbolic airplane in the turn coordinator may be referred to for this information.

For additional information on spins and spin recovery, see the discussion under SPINS in Normal Procedures (Section 4).

ROUGH ENGINE OPERATION OR LOSS OF POWER

SPARK PLUG FOULING

A slight 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 L or R 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 recommended 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 L or R 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 possible. If not, switch to the good magneto and proceed to the nearest airport for repairs.

ENGINE-DRIVEN FUEL PUMP FAILURE

Failure of the engine-driven fuel pump will result in an immediate loss of engine power, similar to fuel exhaustion or starvation, but while operating from a fuel tank containing adequate fuel. A sudden reduction in indicated fuel flow will occur just before loss of engine power.

If the engine-driven fuel pump fails, immediately set the auxiliary fuel pump switch (FUEL PUMP) to the ON position to restore engine power. The flight should be terminated as soon as practical and the engine-driven fuel pump repaired.

EXCESSIVE FUEL VAPOR INDICATIONS

Excessive fuel vapor is most likely to be generated during ground operations when operating at higher altitudes, in unusually warm temperatures or with more volatile fuel blends. Operation at or near idle RPM (low fuel flow) for extended periods will increase the chances of fuel vapor generation. (See "Leaning For Ground Operations", Section 4.)

Indicated fuel flow that is not stable (sudden changes greater than 1 gal/hr) is a sign that fuel vapor may be present in the system. Fuel flow indications that become less stable (increasing changes) may lead to power surges and power loss if not corrected.

If in-flight vapor is suspected, smoother engine operation may result from making the following changes (singly or together): set the auxiliary fuel pump to the ON position, lean the mixture for smooth engine operation and select another fuel tank. Increasing the airspeed to provide more air flow through the cowling will aid in cooling the engine and fuel system components.

LOW OIL PRESSURE

If the low oil pressure annunciator (OIL PRESS) illuminates and oil temperature remains normal, the oil pressure sending unit or relief valve may be malfunctioning. Land at the nearest airport to inspect the source of trouble.

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

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and low voltage annunciator (VOLTS); 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 defective alternator control unit 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 following paragraphs 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 can be adversely affected by higher than normal voltage. The alternator control unit includes an overvoltage sensor which normally will automatically shut down the alternator if the charge voltage reaches approximately 31.5 volts. If the overvoltage sensor malfunctions, as evidenced by an excessive rate of charge shown on the ammeter, the alternator should be turned off, nonessential electrical equipment turned off and the flight terminated as soon as practical.

INSUFFICIENT RATE OF CHARGE

NOTE

The low voltage annunciator (VOLTS) may come on and ammeter discharge indications may occur during low RPM conditions with an electrical load on the system, such as during a low RPM taxi. Under these conditions, the annunciator will go out at higher RPM.

If the overvoltage sensor should shut down the alternator and trip the alternator circuit breaker (ALT FLD), or if the alternator output is low, a discharge rate will be shown on the ammeter followed by illumination of the low voltage annunciator (VOLTS). Since this may be a "nuisance" trip out, an attempt should be made to reactivate the alternator system. To reactivate, set the avionics master switch to the OFF position, check that the alternator circuit breaker (ALT FLD) is in, then set both sides of the master switch to the OFF position and then to the ON position. If the problem no longer exists, normal alternator charging will resume and the low voltage annunciator (VOLTS) will go off. The avionics master switch may then be returned to the ON position.

If the annunciator illuminates 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. Battery power must be conserved for later operation of the wing flaps and, if the emergency occurs at night, for possible use of the landing lights during landing.

OTHER EMERGENCIES

WINDSHIELD DAMAGE

If a bird strike or other incident should damage the windshield in flight to the point of creating an opening, a significant loss in performance may be expected. This loss may be minimized in some cases (depending on amount of damage, altitude, etc.) by opening the side windows while the airplane is maneuvered for a landing at the nearest airport. If airplane performance or other adverse conditions preclude landing at an airport, prepare for an "off airport" landing in accordance with the Precautionary Landing With Engine Power or Ditching checklists.

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NORMAL PROCEDURES

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INTRODUCTION

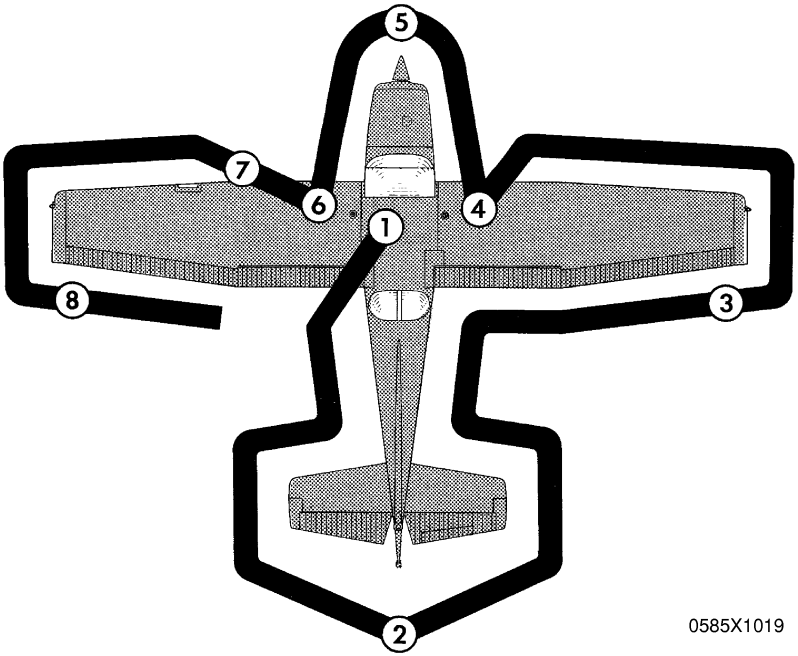
Section 4 provides checklist and amplified procedures for the conduct of normal operation. Normal procedures associated with optional systems can be found in the Supplements, Section 9.

AIRSPEEDS

AIRSPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 2550 pounds and may be used for any lesser weight.

Takeoff:	
Normal Climb Out	75-85 KIAS
Short Field Takeoff, Flaps 10°, Speed at 50 Feet	56 KIAS
Enroute Climb, Flaps Up:	
Normal, Sea Level	75-85 KIAS
Normal, 10,000 Feet	70-80 KIAS
Best Rate-of-Climb, Sea Level	74 KIAS
Best Rate-of-Climb, 10,000 Feet	72 KIAS
Best Angle-of-Climb, Sea Level	62 KIAS
Best Angle-of-Climb, 10,000 Feet	67 KIAS
Landing Approach:	
Normal Approach, Flaps Up	65-75 KIAS
Normal Approach, Flaps 30°	60-70 KIAS
Short Field Approach, Flaps 30°	61 KIAS
Balked Landing:	
Maximum Power, Flaps 20°	60 KIAS
Maximum Recommended Turbulent Air Penetration Speed:	
2550 Lbs	105 KIAS
2200 Lbs	98 KIAS
1900 Lbs	90 KIAS
Maximum Demonstrated Crosswind Velocity:	
Takeoff or Landing	15 KNOTS



NOTE

Visually check airplane for general condition during walk-around inspection. Airplane should be parked in a normal ground attitude (refer to Figure 1-1) to ensure that fuel drain valves allow for accurate sampling. Use of the refueling steps and assist handles will simplify access to the upper wing surfaces for visual checks and refueling operations. 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. Prior to flight, check that pitot heater is warm to touch within 30 seconds with battery and pitot heat switches on. If a night flight is planned, check operation of all lights, and make sure a flashlight is available.

Figure 4-1. Preflight Inspection

CHECKLIST PROCEDURES

PREFLIGHT INSPECTION

(1) CABIN

1. Pitot Tube Cover -- REMOVE. Check for pitot blockage.
2. Pilot's Operating Handbook -- AVAILABLE IN THE AIRPLANE.
3. Airplane Weight and Balance -- CHECKED.
4. Parking Brake -- SET.
5. Control Wheel Lock -- REMOVE.
6. Ignition Switch -- OFF.
7. Avionics Master Switch -- OFF.

⚠ WARNING

WHEN TURNING ON THE MASTER SWITCH, USING AN EXTERNAL POWER SOURCE, OR PULLING THE PROPELLER THROUGH BY HAND, TREAT THE PROPELLER AS IF THE IGNITION SWITCH WERE ON. DO NOT STAND, NOR ALLOW ANYONE ELSE TO STAND, WITHIN THE ARC OF THE PROPELLER, SINCE A LOOSE OR BROKEN WIRE OR A COMPONENT MALFUNCTION COULD CAUSE THE PROPELLER TO ROTATE.

8. Master Switch -- ON.
9. Fuel Quantity Indicators -- CHECK QUANTITY and ENSURE LOW FUEL ANNUNCIATORS (L LOW FUEL R) ARE EXTINGUISHED.
10. Avionics Master Switch -- ON.
11. Avionics Cooling Fan -- CHECK AUDIBLY FOR OPERATION.
12. Avionics Master Switch -- OFF.
13. Static Pressure Alternate Source Valve -- OFF.
14. Annunciator Panel Switch -- PLACE AND HOLD IN TST POSITION and ensure all annunciators illuminate.

15. Annunciator Panel Test Switch -- RELEASE. Check that appropriate annunciators remain on.

NOTE

When Master Switch is turned ON, some annunciators will flash for approximately 10 seconds before illuminating steadily. When panel TST switch is toggled up and held in position, all remaining lights will flash until the switch is released.

16. Fuel Selector Valve -- BOTH.
17. Fuel Shutoff Valve -- ON (Push Full In).
18. Flaps -- EXTEND.
19. Pitot Heat -- ON. (Carefully check that pitot tube is warm to touch within 30 seconds.)
20. Pitot Heat -- OFF.
21. Master Switch -- OFF.
22. Elevator Trim -- SET for takeoff.
23. Baggage Door -- CHECK, lock with key.
24. Autopilot Static Source Opening (if installed) -- CHECK for blockage.

(2) EMPENNAGE

1. Rudder Gust Lock (if installed) -- REMOVE.
2. Tail Tie-Down -- DISCONNECT.
3. Control Surfaces -- CHECK freedom of movement and security.
4. Trim Tab -- CHECK security.
5. Antennas -- CHECK for security of attachment and general condition.

(3) RIGHT WING Trailing Edge

1. Aileron -- CHECK freedom of movement and security.
2. Flap -- CHECK for security and condition.

(4) RIGHT WING

1. Wing Tie-Down -- DISCONNECT.

2. Main Wheel Tire -- CHECK for proper inflation and general condition (weather checks, tread depth and wear, etc...).
3. Fuel Tank Sump Quick Drain Valves -- DRAIN at least a cupful of fuel (using sampler cup) from each sump location to check for water, sediment, and proper fuel grade before each flight and after each refueling. If water is observed, take further samples until clear and then gently rock wings and lower tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from **all** fuel drain points until **all** contamination has been removed. If contaminants are still present, refer to WARNING below and do not fly airplane.

⚠ WARNING

IF, AFTER REPEATED SAMPLING, EVIDENCE OF CONTAMINATION STILL EXISTS, THE AIRPLANE SHOULD NOT BE FLOWN. TANKS SHOULD BE DRAINED AND SYSTEM PURGED BY QUALIFIED MAINTENANCE PERSONNEL. ALL EVIDENCE OF CONTAMINATION MUST BE REMOVED BEFORE FURTHER FLIGHT.

4. Fuel Quantity -- CHECK VISUALLY for desired level.
5. Fuel Filler Cap -- SECURE and VENT UNOBSTRUCTED.

(5) NOSE

1. Fuel Strainer Quick Drain Valve (Located on bottom of fuselage) -- DRAIN at least a cupful of fuel (using sampler cup) from valve to check for water, sediment, and proper fuel grade before each flight and after each refueling. If water is observed, take further samples until clear and then gently rock wings and lower tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from **all** fuel drain points, including the fuel reservoir and fuel selector, until **all** contamination has been removed. If contaminants are still present, refer to WARNING above and do not fly the airplane.

2. Engine Oil Dipstick/Filler Cap -- CHECK oil level, then check dipstick/filler cap SECURE. **Do not operate with less than five quarts.** Fill to eight quarts for extended flight.
3. Engine Cooling Air Inlets -- CLEAR of obstructions.
4. Propeller and Spinner -- CHECK for nicks and security.
5. Air Filter -- CHECK for restrictions by dust or other foreign matter.
6. Nose Wheel Strut and Tire -- CHECK for proper inflation of strut and general condition (weather checks, tread depth and wear, etc...) of tire.
7. Left Static Source Opening -- CHECK for blockage.

(6) LEFT WING

1. Fuel Quantity -- CHECK VISUALLY for desired level.
2. Fuel Filler Cap -- SECURE and VENT UNOBSTRUCTED.
3. Fuel Tank Sump Quick Drain Valves -- DRAIN at least a cupful of fuel (using sampler cup) from each sump location to check for water, sediment, and proper fuel grade before each flight and after each refueling. If water is observed, take further samples until clear and then gently rock wings and lower tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from **all** fuel drain points until **all** contamination has been removed. If contaminants are still present, refer to WARNING on page 4-9 and do not fly airplane.
4. Main Wheel Tire -- CHECK for proper inflation and general condition (weather checks, tread depth and wear, etc...).

(7) LEFT WING Leading Edge

1. Fuel Tank Vent Opening -- CHECK for blockage.
2. Stall Warning Opening -- CHECK for blockage. To check the system, place a clean handkerchief over the vent opening and apply suction; a sound from the warning horn will confirm system operation.
3. Wing Tie-Down -- DISCONNECT.
4. Landing/Taxi Light(s) -- CHECK for condition and cleanliness of cover.

(8) LEFT WING Trailing Edge

1. Aileron-- CHECK for freedom of movement and security.
2. Flap -- CHECK for security and condition.

BEFORE STARTING ENGINE

1. Preflight Inspection -- COMPLETE.
2. Passenger Briefing -- COMPLETE.
3. Seats and Seat Belts -- ADJUST and LOCK. Ensure inertia reel locking.
4. Brakes -- TEST and SET.
5. Circuit Breakers -- CHECK IN.
6. Electrical Equipment -- OFF.

⚠ CAUTION

THE AVIONICS MASTER SWITCH MUST BE OFF DURING ENGINE START TO PREVENT POSSIBLE DAMAGE TO AVIONICS.

7. Avionics Master Switch -- OFF.
8. Fuel Selector Valve -- BOTH.
9. Fuel Shutoff Valve -- ON (push full in).
10. Avionics Circuit Breakers -- CHECK IN.

STARTING ENGINE (With Battery)

1. Throttle -- OPEN 1/4 INCH.
2. Mixture -- IDLE CUTOFF.
3. Propeller Area -- CLEAR.
4. Master Switch -- ON.
5. Flashing Beacon -- ON.

NOTE

If engine is warm, omit priming procedure of steps 6, 7 and 8 below.

6. Auxiliary Fuel Pump Switch -- ON.
7. Mixture -- SET to FULL RICH (full forward) until stable fuel flow is indicated (usually 3 to 5 seconds), then set to IDLE CUTOFF (full aft) position.
8. Auxiliary Fuel Pump Switch -- OFF.
9. Ignition Switch -- START (release when engine starts).
10. Mixture -- ADVANCE smoothly to RICH when engine starts.

NOTE

If engine floods (engine has been primed too much), turn off auxiliary fuel pump, place mixture to idle cutoff, open throttle 1/2 to full, and motor (crank) engine. When engine starts, set mixture to full rich and close throttle promptly.

11. Oil Pressure -- CHECK.
12. Navigation Lights -- ON as required.
13. Avionics Master Switch -- ON.
14. Radios -- ON.
15. Flaps -- RETRACT.

STARTING ENGINE (With External Power)

1. Throttle -- OPEN 1/4 INCH.
2. Mixture -- IDLE CUTOFF.
3. Propeller Area -- CLEAR.
4. Master Switch -- OFF.
5. External Power -- CONNECT to airplane receptacle.
6. Master Switch -- ON.
7. Flashing Beacon -- ON.

NOTE

If engine is warm, omit priming procedure of steps 8, 9 and 10 below.

8. Auxiliary Fuel Pump Switch -- ON.
9. Mixture -- SET to FULL RICH (full forward) until stable fuel flow is indicated (usually 3 to 5 seconds), then set to IDLE CUTOFF (full aft) position.
10. Auxiliary Fuel Pump Switch -- OFF.
11. Ignition Switch -- START (release when engine starts).
12. Mixture -- ADVANCE smoothly to RICH when engine starts.

NOTE

If engine floods (engine has been primed to much), turn off auxiliary fuel pump, set mixture in idle cutoff, open throttle 1/2 to full, and motor (crank) engine. When engine starts, set mixture to full rich and close throttle promptly.

13. Oil Pressure -- CHECK.
14. External Power -- DISCONNECT from airplane receptacle. Secure external power door.
15. Electrical System -- CHECK FOR PROPER OPERATION.
    a. Master Switch -- OFF
       (disconnects both the battery and alternator from the system).

b. Taxi and Landing Light Switches -- ON.
(to provide an initial electrical load on the system).
c. Engine RPM -- REDUCE to idle.
(Minimum alternator output occurs at idle.)
d. Master Switch -- ON (with taxi and landing lights switched on).
(The ammeter should indicate in the negative direction, showing that the alternator output is below the load requirements, but the battery is supplying current to the system.)
e. Engine RPM -- INCREASE to approximately 1500 RPM
(as engine RPM increases, alternator output should increase to meet the system load requirements).
f. Ammeter and Low Voltage Annunciator -- CHECK
(the ammeter should indicate in the positive direction, showing that the alternator is supplying current and the Low Voltage Annunciator (VOLTS) should not be lighted).

NOTE

If the indications, as noted in Step "d" and Step "f", are not observed, the electrical system is not functioning properly. Corrective maintenance must be performed to provide for proper electrical system operation before flight.

16. Navigation Lights -- ON as required.
17. Avionics Master Switch -- ON.
18. Radios -- ON.
19. Flaps -- RETRACT.

BEFORE TAKEOFF

1. Parking Brake -- SET.
2. Passenger Seat Backs -- MOST UPRIGHT POSITION.
3. Seats and Seat Belts -- CHECK SECURE.
4. Cabin Doors -- CLOSED and LOCKED.
5. Flight Controls -- FREE and CORRECT.
6. Flight Instruments -- CHECK and SET.
7. Fuel Quantity -- CHECK.
8. Mixture -- RICH.
9. Fuel Selector Valve -- RECHECK BOTH.
10. Throttle -- 1800 RPM.
    a. Magnetos -- CHECK (RPM drop should not exceed 150 RPM on either magneto or 50 RPM differential between magnetos).
    b. Vacuum Gage -- CHECK.
    c. Engine Instruments and Ammeter -- CHECK.
11. Annunciator Panel -- Ensure no annunciators are illuminated.
12. Throttle -- CHECK IDLE.
13. Throttle -- 1000 RPM or LESS.
14. Throttle Friction Lock -- ADJUST.
15. Strobe Lights -- AS DESIRED.
16. Radios and Avionics -- SET.
17. NAV/GPS Switch (if installed) -- SET.
18. Autopilot (if installed) -- OFF.
19. Manual Electric Trim (if installed) -- CHECK.
20. Elevator Trim -- SET for takeoff.
21. Wing Flaps -- SET for takeoff (0°-10°).
22. Brakes -- RELEASE.

TAKEOFF

NORMAL TAKEOFF

1. Wing Flaps -- 0°-10°.
2. Throttle -- FULL OPEN.
3. Mixture -- RICH (above 3000 feet, LEAN to obtain maximum RPM).
4. Elevator Control -- LIFT NOSE WHEEL (at 55 KIAS).
5. Climb Speed -- 70-80 KIAS.
6. Wing Flaps -- RETRACT.

SHORT FIELD TAKEOFF

1. Wing Flaps -- 10°.
2. Brakes -- APPLY.
3. Throttle -- FULL OPEN.
4. Mixture -- RICH (above 3000 feet, LEAN to obtain maximum RPM).
5. Brakes -- RELEASE.
6. Elevator Control -- SLIGHTLY TAIL LOW.
7. Climb Speed -- 56 KIAS (until all obstacles are cleared).
8. Wing Flaps -- RETRACT slowly after reaching 60 KIAS.

ENROUTE CLIMB

1. Airspeed -- 70-85 KIAS.
2. Throttle -- FULL OPEN.
3. Mixture -- RICH (above 3000 feet, LEAN to obtain maximum RPM).

CRUISE

1. Power -- 2100-2700 RPM (No more than 75% is recommended).
2. Elevator Trim -- ADJUST.
3. Mixture -- LEAN.

DESCENT

1. Power -- AS DESIRED.
2. Mixture -- ADJUST for smooth operation (full rich for idle power).
3. Altimeter -- SET.
4. NAV/GPS Switch -- SET.
5. Fuel Selector Valve -- BOTH.
6. Wing Flaps -- AS DESIRED (0° - 10° below 110 KIAS, 10° - 30° below 85 KIAS).

BEFORE LANDING

1. Pilot and Passenger Seat Backs -- MOST UPRIGHT POSITION.
2. Seats and Seat Belts -- SECURED and LOCKED.
3. Fuel Selector Valve -- BOTH.
4. Mixture -- RICH.
5. Landing/Taxi Lights -- ON.
6. Autopilot (if installed) -- OFF.

LANDING

NORMAL LANDING

1. Airspeed -- 65-75 KIAS (flaps UP).
2. Wing Flaps -- AS DESIRED (0°-10° below 110 KIAS, 10°-30° below 85 KIAS).
3. Airspeed -- 60-70 KIAS (flaps DOWN).
4. Touchdown -- MAIN WHEELS FIRST.
5. Landing Roll -- LOWER NOSE WHEEL GENTLY.
6. Braking -- MINIMUM REQUIRED.

SHORT FIELD LANDING

1. Airspeed -- 65-75 KIAS (flaps UP).
2. Wing Flaps -- FULL DOWN (30°).
3. Airspeed -- 61 KIAS (until flare).
4. Power -- REDUCE to idle after clearing obstacle.
5. Touchdown -- MAIN WHEELS FIRST.
6. Brakes -- APPLY HEAVILY.
7. Wing Flaps -- RETRACT.

BALKED LANDING

1. Throttle -- FULL OPEN.
2. Wing Flaps -- RETRACT TO 20°.
3. Climb Speed -- 60 KIAS.
4. Wing Flaps -- 10° (until obstacles are cleared).
   RETRACT (after reaching a safe altitude and 65 KIAS).

AFTER LANDING

1. Wing Flaps -- UP.

SECURING AIRPLANE

1. Parking Brake -- SET.
2. Electrical Equipment, Autopilot (if installed) -- OFF.
3. Avionics Master Switch -- OFF.
4. Mixture -- IDLE CUTOFF (pulled full out).
5. Ignition Switch -- OFF.
6. Master Switch -- OFF.
7. Control Lock -- INSTALL.
8. Fuel Selector Valve -- LEFT or RIGHT to prevent cross feeding.

AMPLIFIED PROCEDURES

PREFLIGHT INSPECTION

The Preflight Inspection, described in Figure 4-1 and adjacent checklist, is required prior to each flight. If the airplane has been in extended storage, has had recent major maintenance, or has been operated from marginal airports, a more extensive exterior inspection is recommended.

After major maintenance has been performed, the flight and trim tab controls should be double checked for free and correct movement and security. The security of all inspection plates on the airplane should be checked following periodic inspections. If the airplane has been waxed or polished, check the external static pressure source hole for stoppage.

If the airplane has been exposed to much ground handling in a crowded hangar, it should be checked for dents and scratches on wings, fuselage, and tail surfaces, damage to navigation and anti-collision lights, damage to nose wheel as a result of exceeding tow limits, and avionics antennas.

Outside storage for long periods may result in dust and dirt accumulation on the induction air filter, obstructions in airspeed system lines, water contaminants in fuel tanks and insect/bird/rodent nests in any opening. If any water is detected in the fuel system, the fuel tank sump quick drain valves, fuel reservoir quick drain valve, and fuel strainer quick drain valve should all be thoroughly drained again. Then, the wings should be gently rocked and the tail lowered to the ground to move any further contaminants to the sampling points. Repeated samples should then be taken at **all** quick drain points until **all** contamination has been removed. If, after repeated sampling, evidence of contamination still exists, the fuel tanks should be completely drained and the fuel system cleaned.

Additionally, if the airplane has been stored outside in windy or gusty areas, or tied down adjacent to taxiing airplanes, special attention should be paid to control surface stops, hinges, and brackets to detect the presence of potential wind damage.

If the airplane has been operated from muddy fields or in snow or slush, check the main and nose gear wheel fairings for obstructions and cleanliness. Operation from a gravel or cinder field will require extra attention to propeller tips and abrasion on leading edges of the horizontal tail. Stone damage to the propeller can seriously reduce the fatigue life of the blades.

Airplanes that are operated from rough fields, especially at high altitudes, are subjected to abnormal landing gear abuse. Frequently check all components of the landing gear, shock strut, tires, and brakes. If the shock strut is insufficiently extended, undue landing and taxi loads will be subjected on the airplane structure.

To prevent loss of fuel in flight, make sure the fuel tank filler caps are tightly sealed after any fuel system check or servicing. Fuel system vents should also be inspected for obstructions, ice or water, especially after exposure to cold, wet weather.

STARTING ENGINE

In cooler weather, the engine compartment temperature drops off rapidly following engine shutdown and the injector nozzle lines remain nearly full of fuel.

However, in warmer weather, engine compartment temperatures may increase rapidly following engine shutdown, and fuel in the lines will vaporize and escape into the intake manifold. Hot weather starting procedures depend considerably on how soon the next engine start is attempted. Within the first 20 to 30 minutes after shutdown, the fuel manifold is adequately primed and the empty injector nozzle lines will fill before the engine dies. However, after approximately 30 minutes, the vaporized fuel in the manifold will have nearly dissipated and some slight “priming” could be required to refill the nozzle lines and keep the engine running after the initial start. Starting a hot engine is facilitated by advancing the mixture control promptly to 1/3 open when the engine starts, and then smoothly to full rich as power develops.

Should the engine tend to die after starting, turn on the auxiliary fuel pump temporarily and adjust the throttle and/or mixture as necessary to keep the engine running. In the event of over priming or flooding, turn off the auxiliary fuel pump, open the throttle from 1/2 to full open, and continue cranking with the mixture full lean. When the engine starts, smoothly advance the mixture control to full rich and retard the throttle to desired idle speed.

If the engine is under primed (most likely in cold weather with a cold engine) it will not start at all, and additional priming will be necessary.

After starting, if the oil pressure gage does not begin to show pressure within 30 seconds in the summer time and approximately one minute in very cold weather, stop the engine and investigate. Lack of oil pressure can cause serious engine damage.

NOTE

Additional details concerning cold weather starting and operation may be found under COLD WEATHER OPERATION paragraphs in this section.

RECOMMENDED STARTER DUTY CYCLE

Crank the starter for 10 seconds followed by a 20 second cool down period. This cycle can be repeated two additional times, followed by a ten minute cool down period before resuming cranking. After cool down, crank the starter again, three cycles of 10 seconds followed by 20 seconds of cool down. If the engine still fails to start, an investigation to determine the cause should be initiated.

LEANING FOR GROUND OPERATIONS

1. For all ground operations, after starting the engine and when the engine is running smoothly:

   a. set the throttle to 1200 RPM.
   b. lean the mixture for maximum RPM.
   c. set the throttle to an RPM appropriate for ground operations (800 to 1000 RPM recommended).

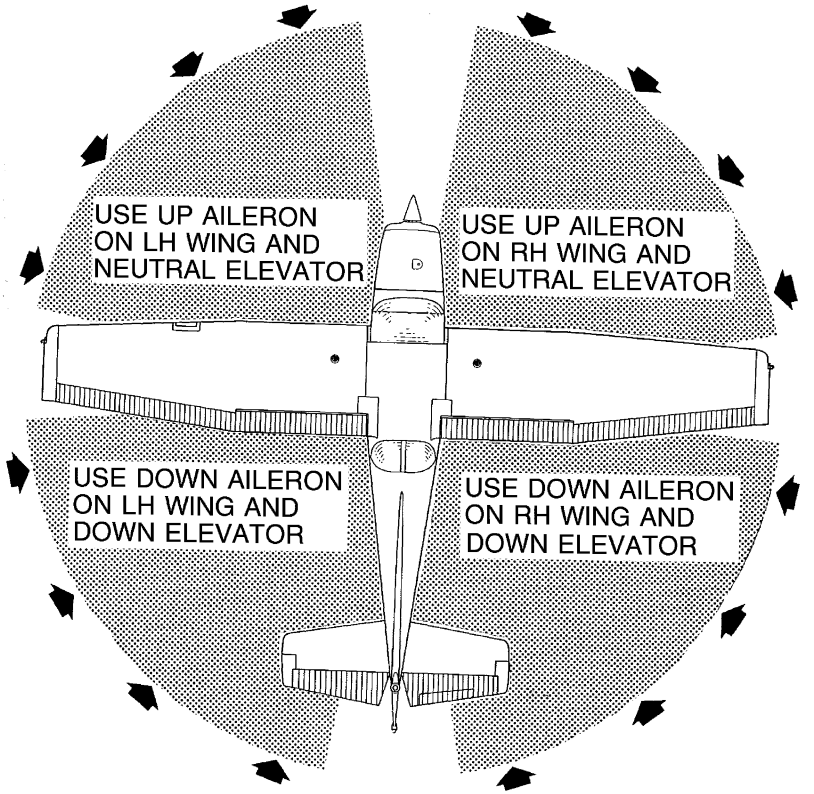
NOTE

If ground operation will be required after the BEFORE TAKEOFF checklist is completed, lean the mixture again (as described above) until ready for the TAKEOFF checklist.

TAXIING

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

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



NOTE

Strong quartering tail winds require caution. Avoid sudden bursts of the throttle and sharp braking when the airplane is in this situation. Use the steerable nose wheel and rudder to maintain direction.

0585X1020

Figure 4-2. Taxiing Diagram

BEFORE TAKEOFF

WARM UP

If the engine idles (approximatley 600 RPM) and accelerates smoothly, the airplane is ready for takeoff. 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 1800 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 150 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 alternator control unit 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 landing light or by operating the wing flaps during the engine runup (1800 RPM). The ammeter will remain within a needle width of its initial reading if the alternator and alternator control unit are operating properly.

LANDING LIGHTS

If landing lights are to be used to enhance the visibility of the airplane in the traffic pattern or enroute, it is recommended that only the taxi light be used. This will extend the service life of the landing light appreciably.

TAKEOFF

POWER CHECK

It is important to check full throttle engine operation early in the takeoff roll. Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff. If this occurs, you are justified in making a thorough full throttle static runup before another takeoff is attempted. The engine should run smoothly and turn approximately 2300 - 2400 RPM with mixture leaned to provide maximum RPM.

Full throttle run ups over loose gravel are especially harmful to propeller tips. When takeoffs 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 8 under Propeller Care.

Prior to takeoff 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 takeoffs are accomplished with wing flaps 0°-10°. Using 10° wing flaps reduces the ground roll and total distance over an obstacle by approximately 10 percent. **Flap deflections greater than 10° are not approved for takeoff**. If 10° wing flaps are used for takeoff, they should be left down until all obstacles are cleared and a safe flap retraction speed of 60 KIAS is reached. On a short field, 10° wing flaps and an obstacle clearance speed of 56 KIAS should be used.

Soft or rough field takeoffs are performed with 10° flaps by lifting the airplane off the ground as soon as practical in a slightly tail low attitude. If no obstacles are ahead, the airplane should be leveled off immediately to accelerate to a higher climb speed. When departing a soft field with an aft C.G. loading, the elevator trim should be adjusted towards the nose down direction to give comfortable control wheel forces during the initial climb.

CROSSWIND TAKEOFF

Takeoffs into strong crosswind conditions normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after takeoff. With the ailerons partially deflected into the wind, the airplane is accelerated to a speed slightly higher than normal, then pulled off briskly 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

Normal enroute climbs are performed with flaps up and **full throttle** and at speeds 5 to 10 knots higher than best rate-of-climb speeds for the best combination of performance, visibility and engine cooling. The mixture should be **full rich** below 3000 feet and may be leaned above 3000 feet for smoother operation or to obtain maximum RPM. For maximum rate of climb, use the best rate-of-climb speeds showing in the Rate of Climb chart in Section 5. If an obstruction dictates the use of a steep climb angle, the best angle-of-climb speed should be used with flaps up and maximum power. Climbs at speeds lower than the best rate-of-climb speed should be of short duration to improve engine cooling.

CRUISE

Normal cruise is performed between 45% and 75% power. The engine RPM and corresponding fuel consumption for various altitudes can be determined by using the data in Section 5.

NOTE

Cruising should be done at 75% power as much as practicable until a total of 50 hours has accumulated or oil consumption has stabilized. Operation at this higher power will ensure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

The Cruise Performance charts in Section 5 provide the pilot with detailed information concerning the cruise performance of the Model 172S in still air. Power and altitude, as well as winds aloft, have a strong influence on the time and fuel needed to complete any flight.

The Cruise Performance Table, Figure 4-3, illustrates the true airspeed and nautical miles per gallon during cruise for various altitudes and percent powers, and is based on standard conditions and zero wind. This table should be used as a guide, along with the available winds aloft information, to determine the most favorable altitude and power setting for a given trip. The selection of cruise altitude on the basis of the most favorable wind conditions and the use of low power settings are significant factors that should be considered on every trip to reduce fuel consumption.

In addition to power settings, proper leaning techniques also contribute to greater range and are figured into cruise performance tables. To achieve the recommended lean mixture fuel consumption figures shown in Section 5, the mixture should be leaned using the exhaust gas temperature (EGT) indicator as noted.

NOTE

At lower power it may be necessary to richen the mixture slightly to obtain smooth operation.

ALTITUDE	75% POWER		65% POWER		55% POWER	
	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
Sea Level	114	11.2	108	12.0	101	12.8
4000 feet	119	11.7	112	12.4	104	13.2
8000 feet	124	12.2	117	12.9	107	13.6

Figure 4-3. Cruise Performance Table

LEANING WITH AN EGT INDICATOR

At or below 75% power in level cruise flight, the exhaust gas temperature (EGT) indicator is used to lean the fuel-air mixture for best performance or economy. The Cruise Performance charts in Section 5 are based on the EGT to adjust the mixture to Recommended Lean per Figure 4-4.

MIXTURE DESCRIPTION	EXHAUST GAS TEMPERATURE
RECOMMENDED LEAN (Pilot's Operating Handbook)	50° Rich of Peak EGT
BEST ECONOMY	Peak EGT

Figure 4-4. EGT Table

Use the mixture control vernier adjustment (rotate the knob CCW to lean the mixture) to **slowly** lean, from full rich or maximum RPM mixture, while monitoring the EGT indicator. As the EGT indication begins to increase, continue to **slowly** lean the mixture until an EGT indication decrease is just detectable. Reverse the adjustment **slowly** in the rich direction until an EGT indication decrease is again just detectable, then set the EGT index pointer to match the peak indication. The mixture may be leaned slightly to return to peak EGT or may be further richened to Recommended Lean mixture as desired. **Continuous operation at mixture settings lean of peak EGT is prohibited.** Any change in altitude or throttle position will require that peak EGT be redetermined and the desired mixture be reset. Under some conditions, engine roughness may occur at peak EGT. In this case, operate at Recommended Lean mixture.

As noted in Figure 4-4, operation at peak EGT provides the best fuel economy. Operation at peak EGT results in approximately 4% greater range and approximately a 3 knot decrease in airspeed from the figures shown in the Performance section of this handbook. Recommended Lean mixture provides best level cruise performance (generally close to "best power" or maximum RPM).

NOTE

The EGT indicator requires several seconds to respond to mixture adjustments and changes in exhaust gas temperature. More rapid changes in EGT indication are neither necessary nor desirable. Determining peak EGT and setting the desired mixture should take approximately one minute when the adjustments are made sufficiently slowly and accurately.

FUEL SAVINGS PROCEDURES FOR FLIGHT TRAINING OPERATIONS

For best fuel economy during flight training operations, the following procedures are recommended.

1. After engine start and for all ground operations, set the throttle to 1200 RPM and lean the mixture for maximum RPM. Leave the mixture at this setting until beginning the BEFORE TAKEOFF checklist. After the BEFORE TAKEOFF checklist is complete re-lean the mixture as described above until ready for the TAKEOFF checklist.
2. Lean the mixture for maximum RPM during full throttle climbs above 3000 feet. The mixture may remain leaned (maximum RPM at full throttle) for practicing maneuvers such as stalls and slow flight.
3. Lean the mixture for maximum RPM during all operations at any altitude, including those below 3000 feet, when using 75% or less power.

NOTE

- When cruising or maneuvering at 80% or less power, the mixture may be further leaned until the EGT indicator needle peaks and is then enrichened 50°F. This is especially applicable to cross-country training flights, but should be practiced during transition flight to and from the practice area as well.
- Using the above recommended procedures can provide fuel savings in excess of 5% when compared to typical training operations at full rich mixture. In addition, the above procedures will minimize spark plug fouling since the reduction in fuel consumption results in a proportional reduction in tetraethyl lead passing through the engine.

FUEL VAPOR PROCEDURES

The engine fuel system can become susceptible to fuel vapor formation on the ground during warm weather. This will generally occur when the outside ambient air temperature is above 80°F. The situation is further aggravated by the fact that the engine fuel flows are lower at idle and taxi engine speeds. When vapor occurs as evidenced by idle engine speed and fuel flow fluctuations, the following procedures are recommended.

1. With the mixture full rich, set the throttle at 1800 RPM to 2000 RPM. Maintain this power setting for 1 to 2 minutes or until smooth engine operation returns.
2. Retard the throttle to idle to verify normal engine operation.
3. Advance the throttle to 1200 RPM and lean the mixture as described under FUEL SAVINGS PROCEDURES FOR FLIGHT TRAINING OPERATIONS.
4. Just prior to TAKEOFF, apply full throttle, for approximately 10 seconds to verify smooth engine operation for takeoff.

NOTE

When the engine is operated above 1800 RPM, the resulting increased fuel flow also makes for lower fuel temperatures throughout the engine fuel system. This increased flow purges the fuel vapor and the cooler fuel minimizes vapor formation.

In addition to the above procedures, the sections below should be reviewed and where applicable, adhered to:

Section 2 -- Take note of the placard on "When Switching From Dry Tank".
Section 3 -- Take note of the excessive fuel vapor procedures in both the checklist and the amplified procedures sections.
Section 4 -- Take note of the hot weather operational notes and procedures in both the checklist and the amplified procedures sections.
Section 7 -- Take note of the altitude operational procedures and the section on auxiliary fuel pump operation.

STALLS

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

Power off stall speeds at maximum weight for both forward and aft C.G. positions are presented in Section 5.

SPINS

Intentional spins are approved when the airplane is operated in the utility category. Spins with baggage loadings or occupied rear seat(s) are not approved.

However, before attempting to perform spins several items should be carefully considered to assure a safe flight. No spins should be attempted without first having received dual instruction both in spin entries and spin recoveries from a qualified instructor who is familiar with the spin characteristics of the Cessna 172S.

The cabin should be clean and all loose equipment (including the microphone and rear seat belts) should be stowed or secured. For a solo flight in which spins will be conducted, the copilot's seat belt and shoulder harness should also be secured. Care should be taken to ensure that the pilot can easily reach the flight controls and produce maximum control travels.

It is recommended that, where feasible, entries be accomplished at high enough altitude that recoveries are completed 4000 feet or more above ground level. At least 1000 feet of altitude loss should be allowed for a 1-turn spin and recovery, while a 6-turn spin and recovery may require somewhat more than twice that amount. For example, the recommended entry altitude for a 6-turn spin would be 6000 feet above ground level. In any case, entries should be planned so that recoveries are completed well above the minimum 1500 feet above ground level required by FAR 91.303. Another reason for using high altitudes for practicing spins is that a greater field of view is provided which will assist in maintaining pilot orientation.

The normal entry is made from a power off stall. As the stall is approached, the elevator control should be smoothly pulled to the full aft position. Just prior to reaching the stall "break", rudder control in the desired direction of the spin rotation should be applied so that full rudder deflection is reached almost simultaneously with reaching full aft elevator. A slightly greater rate of deceleration than for normal stall entries, application of ailerons in the direction of the desired spin, and the use of power at the entry will assure more consistent and positive entries to the spin. As the airplane begins to spin, reduce the power to idle and return the ailerons to neutral. Both elevator and rudder controls should be held full with the spin until the spin recovery is initiated. An inadvertent relaxation of either of these controls could result in the development of a nose down spiral.

For the purpose of training in spins and spin recoveries, a 1 or 2 turn spin is adequate and should be used. Up to 2 turns, the spin will progress to a fairly rapid rate of rotation and a steep attitude. Application of recovery controls will produce prompt recoveries (within 1/4 turn). 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 airplane. If this occurs, recovery should be accomplished promptly but smoothly by leveling the wings and recovering from the resulting dive.

Regardless of how many turns the spin is held or how it is entered, the following recovery technique should be used:

1. VERIFY THAT THROTTLE IS IN IDLE POSITION AND AILERONS ARE NEUTRAL.
2. APPLY AND **HOLD** FULL RUDDER OPPOSITE TO THE DIRECTION OF ROTATION.
3. JUST **AFTER** THE RUDDER REACHES THE STOP, MOVE THE CONTROL WHEEL **BRISKLY** FORWARD FAR ENOUGH TO BREAK THE STALL.
4. **HOLD** THESE CONTROL INPUTS UNTIL ROTATION STOPS.
5. AS ROTATION STOPS, NEUTRALIZE RUDDER, AND MAKE A SMOOTH RECOVERY FROM THE RESULTING DIVE.

NOTE

If disorientation precludes a visual determination of the direction of rotation, the symbolic airplane in the turn coordinator may be referred to for this information.

Variations in basic airplane rigging or in weight and balance due to installed equipment or right seat occupancy can cause differences in behavior, particularly in extended spins. These differences are normal and will result in variations in the spin characteristics and in the spiraling tendencies for spins of more than 2 turns. However, the recovery technique should always be used and will result in the most expeditious recovery from any spin.

Intentional spins with flaps extended are prohibited, since the high speeds which may occur during recovery are potentially damaging to the flap/wing structure.

LANDING

NORMAL LANDING

Normal landing approaches can be made with power on or power off with any flap setting desired. Surface winds and air turbulence are usually the primary factors in determining the most comfortable approach speeds. 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.

Actual touchdown should be made with power off and 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 diminished to avoid unnecessary nose gear loads. This procedure is especially important in rough or soft field landings.

SHORT FIELD LANDING

For a short field landing in smooth air conditions, make an approach at 61 KIAS with 30° flaps using enough power to control the glide path. (Slightly higher approach speeds should be used under turbulent air conditions.) After all approach obstacles are cleared, progressively reduce power and maintain the approach speed by lowering the nose of the airplane. Touchdown should be made with power off and on the main wheels first. Immediately after touchdown, lower the nose wheel and apply heavy braking as required. For maximum brake effectiveness, retract the flaps, hold the control wheel full back, and apply maximum 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 airplane. 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 as well as airplane limitations. Operation in direct crosswinds of 15 knots has been demonstrated.

BALKED LANDING

In a balked landing (go-around) climb, reduce the flap setting to 20° immediately after full power is applied. If obstacles must be cleared during the go-around climb, reduce the wing flap setting to 10° and maintain a safe airspeed until the obstacles are cleared. Above 3000 feet, lean the mixture to obtain maximum RPM. After clearing any obstacles, the flaps may be retracted as the airplane accelerates to the normal flaps up climb speed.

COLD WEATHER OPERATION

Special consideration should be given to the operation of the airplane fuel system during the winter season or prior to any flight in cold temperatures. Proper preflight draining of the fuel system is especially important and will eliminate any free water accumulation. The use of additives such as isopropyl alcohol or diethylene glycol monomethyl ether may also be desirable. Refer to Section 8 for information on the proper use of additives.

Cold weather often causes conditions which require special care during airplane operations. Even small accumulations of frost, ice, or snow must be removed, particularly from wing, tail and all control surfaces to assure satisfactory flight performance and handling. Also, control surfaces must be free of any internal accumulations of ice or snow.

If snow or slush covers the takeoff surface, allowance must be made for takeoff distances which will be increasingly extended as the snow or slush depth increases. The depth and consistency of this cover can, in fact, prevent takeoff in many instances.

⚠ WARNING

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.

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

When air temperatures are below 20°F (-6°C), 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. Preheat 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 master switch must be in the OFF position before connecting the external power source to the airplane receptacle. See Section 7, Ground Service Plug Receptacle for external power source operations.

Cold weather starting procedures are the same as the normal starting procedures. Use caution to prevent inadvertent forward movement of the airplane during starting when parked on snow or ice.

NOTE

If the engine does not start during the first few attempts, or if 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.

During cold weather operations, no indication will be apparent on the oil temperature gage prior to takeoff 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 airplane is ready for takeoff.

WINTERIZATION KIT

A winterization kit is provided and may be utilized when cold weather operations are conducted.

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 CHARACTERISTICS AND NOISE REDUCTION

The certificated noise level for the Model 172S at 2550 pounds maximum weight is 75.1 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

The following procedures are suggested to minimize the effect of airplane noise on the public:

1. Pilots operating airplanes 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 2000 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 takeoff 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 judgment, an altitude of less than 2000 feet is necessary to adequately exercise the duty to see and avoid other airplanes.

SECTION 5
PERFORMANCE

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INTRODUCTION

Performance data charts on the following pages are presented so that you may know what to expect from the airplane under various conditions, and also, to facilitate the planning of flights in detail and with reasonable accuracy. The data in the charts has been computed from actual flight tests with the airplane and engine in good condition and approximating average piloting techniques.

It should be noted that performance information presented in the range and endurance profile charts allows for 45 minutes reserve fuel at the specified power setting. Fuel flow data for cruise is based on the recommended lean mixture setting at all altitudes. Some indeterminate variables such as mixture leaning technique, fuel metering characteristics, engine and propeller condition, and air turbulence may account for variations of 10% or more in range and endurance. Therefore, it is important to utilize all available information to estimate the fuel required for the particular flight and to flight plan in a conservative manner.

USE OF PERFORMANCE CHARTS

Performance data is presented in tabular or graphical form to illustrate the effect of different variables. Sufficiently detailed information is provided in the tables so that conservative values can be selected and used to determine the particular performance figure with reasonable accuracy.

SAMPLE PROBLEM

The following sample flight problem utilizes information from the various charts to determine the predicted performance data for a typical flight. Assume the following information has already been determined:

AIRPLANE CONFIGURATION:	
Takeoff weight	2550 Pounds
Usable fuel	53 Gallons
TAKEOFF CONDITIONS:	
Field pressure altitude	1500 Feet
Temperature	28°C (16°C Above Standard)
Wind component along runway	12 Knot Headwind
Field length	3500 Feet

CRUISE CONDITIONS:

Total distance	360 Nautical Miles
Pressure altitude	7500 Feet
Temperature	16°C (16°C Above Standard)
Expected wind enroute	10 Knot Headwind

LANDING CONDITIONS:

Field pressure altitude	2000 Feet
Temperature	25°C
Field length	3000 Feet

TAKEOFF

The takeoff distance chart, Figure 5-5, should be consulted, keeping in mind that distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 2550 pounds, pressure altitude of 2000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	1285 Feet
Total distance to clear a 50-foot obstacle	2190 Feet

These distances are well within the available takeoff field length. However, a correction for the effect of wind may be made based on Note 3 of the takeoff chart. The correction for a 12 knot headwind is:

$$\frac{12 \text{ Knots}}{9 \text{ Knots}} \text{ X } 10\% = 13\% \text{ Decrease}$$

This results in the following distances, corrected for wind:

Ground roll, zero wind	1285
Decrease in ground roll (1285 feet X 13%)	-167
Corrected ground roll	1118 Feet

Total distance to clear a 50-foot obstacle, zero wind	2190
Decrease in total distance (2190 feet X 13%)	- 285
Corrected total distance to clear 50-foot obstacle	1905 Feet

CRUISE

The cruising altitude should be selected based on a consideration of trip length, winds aloft, and the airplane's performance. A typical cruising altitude and the expected wind enroute have been given for this sample problem. However, the power setting selection for cruise must be determined based on several considerations. These include the cruise performance characteristics presented in Figure 5-8, the range profile chart presented in Figure 5-9, and the endurance profile chart presented in Figure 5-10.

The relationship between power and range is illustrated by the range profile chart. Considerable fuel savings and longer range result when lower power settings are used. For this sample problem, a cruise power of approximately 65% will be used.

The cruise performance chart, Figure 5-8, is entered at 8000 feet pressure altitude and 20°C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The engine speed chosen is 2600 RPM, which results in the following:

Power	64%
True airspeed	117 Knots
Cruise fuel flow	8.9 GPH

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in Figure 5-7 and Figure 5-8. For this sample problem, Figure 5-7 shows that a climb from 2000 feet to 8000 feet requires 2.2 gallons of fuel. The corresponding distance during the climb is 15 nautical miles. These values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The approximate effect of a non-standard temperature is to increase the time, fuel, and distance by 10% for each 10°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard (16°C - 0°C), the correction would be:

$$\frac{16°C}{10°C} \text{ X } 10\% = 16\% \text{ Increase}$$

With this factor included, the fuel **estimate** would be calculated as follows:

Fuel to climb, standard temperature	2.2
Increase due to non-standard temperature (2.2 X 16%)	0.4
Corrected fuel to climb	2.6 Gallons

Using a similar procedure for the distance to climb results in 18 nautical miles. (15 nm using chart + 2.4 nm to correct for higher than standard temperature = 17.4 nm. Rounded up to 18 nm.)

The resultant cruise distance is:

Total distance	360
Climb distance	-18
Cruise distance	342 nm

With an expected 10 knot headwind, the ground speed for cruise is predicted to be:

117
-10

107 Knots

Therefore, the time required for the cruise portion of the trip is:

$$\frac{342 \text{ Nautical Miles}}{107 \text{ Knots}} = 3.2 \text{ Hours}$$

The fuel required for cruise is:

3.2 hours X 8.9 gallons/hour = 28.5 Gallons

A 45-minute reserve requires:

$$\frac{45}{60} \text{ X } 8.9 \text{ gallons / hour} = 6.7 \text{ Gallons}$$

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	1.4
Climb	2.6
Cruise	28.5
Reserve	6.7
Total fuel required	39.2 Gallons

Once the flight is underway, ground speed checks will provide a more accurate basis for estimating the time enroute and the corresponding fuel required to complete the trip with ample reserve.

LANDING

A procedure similar to takeoff should be used for estimating the landing distance at the destination airport. Figure 5-11 presents landing distance information for the short field technique. The distances corresponding to 2000 feet and 30°C are as follows:

Ground roll	650 Feet
Total distance to clear a 50-foot obstacle	1455 Feet

A correction for the effect of wind may be made based on Note 2 of the landing chart, using the same procedure as outlined for takeoff.

DEMONSTRATED OPERATING TEMPERATURE

Satisfactory engine cooling has been demonstrated for this airplane with an outside air temperature 23°C above standard. This is not to be considered as an operating limitation. Reference should be made to Section 2 for engine operating limitations.

AIRSPEED CALIBRATION

NORMAL STATIC SOURCE

CONDITION:

Power required for level flight or maximum power descent.

FLAPS UP												
KIAS	50	60	70	80	90	100	110	120	130	140	150	160
KCAS	56	62	70	78	87	97	107	117	127	137	147	157
FLAPS 10°												
KIAS	40	50	60	70	80	90	100	110	- - -	- - -	- - -	- - -
KCAS	51	57	63	71	80	89	99	109	- - -	- - -	- - -	- - -
FLAPS 30°												
KIAS	40	50	60	70	80	85	- - -	- - -	- - -	- - -	- - -	- - -
KCAS	50	56	63	72	81	86	- - -	- - -	- - -	- - -	- - -	- - -

Figure 5-1. Airspeed Calibration (Sheet 1 of 2)

AIRSPEED CALIBRATION

ALTERNATE STATIC SOURCE

CONDITION:

Power required for level flight or maximum power descent.

FLAPS UP												
KIAS	50	60	70	80	90	100	110	120	130	140	150	160
KCAS	56	62	68	76	85	95	105	115	125	134	144	154
FLAPS 10°												
KIAS	40	50	60	70	80	90	100	110	- - -	- - -	- - -	- - -
KCAS	51	55	60	68	77	86	96	105	- - -	- - -	- - -	- - -
FLAPS 30°												
KIAS	40	50	60	70	80	85	- - -	- - -	- - -	- - -	- - -	- - -
KCAS	49	54	61	69	78	83	- - -	- - -	- - -	- - -	- - -	- - -

NOTE:

Windows closed, ventilators closed, cabin heater, cabin air, and defroster on maximum.

Figure 5-1. Airspeed Calibration (Sheet 2 of 2)

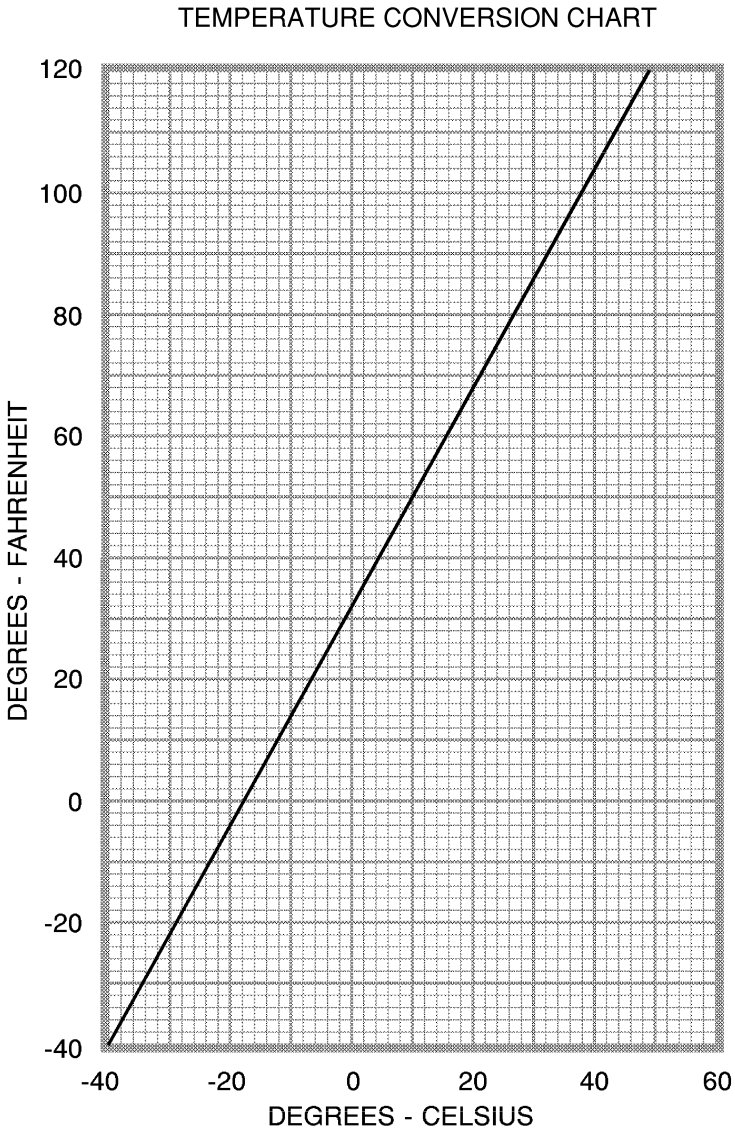


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS AT 2550 POUNDS

Conditions:
Power Off

MOST REARWARD CENTER OF GRAVITY

FLAP SETTING	ANGLE OF BANK							
	0°		30°		45°		60°	
	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
UP	48	53	52	57	57	63	68	75
10°	42	50	45	54	50	59	59	71
30°	40	48	43	52	48	57	57	68

MOST FORWARD CENTER OF GRAVITY

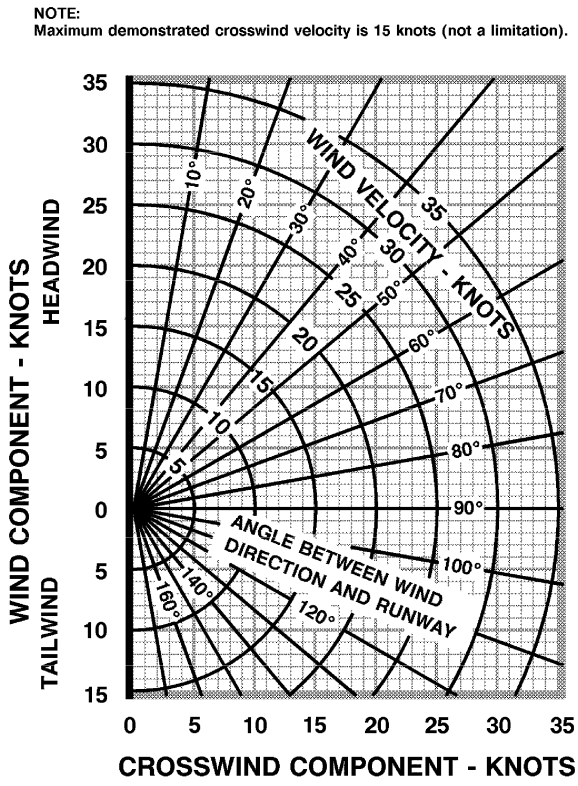
FLAP SETTING	ANGLE OF BANK							
	0°		30°		45°		60°	
	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
UP	48	53	52	57	57	63	68	75
10°	43	51	46	55	51	61	61	72
30°	40	48	43	52	48	57	57	68

NOTES:

1. Altitude loss during a stall recovery may be as much as 230 feet.
2. KIAS values are approximate.

Figure 5-3. Stall Speeds

WIND COMPONENTS



NOTE

Maximum demonstrated crosswind component is 15 knots (not a limitation).

0585C1003

Figure 5-4. Crosswind Components

SHORT FIELD TAKEOFF DISTANCE AT 2550 POUNDS

CONDITIONS:

Flaps 10°
Full Throttle Prior to Brake Release
Paved, level, dry runway
Zero Wind
Lift Off: 51 KIAS
Speed at 50 Ft: 56 KIAS

Press Alt In Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst
S. L.	860	1465	925	1575	995	1690	1070	1810	1150	1945
1000	940	1600	1010	1720	1090	1850	1170	1990	1260	2135
2000	1025	1755	1110	1890	1195	2035	1285	2190	1380	2355
3000	1125	1925	1215	2080	1310	2240	1410	2420	1515	2605
4000	1235	2120	1335	2295	1440	2480	1550	2685	1660	2880
5000	1355	2345	1465	2545	1585	2755	1705	2975	1825	3205
6000	1495	2605	1615	2830	1745	3075	1875	3320	2010	3585
7000	1645	2910	1785	3170	1920	3440	2065	3730	2215	4045
8000	1820	3265	1970	3575	2120	3880	2280	4225	2450	4615

NOTES:

1. Short field technique as specified in Section 4.
2. Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static runup.
3. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
4. For operation on dry, grass runway, increase distances by 15% of the “ground roll” figure.

Figure 5-5. Short Field Takeoff Distance (Sheet 1 of 3)

SHORT FIELD TAKEOFF DISTANCE AT 2400 POUNDS

CONDITIONS:

Flaps 10°
Full Throttle Prior to Brake Release
Paved, level, dry runway
Zero Wind
Lift Off: 48 KIAS
Speed at 50 Ft: 54 KIAS

Press Alt In Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst
S. L.	745	1275	800	1370	860	1470	925	1570	995	1685
1000	810	1390	875	1495	940	1605	1010	1720	1085	1845
2000	885	1520	955	1635	1030	1760	1110	1890	1190	2030
3000	970	1665	1050	1795	1130	1930	1215	2080	1305	2230
4000	1065	1830	1150	1975	1240	2130	1335	2295	1430	2455
5000	1170	2015	1265	2180	1360	2355	1465	2530	1570	2715
6000	1285	2230	1390	2410	1500	2610	1610	2805	1725	3015
7000	1415	2470	1530	2685	1650	2900	1770	3125	1900	3370
8000	1560	2755	1690	3000	1815	3240	1950	3500	2095	3790

NOTES:

1. Short field technique as specified in Section 4.
2. Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static runup.
3. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
4. For operation on dry, grass runway, increase distances by 15% of the “ground roll” figure.

Figure 5-5. Short Field Takeoff Distance (Sheet 2 of 3)

SHORT FIELD TAKEOFF DISTANCE AT 2200 POUNDS

CONDITIONS:

Flaps 10°
Full Throttle Prior to Brake Release
Paved, level, dry runway
Zero Wind
Lift Off: 44 KIAS
Speed at 50 Ft: 50 KIAS

Press Alt In Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst
S. L.	610	1055	655	1130	705	1205	760	1290	815	1380
1000	665	1145	720	1230	770	1315	830	1410	890	1505
2000	725	1250	785	1340	845	1435	905	1540	975	1650
3000	795	1365	860	1465	925	1570	995	1685	1065	1805
4000	870	1490	940	1605	1010	1725	1090	1855	1165	1975
5000	955	1635	1030	1765	1110	1900	1195	2035	1275	2175
6000	1050	1800	1130	1940	1220	2090	1310	2240	1400	2395
7000	1150	1985	1245	2145	1340	2305	1435	2475	1540	2650
8000	1270	2195	1370	2375	1475	2555	1580	2745	1695	2950

NOTES:

1. Short field technique as specified in Section 4.
2. Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static runup.
3. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
4. For operation on dry, grass runway, increase distances by 15% of the “ground roll” figure.

Figure 5-5. Short Field Takeoff Distance (Sheet 3 of 3)

MAXIMUM RATE-OF-CLIMB AT 2550 POUNDS

CONDITIONS:

Flaps Up
Full Throttle

PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
		-20°C	0°C	20°C	40°C
S.L.	74	855	785	710	645
2000	73	760	695	625	560
4000	73	685	620	555	495
6000	73	575	515	450	390
8000	72	465	405	345	285
10,000	72	360	300	240	180
12,000	72	255	195	135	- - -

NOTE:

1. Mixture leaned above 3,000 feet for maximum RPM.

Figure 5-6. Maximum Rate of Climb

TIME, FUEL AND DISTANCE TO CLIMB AT 2550 POUNDS

CONDITIONS:

Flaps Up
Full Throttle
Standard Temperature

PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
			TIME IN MIN	FUEL USED GAL	DIST NM
S.L.	74	730	0	0.0	0
1000	73	695	1	0.4	2
2000	73	655	3	0.8	4
3000	73	620	4	1.2	6
4000	73	600	6	1.5	8
5000	73	550	8	1.9	10
6000	73	505	10	2.2	13
7000	73	455	12	2.6	16
8000	72	410	14	3.0	19
9000	72	360	17	3.4	22
10,000	72	315	20	3.9	27
11,000	72	265	24	4.4	32
12,000	72	220	28	5.0	38

NOTES:

1. Add 1.4 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 3,000 feet for maximum RPM.
3. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
4. Distances shown are based on zero wind.

Figure 5-7. Time, Fuel and Distance to Climb

CRUISE PERFORMANCE

CONDITIONS:
2550 Pounds
Recommended Lean Mixture At All Altitudes (Refer to Section 4, Cruise)

PRESS ALT FT	RPM	20°C BELOW STANDARD TEMP			STANDARD TEMPERATURE			20°C ABOVE STANDARD TEMP		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2000	2550	83	117	11.1	77	118	10.5	72	117	9.9
	2500	78	115	10.6	73	115	9.9	68	115	9.4
	2400	69	111	9.6	64	110	9.0	60	109	8.5
	2300	61	105	8.6	57	104	8.1	53	102	7.7
	2200	53	99	7.7	50	97	7.3	47	95	6.9
	2100	47	92	6.9	44	90	6.6	42	89	6.3
4000	2600	83	120	11.1	77	120	10.4	72	119	9.8
	2550	79	118	10.6	73	117	9.9	68	117	9.4
	2500	74	115	10.1	69	115	9.5	64	114	8.9
	2400	65	110	9.1	61	109	8.5	57	107	8.1
	2300	58	104	8.2	54	102	7.7	51	101	7.3
	2200	51	98	7.4	48	96	7.0	45	94	6.7
	2100	45	91	6.6	42	89	6.4	40	87	6.1
6000	2650	83	122	11.1	77	122	10.4	72	121	9.8
	2600	78	120	10.6	73	119	9.9	68	118	9.4
	2500	70	115	9.6	65	114	9.0	60	112	8.5
	2400	62	109	8.6	57	108	8.2	54	106	7.7
	2300	54	103	7.8	51	101	7.4	48	99	7.0
	2200	48	96	7.1	45	94	6.7	43	92	6.4

Figure 5-8. Cruise Performance (Sheet 1 of 2)

CRUISE PERFORMANCE

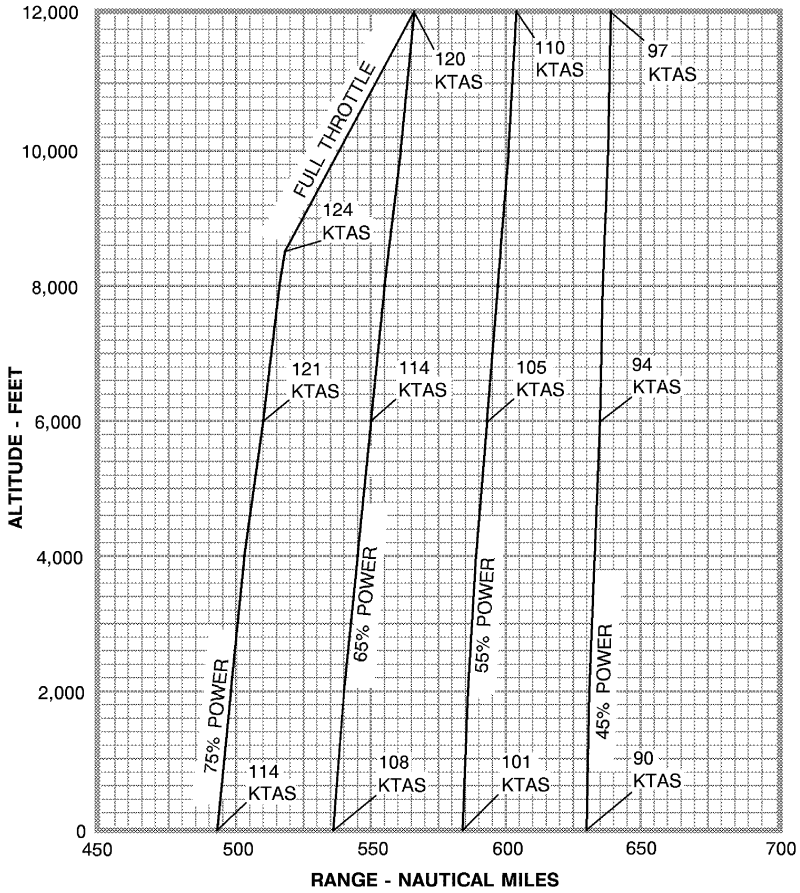
CONDITIONS:
2550 Pounds
Recommended Lean Mixture At All Altitudes (Refer to Section 4, Cruise)

PRESS ALT FT	RPM	20°C BELOW STANDARD TEMP			STANDARD TEMPERATURE			20°C ABOVE STANDARD TEMP		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
8000	2700	83	125	11.1	77	124	10.4	71	123	9.7
	2650	78	122	10.5	72	122	9.9	67	120	9.3
	2600	74	120	10.0	68	119	9.4	64	117	8.9
	2500	65	114	9.1	61	112	8.6	57	111	8.1
	2400	58	108	8.2	54	106	7.8	51	104	7.4
	2300	52	101	7.5	48	99	7.1	46	97	6.8
	2200	46	94	6.8	43	92	6.5	41	90	6.2
10,000	2700	78	124	10.5	72	123	9.8	67	122	9.3
	2650	73	122	10.0	68	120	9.4	63	119	8.9
	2600	69	119	9.5	64	117	9.0	60	115	8.5
	2500	62	113	8.7	57	111	8.2	54	109	7.8
	2400	55	106	7.9	51	104	7.5	49	102	7.1
	2300	49	100	7.2	46	97	6.8	44	95	6.5
12,000	2650	69	121	9.5	64	119	8.9	60	117	8.5
	2600	65	118	9.1	61	116	8.5	57	114	8.1
	2500	58	111	8.3	54	109	7.8	51	107	7.4
	2400	52	105	7.5	49	102	7.1	46	100	6.8
	2300	47	98	6.9	44	95	6.6	41	92	6.3

Figure 5-8. Cruise Performance (Sheet 2 of 2)

RANGE PROFILE
45 MINUTES RESERVE
53 GALLONS USABLE FUEL

CONDITIONS:
2550 Pounds
Recommended Lean Mixture for Cruise At All Altitudes
Standard Temperature
Zero Wind

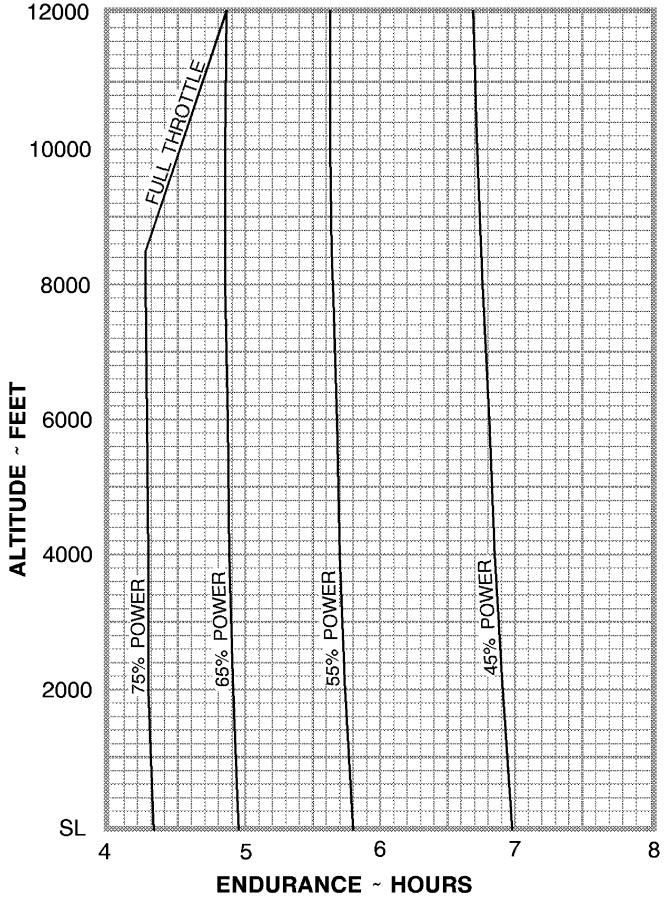


NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during climb.

Figure 5-9. Range Profile

ENDURANCE PROFILE
45 MINUTES RESERVE
53 GALLONS USABLE FUEL

CONDITIONS:
2550 Pounds
Recommended Lean Mixture for Cruise At All Altitudes
Standard Temperature



NOTE:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb.

Figure 5-10. Endurance Profile

SHORT FIELD LANDING DISTANCE AT 2550 POUNDS

CONDITIONS:

Flaps 30°
Power Off
Maximum Braking
Paved, level, dry runway
Zero Wind
Speed at 50 Ft: 61 KIAS

Press Alt In Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst
S. L.	545	1290	565	1320	585	1350	605	1380	625	1415
1000	565	1320	585	1350	605	1385	625	1420	650	1450
2000	585	1355	610	1385	630	1420	650	1455	670	1490
3000	610	1385	630	1425	655	1460	675	1495	695	1530
4000	630	1425	655	1460	675	1495	700	1535	725	1570
5000	655	1460	680	1500	705	1535	725	1575	750	1615
6000	680	1500	705	1540	730	1580	755	1620	780	1660
7000	705	1545	730	1585	760	1625	785	1665	810	1705
8000	735	1585	760	1630	790	1670	815	1715	840	1755

NOTES:

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on dry, grass runway, increase distances by 45% of the “ground roll” figure.
4. If landing with flaps up, increase the approach speed by 9 KIAS and allow for 35% longer distances.

Figure 5-11. Short Field Landing Distance

SECTION 6
WEIGHT & BALANCE/ EQUIPMENT LIST

TABLE OF CONTENTS

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Airplane Weighing Procedures 6-3
Weight And Balance 6-6
Baggage Tie-Down 6-8
Comprehensive Equipment List 6-17

INTRODUCTION

This section describes the procedure for establishing the basic empty weight and moment of the airplane. Sample forms are provided for reference. Procedures for calculating the weight and moment for various operations are also provided.

It should be noted that specific information regarding the weight, arm, moment and installed equipment for this airplane as delivered from the factory can only be found in the plastic envelope carried in the back of this handbook.

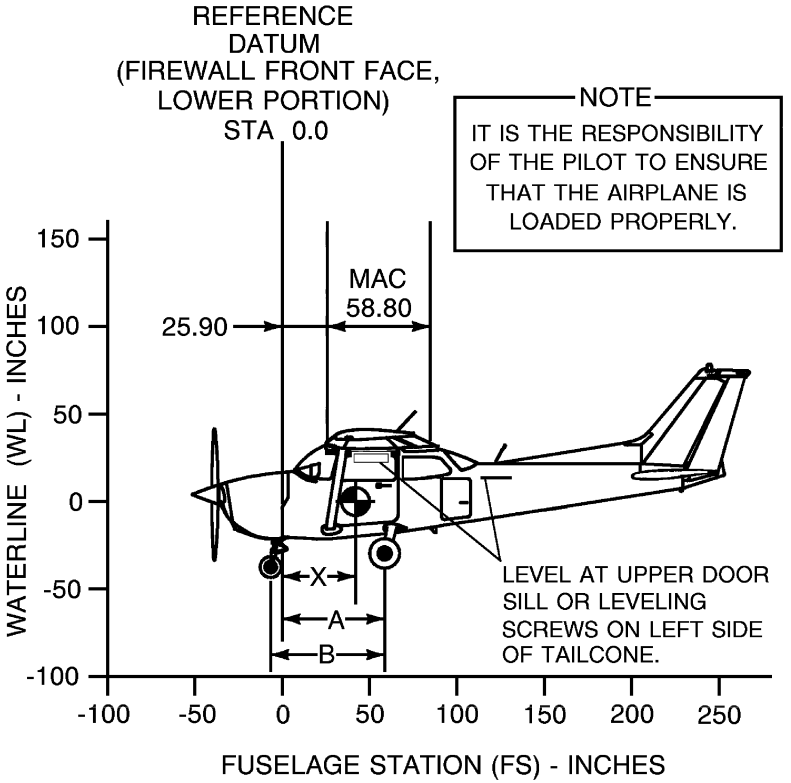
⚠ WARNING

IT IS THE RESPONSIBILITY OF THE PILOT TO ENSURE THE AIRPLANE IS LOADED PROPERLY. OPERATION OUTSIDE OF PRESCRIBED WEIGHT AND BALANCE LIMITATIONS COULD RESULT IN AN ACCIDENT AND SERIOUS OR FATAL INJURY.

AIRPLANE WEIGHING PROCEDURES

1. Preparation:
   a. Inflate tires to recommended operating pressures.
   b. Defuel airplane. Refer to the Maintenance Manual.
   c. Service engine oil as required to obtain a normal full indication (8 quarts on dipstick).
   d. Move sliding seats to the most forward position.
   e. Raise flaps to the fully retracted position.
   f. Place all control surfaces in neutral position.
   g. Remove all non-required items from airplane.
2. Leveling:
   a. Place scales under each wheel (minimum scale capacity, 500-pounds nose, 1000 pounds each main).
   b. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level (Refer to Figure 6-1).

AIRPLANE WEIGHING FORM



0585C1010

Figure 6-1. Airplane Weighing Form (Sheet 1 of 2)

LOCATING CG WITH AIRPLANE ON LANDING GEAR

FORMULA for Longitudinal CG:

$$(X) = (A) - \frac{\text{(NOSE GEAR NET WEIGHT) ( ) X (B)}}{\text{NOSE AND MAIN LANDING GEAR WEIGHT TOTALED ( )}} = (\quad) \text{ INCHES AFT OF DATUM}$$

LOCATING PERCENT MAC

FORMULA for Percent MAC:

$$\text{CG Percent MAC} = \frac{\text{(CG Arm of Airplane) - 25.90}}{0.5880}$$

MEASURING A AND B

MEASURE A AND B PER PILOT'S OPERATING HANDBOOK INSTRUCTIONS TO ASSIST IN LOCATING CG WITH AIRPLANE WEIGHED ON LANDING GEAR.

LEVELING PROVISIONS

LONGITUDINAL - LEFT SIDE OF TAILCONE AT FS 108.00 & 142.00

AIRPLANE AS WEIGHED TABLE

POSITION	SCALE READING	SCALE DRIFT	TARE	NET WEIGHT
LEFT SIDE				
RIGHT SIDE				
NOSE				
AIRPLANE TOTAL AS WEIGHED				

BASIC EMPTY WEIGHT AND CENTER-OF-GRAVITY TABLE

ITEM	WEIGHT POUNDS	CG ARM (INCHES)	MOMENT (INCH-POUNDS /1000)
AIRPLANE (CALCULATED OR AS WEIGHED) (INCLUDES ALL UNDRAINABLE FLUIDS AND FULL OIL)			
DRAINABLE UNUSABLE FUEL AT 6.0 POUNDS PER GALLON - (3 GALLONS)	18.0	46.0	0.83
BASIC EMPTY WEIGHT			

Figure 6-1. Airplane Weighing Form (Sheet 2 of 2)

3. Weighing:
   a. Weigh airplane in a closed hangar to avoid errors caused by air currents.
   b. With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.
4. Measuring:
   a. Obtain measurement A by measuring horizontally (along the airplane centerline) from a line stretched between the main wheel centers to a plumb bob dropped from the firewall.
   b. Obtain measurement B by measuring horizontally and parallel to the airplane centerline, from center of nose wheel axle, left side, to a plumb bob dropped from the line between the main wheel centers. Repeat on right side and average the measurements.
5. Using weights from item 3 and measurements from item 4, the airplane weight and C.G. can be determined.
6. Basic Empty Weight may be determined by completing Figure 6-1.

WEIGHT AND BALANCE

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

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

NOTE

In addition to the basic 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.

SAMPLE WEIGHT AND BALANCE RECORD

(CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT AFFECTING WEIGHT AND BALANCE)

AIRPLANE MODEL			SERIAL NO.			PAGE NUMBER					
DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE						RUNNING BASIC EMPTY WEIGHT	
				ADDED (+)			REMOVED (-)				
	IN	OUT		WT. (LB.)	ARM (IN.)	MOMENT /1000	WT. (LB.)	ARM (IN.)	MOMENT /1000	WT. (LB.)	MOMENT /1000
			AS DELIVERED								

0585C1009

Figure 6-2. Sample Weight and Balance Record

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 areas 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 limitations (seat travel and 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.

BAGGAGE TIE-DOWN

A nylon baggage net having tie-down straps is provided as standard equipment to secure baggage on the cabin floor aft of the rear seat (baggage area 1) and in the aft baggage area (baggage area 2). Six eyebolts serve as attaching points for the net. Two eyebolts for the forward tie-down straps are mounted on the cabin floor near each sidewall just forward of the baggage door approximately at station 90; two eyebolts are installed on the cabin floor slightly inboard of each sidewall approximately at station 107; and two eyebolts are located below the aft window near each sidewall approximately at station 107. A placard on the baggage door defines the weight limitations in the baggage areas.

When baggage area 1 is utilized for baggage only, the two forward floor mounted eyebolts and the two aft floor mounted eyebolts (or the two eyebolts below the aft window) may be used, depending on the height of the baggage. When baggage is carried in the baggage area 2 only, the aft floor mounted eyebolts and the eyebolts below the aft window should be used. When baggage is loaded in both areas, all six eyebolts should be utilized.

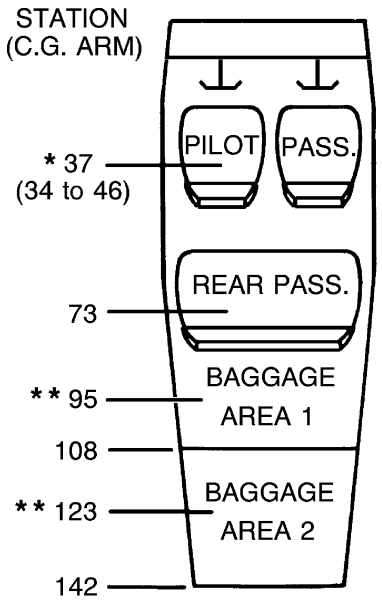
LOADING ARRANGEMENTS

* Pilot or passenger center of gravity on adjustable seats positioned for average occupant. Numbers in parentheses indicate forward and aft limits of occupant center of gravity range.

* * Arm measured to the center of the areas shown.

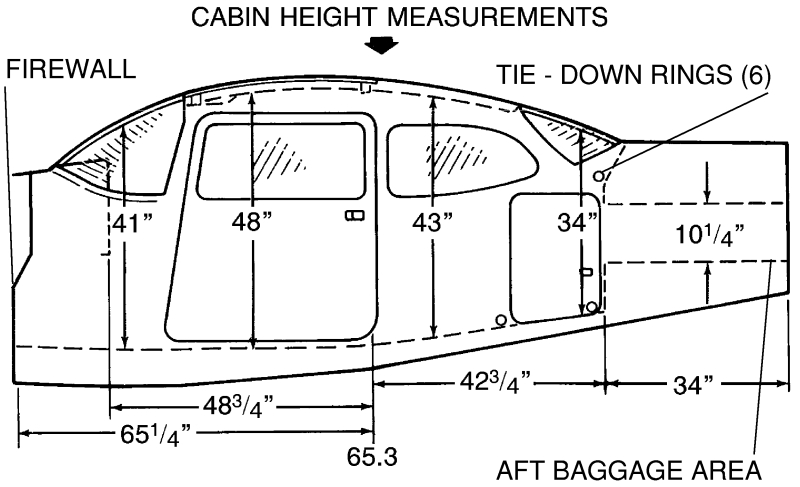
NOTES: 1. The usable fuel C.G. arm for integral tanks is located at station 48.0.

2. The rear cabin wall (approximate station 108) or aft baggage wall (approximate station 142) can be used as convenient interior reference points for determining the location of baggage area fuselage stations.



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Figure 6-3. Loading Arrangements

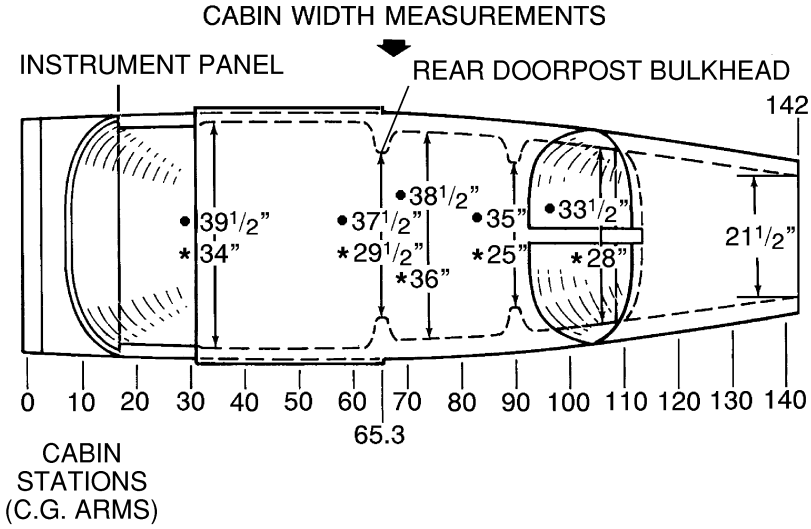


DOOR OPENING DIMENSIONS

	WIDTH (TOP)	WIDTH (BOTTOM)	HEIGHT (FRONT)	HEIGHT (REAR)
CABIN DOORS	32 1/2”	37”	40 1/2”	39”
BAGGAGE DOOR	15 1/4”	15 1/4”	22”	21”

0585X1023

Figure 6-4. Internal Cabin Dimensions (Sheet 1 of 2)



• LWR WINDOW LINE

* CABIN FLOOR

0585X1023

Figure 6-4. Internal Cabin Dimensions (Sheet 2 of 2)

ITEM DESCRIPTION	WEIGHT AND MOMENT TABULATION			
	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight (lbs.)	Moment (Lb-ins. /1000)	Weight (lbs.)	Moment (Lb-ins. /1000)
1. Basic Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel and full oil)	1642	62.6		
2. Usable Fuel (At 6 Lbs./Gal.)				
53 Gallons Maximum				
30 Gallons (Quantity used for example)	180	8.6		
3. Pilot and Front Passenger (Station 34 to 46)	340	12.6		
4. Rear Passengers	340	24.8		
5. *Baggage Area 1 (Station 82 to 108; 120 Lbs. Max.)	56	4.6		
6. *Baggage Area 2 (Station 108 to 142; 50 Lbs. Max.)				
7. **RAMP WEIGHT AND MOMENT** (add columns)	**2558**	**113.2**		
8. Fuel allowance for engine start, taxi and runup	-8.0	-0.4		
9. **TAKEOFF WEIGHT AND MOMENT** (Subtract Step 8 from Step 7)	**2550**	**112.8**		

10. Locate this point (2550 at 112.8) on the Center of Gravity Moment Envelope, and since this point falls within the envelope, the loading is acceptable.

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

Figure 6-5. Sample Loading Problem (Sheet 1 of 2)

YOUR AIRPLANE	
Weight (lbs.)	Moment (Lb-ins. /1000)

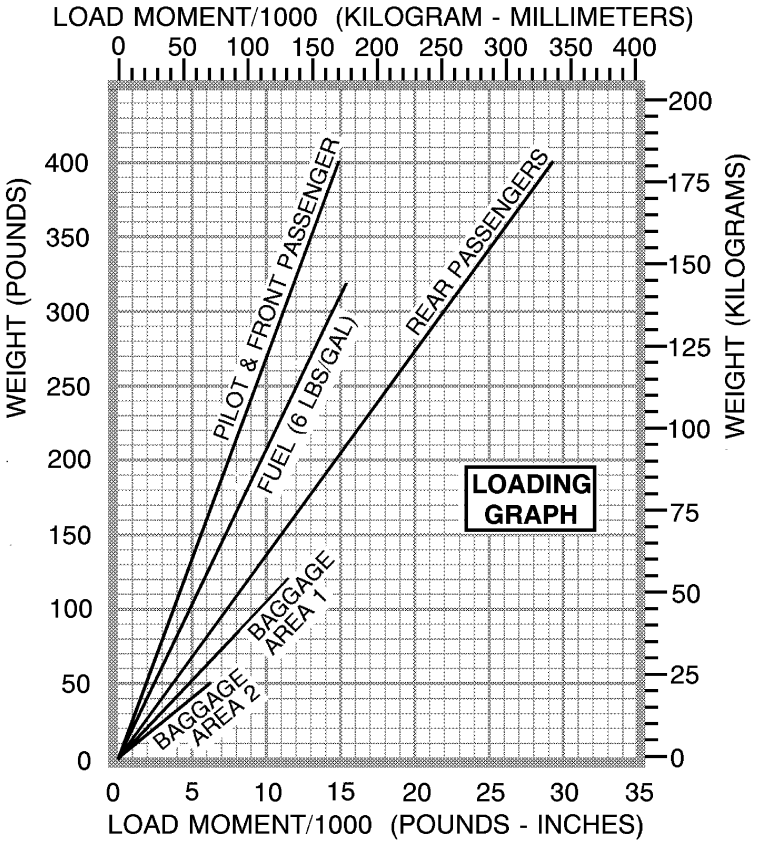
YOUR AIRPLANE	
Weight (lbs.)	Moment (Lb-ins. /1000)

YOUR AIRPLANE	
Weight (lbs.)	Moment (Lb-ins. /1000)

NOTE

When several loading configurations are representative of your operations, it may be useful to fill out one or more of the above columns so specific loadings are available at a glance.

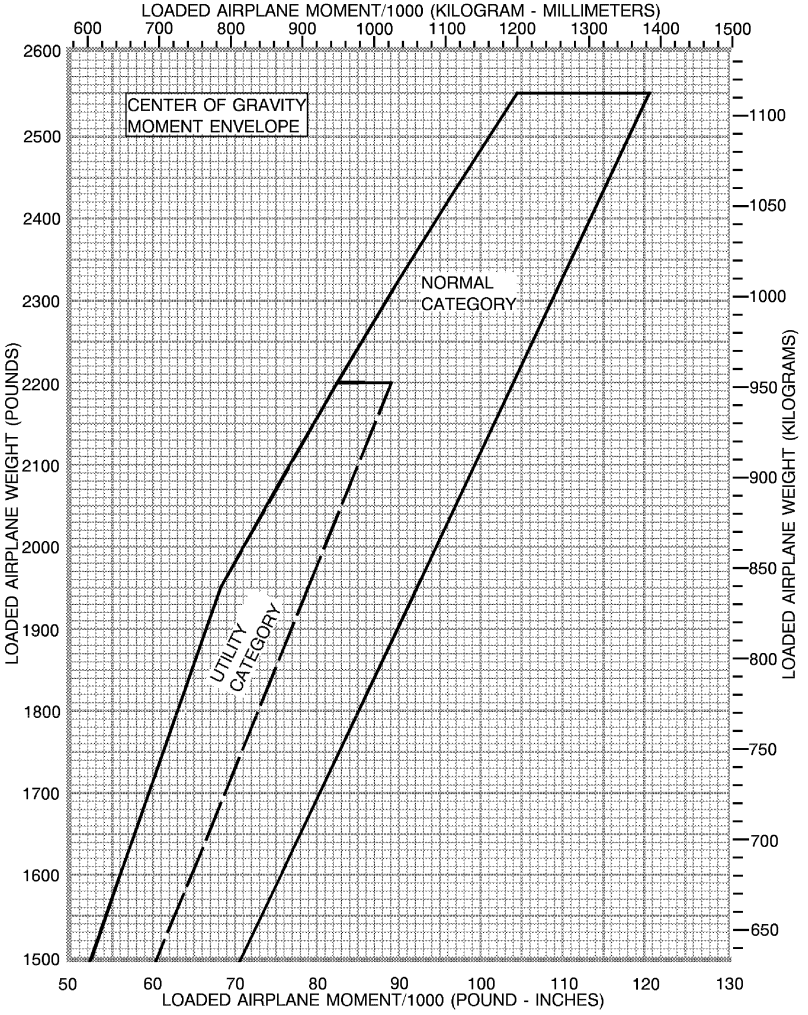
Figure 6-5. Sample Loading Problem (Sheet 2 of 2)



NOTE: 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.

0585C1006

Figure 6-6. Loading Graph



0585C1007

Figure 6-7. Center of Gravity Moment Envelope

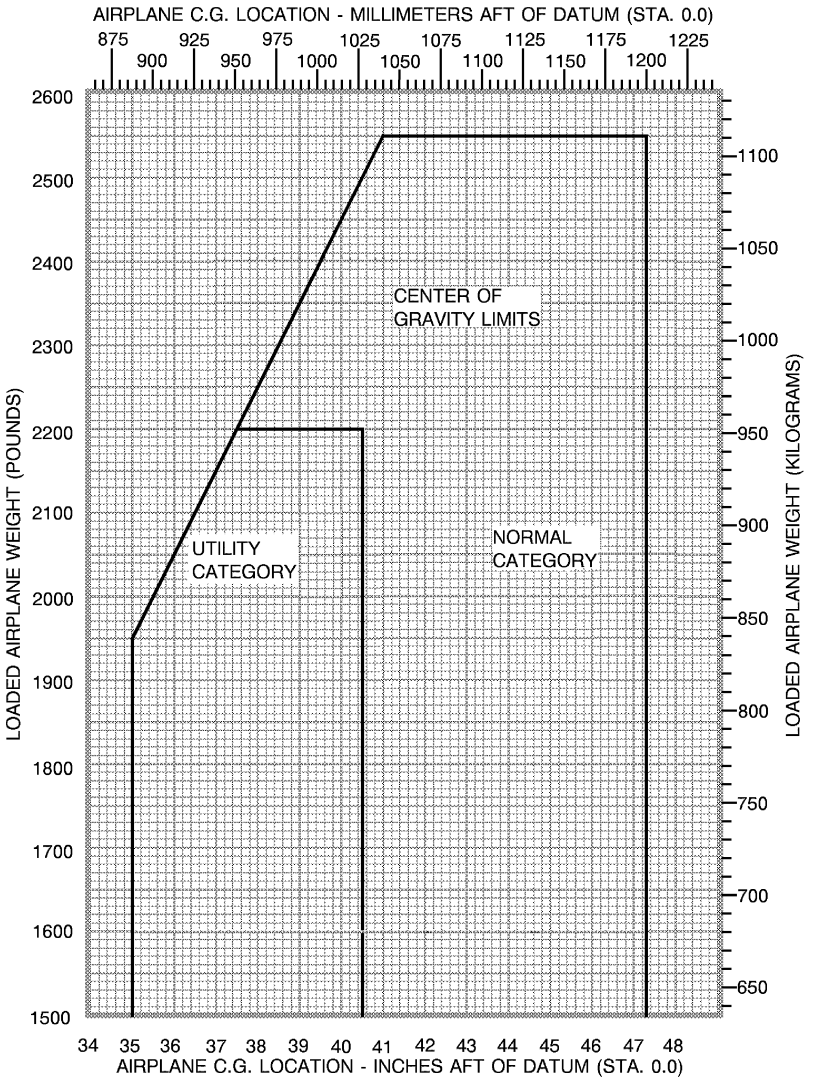


Figure 6-8. Center of Gravity Limits

COMPREHENSIVE EQUIPMENT LIST

The following figure (Figure 6-9) is a comprehensive list of all Cessna equipment which is available for the Model 172S airplane. This comprehensive equipment list provides the following information in column form:

In the **ITEM NO** column, each item is assigned a coded number. The first two digits of the code represent the assignment of the item within the Air Transport Association Specification 100 breakdown (11 for Paint and Placards, 24 for Electrical Power, 77 for Engine Indicating, etc...). These assignments also correspond to the Maintenance Manual chapter breakdown for the airplane. After the first two digits (and hyphen), items receive a unique sequence number (01, 02, 03, etc...). After the sequence number (and hyphen), a suffix letter is assigned to identify equipment as a required item, a standard item or an optional item. Suffix letters are as follows:

- -R = required items or equipment for FAA certification
- -S = standard equipment items
- -O = optional equipment items replacing required or standard items
- -A = optional equipment items which are in addition to required or standard items

In the **EQUIPMENT LIST DESCRIPTION** column, each item is assigned a descriptive name to help identify its function.

In the **REF DRAWING** column, a Cessna drawing number is provided which corresponds to the item.

NOTE

If additional equipment is to be installed, it must be done in accordance with the reference drawing, service bulletin or a separate FAA approval.

In the **WT LBS** and **ARM INS** columns, information is provided on the weight (in pounds) and arm (in inches) of the equipment item.

NOTES

Unless otherwise indicated, true values (not net change values) for the weight and arm are shown. Positive arms are distances aft of the airplane datum; negative arms are distances forward of the datum.

Asterisks (*) in the weight and arm column indicate complete assembly installations. Some major components of the assembly are listed on the lines immediately following. The sum of these major components does not necessarily equal the complete assembly installation.

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS.
	11 - PLACARDS AND MARKINGS			
11-01-R	PLACARD, OPERATIONAL LIMITATIONS	0505087-23	0.0	43.0
11-02-S	PAINT, OVERALL EXTERIOR	0504051	19.2*	95.4*
	- OVERALL WHITE	870-003	18.4	93.6
	- COLORED STRIPE DECALS	119916	0.8	135.9
	21 - AIR CONDITIONING			
21-01-S	REAR SEAT VENTS	0513575-28	1.7	60.0
21-02-S	CABIN HEATER SYSTEM (EXHAUST SHROUD ASSY, HEATER & HOSES)	9954100-1	2.5	-4.0
	22 - AUTO FLIGHT			
22-01-S	WING LEVELER PROVISIONS	3900003	2.2*	23.0*
	- CABLE ASSEMBLY	3924109-1	1.6	14.8
	- WING CABLE ASSEMBLY	3924110-1	0.6	45.0
22-02-A	SINGLE AXIS AUTOPILOT	3900004	7.2*	43.6*
	- AUTOPILOT COMPUTER/CONTROLLER	065-00176-2501	3.1	12.1
	- ROLL ACTUATOR, WITH MOUNT	3940400-1	3.6	68.5
	- CONFIGURATION MODULE	071-00073-5000	0.1	9.0
22-03-A	TWO AXIS AUTOPILOT	3900021	19.7*	104.4*
	- AUTOPILOT COMPUTER/CONTROLLER	065-00176-5201	3.1	12.1
	- ROLL ACTUATOR WITH MOUNT	3940400-1	3.6	68.5
	- PITCH ACTUATOR, WITH MOUNT	0501145-1	4.5	173.8
	- MISC STRUCTURE, WIRE & HARDWARE	3924126-1	3.0	60.0
	- PITCH TRIM OPTION, REQUIRES 22-03A	3900021-1	4.1*	139.8*
	- PITCH TRIM ACTUATOR	0501153-1	2.1	174.5
	- PITCH TRIM ELECTRICAL WIRING		1.6	87.8
	- ACCESS PANEL		1.4	170.0
	- MISCELLANEOUS STRUCTURE, WIRE & HARDWARE		3.0	60.0
22-04-A	ALTITUDE ALERT CONTROLLER REPLACES STANDARD 2-AXIS AUTOPILOT CONTROLLER & REQUIRES GPS ALT ALERT BE DISABLED - WT CHG	3910299	0.0	- - -
	23 - COMMUNICATIONS			
23-01-S	STATIC DISCHARGE WICKS (SET OF 10)	0501048-1	0.4	143.2
23-02-S	NAV/COM #1 INSTALLATION - NO G.S.	3930407-1	7.9*	52.7*
	- KX 155A BENDIX/KING NAV/COM	069-01032-0102	3.5	12.5
	- KI 208 INDICATOR	066-03056-0002	1.0	13.9
	- VHF COM ANTENNA		0.5	61.2
	- COM ANTENNA CABLE		0.4	26.5
	- OMNI NAV ANTENNA		0.5	253.4
	- OMNI ANTENNA CABLE		1.5	123.8
	- HARDWARE & CABLE ASSEMBLY	3921100-1	0.5*	9.7*

Figure 6-9. Equipment List Description (Sheet 1 of 8)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS.
23-03-A	NAV/COM #2 INSTALLATION - WITH G.S.		6.5*	17.1*
	- KX 155A NAV/COM WITH GLIDESLOPE	069-01032-0101	4.0	12.5
	- KI 209A INDICATOR WITH GLIDESLOPE	066-03056-0003	1.2	13.9
	- NAV ANTENNA WITH G.S. COUPLER		0.2	14.0
	- CO-AX COM ANTENNA		0.5	61.2
	- HARDWARE & CABLE ASSEMBLY	3921101-1	0.2	3.5
23-04-A	AUDIO/INTECOM/MARKER BEACON INSTL	3930407-1	2.5*	19.7*
	- KMA-26 AUDIO/RECEIVER PANEL	066-01155-0201	1.7	14.8
	- HARDWARE & CABLE ASSEMBLY	3900003-2	0.8	30.0
23-05-S	BASIC AVIONICS EQUIP/LESS BLACK BOXES		11.3*	27.4*
	- MARKER BEACON ANTENNA INSTL	3960188-1	0.5	131.0
	- FUSELAGE AND AUDIO WIRING	3921114-1	7.9	26.5
	- MICROPHONE INSTL, HAND HELD	3970124-9	0.2	18.0
	- AVN COOLING FAN INSTL	3930400-1	1.2	5.9
	- BASIC CIRCUIT BREAKER PANEL	3930417-2	0.4	16.5
	- AVN GROUND INSTL	3940357-1	0.2	15.0
	- MISCELLANEOUS HARDWARE		0.9	16.0
	24 - ELECTRICAL POWER			
24-01-R	ALTERNATOR, 28 VOLT 60 AMP	9910591-11	10.0	-29.0
24-02-R	BATTERY, 24 VOLT, 12.75 A.H. MANIFOLD TYPE	C614002-0101	23.2	-5.0
24-03-R	POWER JUNCTION BOX (PRECISION AIRMOTIVE CORP. MC01-2A) INCLUDES:	MC01-2A	6.4*	2.5*
	- ALTERNATOR CONTROL UNIT-AC2101	1270101-1	0.2	3.0
	- MASTER CONTACTOR P/N X61-0007	1270101-1	0.7	2.4
	- STARTER CONTACTOR P/N X61-0012	3930400-1	0.7	2.4
	- AMMETER TRANSDUCER P/N CS3100	3930417-2	0.1	3.0
	25 - EQUIPMENT/FURNISHINGS			
25-01-R	PILOT SEAT, CLOTH COVER	0514211-1	34.3	41.5
25-02-O	PILOT SEAT, LEATHER COVER	0514211-5	35.0	41.5
25-03-O	PILOT SEAT, LEATHER/VINYL COVER	0514211-8	34.8	41.5
25-04-O	PILOT SEAT, MILLENNIUM COVER	0514211-11		41.5
25-05-S	COPILOT SEAT, CLOTH COVER	0512211-1	34.3	41.5
25-06-O	COPILOT SEAT, LEATHER COVER	0514211-5	35.0	41.5
25-07-O	COPILOT SEAT, LEATHER/VINYL COVER	0512211-8	34.8	41.5
25-08-O	COPILOT SEAT, MILLENNIUM COVER	0512211-11		41.5
25-09-S	REAR SEAT, CLOTH COVER	0514219-1	43.3	79.5
25-10-O	REAR SEAT, LEATHER COVER	0514219-2	44.7	79.5
25-11-O	REAR SEAT, LEATHER/VINYL COVER	0514219-3	44.3	79.5
25-12-O	REAR SEAT, MILLENNIUM COVER	0514219-4		79.5
25-13-R	CREW RESTRAINT SYSTEM, INERTIA REEL	2000031-9,-10	5.2	54.0
25-14-O	CREW RESTRAINT SYSTEM, MANUAL ADJUST	2000031-9,-10	4.0	54.0

Figure 6-9. Equipment List Description (Sheet 2 of 8)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS.
25-15-S	REAR SEAT RESTRAINT SYSTEM, INERTIA REEL	2000031-11,-12	5.2	90.0
25-16-O	REAR SEAT RESTRAINT SYSTEM, MANUAL ADJUST	2000031-11,-12	4.0	90.0
25-17-S	PADDED GLARESHIELD	0514230-1	1.2	21.0
25-18-S	SUN VISORS	0514166-2	1.1	32.8
25-19-S	SUN VISOR INSTL - MILLENNIUM	0519004-1		
25-20-S	BAGGAGE RESTRAINT NET	2015009-7	0.5	95.0
25-21-S	CARGO TIE DOWN RINGS	0515055-6	0.2	95.0
25-22-S	PILOT'S OPERATING CHECKLIST (STOWED IN MAP CASE)	0500835-1	0.3	14.3
25-23-R	PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL (STOWED IN PILOT'S SEAT BACK CASE)	0500835-1	1.2	50.0
25-24-S	FUEL SAMPLING CUP (STOWED)	S2107-1	0.1	14.3
25-25-S	TOW BAR, NOSE GEAR (STOWED)	0501019-1	1.7	124.0
25-26-R	EMERGENCY LOCATOR TRANSMITTER	3940401-1	3.2*	101.0*
	- ELT TRANSMITTER	3000-11	1.8	113.3
	- ANTENNA AND CABLE ASSY	3003-45	0.5	122.0
	26 - FIRE PROTECTION			
26-01-S	FIRE EXTINGUISHER INSTALLATION	0501011-2	5.3*	43.8*
	- FIRE EXTINGUISHER	C421001-0201	4.8	44.0
	- MOUNTING CLAMP	1290010-1	0.5	42.2
	27 - FLIGHT CONTROLS			
27-01-S	RIGHT SEAT CONTROLS	0506009-1	6.1*	13.7*
	- COPILOT CONTROL WHEEL	0513576-4	2.6	26.0
	- COPILOT RUDDER & BRAKE PEDAL INSTL,	0510402-16	1.1	6.8
27-02-S	PILOTS CONTROL WHEEL WITH MAP LIGHT, MIC SWITCH AND JACK	0513576-5	0.2	22.0
	28 - FUEL			
28-01-R	FUEL QUANTITY INDICATORS	S3281-2	0.4	16.5
28-02-R	AUXILIARY FUEL PUMP (UNDER FLOORBOARD)	5100-00-1	1.9	9.5
	31 - INDICATING/RECORDING SYSTEM			
31-01-S	DIGITAL ELECTRONIC CLOCK/OAT	M803B-2-0/28V-B	0.7	16.5
31-02-S	HOUR RECORDER "HOBBS TIME"	C664503-0103	0.5	9.1
31-03-R	ANNUNCIATOR	CSEWCA-01	0.5	16.0
31-04-R	PNEUMATIC STALL WARNING SYSTEM	0523112-2	0.4	28.5

Figure 6-9. Equipment List Description (Sheet 3 of 8)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS.
	32 - LANDING GEAR			
32-01-R	WHEEL BRAKE AND TIRE, 6.00 X 6 MAIN	0541200-9,-10	34.4*	57.8*
	- WHEEL ASSY, CLEVELAND (EACH)	C163001-0104	6.2	58.2
	- BRAKE ASSY, CLEVELAND (EACH)	C163030-1111	1.8	54.5
	- TIRE, 6-PLY, 6.00 X 6 BLACKWALL	C262003-0204	7.9	58.2
	- TUBE (EACH)	C262023-0102	1.3	58.2
32-02-R	WHEEL AND TIRE, 5.00 X 5 NOSE	0543062-17	9.5*	-6.8*
	- WHEEL ASSY, CLEVELAND	1241156-12	3.5	-6.8
	- TIRE, 6-PLY, 5.00 X 5 BLACKWALL	C262003-0202	4.6	-6.8
	- TUBE	C262023-0101	1.4	-6.8
32-03-A	WHEEL FAIRINGS AND INSTALLATION	0541225-1	16.5*	46.1*
	- NOSE WHEEL FAIRING	0543079-3	3.5	-3.5
	- MAIN WHEEL FAIRINGS (SET OF 2)	0541223-16, -17	10.1	61.1
	- BRAKE FAIRINGS (SET OF 2)	0541224-1, -2	1.1	55.6
	- MOUNTING PLATE (SET OF 2)	0541220-1,-2	0.8	59.5
32-04-O	PREMIUM TIRES, 6.00 X 6, 160 MPH RATING, EXCHANGE WITH STANDARD TIRES (NET CHANGE)	0501166-1	4.1	47.1
	33 - LIGHTS			
33-01-S	MAP LIGHT IN CONTROL WHEEL (PART OF 27-02-S)	0560059	(0.2)	(21.5)
33-02-S	UNDER WING COURTESY LIGHTS (SET OF 2)	0521101-8	0.5	61.0
33-03-S	NAVIGATION LIGHT DETECTORS	1221201-3,-4	0.0	40.8
33-04-S	FLASHING BEACON	0506003-6	1.4	204.7
33-05-S	WING TIP STROBE LIGHT	0501027-6	3.4	43.3
33-06-S	LANDING AND TAXI LIGHT INSTL IN WING	0523029-7	2.4	28.7
	34 - NAVIGATION			
34-01-R	INDICATOR, AIRSPEED	S3225-6	0.6	16.2
34-02-S	ALTERNATE STATIC AIR SOURCE	0501017-2	0.2	15.5
34-03-R	SENSITIVE ALTIMETER	S3288-1	0.9	14.0
34-04-S	BLIND ALTITUDE ENCODER INSTL	3930402-1	0.9	11.0
34-05-R	COMPASS INSTL, MAGNETIC	0513262-3	0.5	14.0
34-06-S	GYRO, INSTALLATION, REQUIRES 37-01-S	0501135-1	6.0*	13.0*
	- DIRECTIONAL GYRO	S3330-1	2.5	14.0
	- ATTITUDE GYRO	S3326-1	2.1	14.0
	- HOSES AND MISC HARDWARE	0501135-1	1.5	10.0
34-07-O	GYRO INSTL, REQUIRES 37-01-S & USED WITH 22-02-A OR 22-03-A	3900005	6.5*	13.1*
	- ATTITUDE GYRO	S3326-1	2.3	14.0
	- DIRECTIONAL GYRO	S3330-2	2.8	14.0
	- HOSES & MSIC HARDWARE	3900005	1.5	10.0

Figure 6-9. Equipment List Description (Sheet 4 of 8)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS.
34-08-O	GYRO INSTL, REQUIRES 37-01-S & USED WITH 34-14-O	3900016	3.9*	11.8*
	- ATTITUDE GYRO	S3326-1	2.3	14.0
	- HOSES & MSIC HARDWARE	3900016	1.5	10.0
34-09-S	TURN COORDINATOR INDICATOR	S3291-1	1.0	15.8
34-10-S	VERTICAL SPEED INDICATOR	S3327-1	0.8	15.7
34-11-A	ADF INSTALLATION	3930408-1	10.4*	26.9*
	- KR 87 ADF RECEIVER	066-01072-0014	3.2	11.4
	- KI 227 ADF INDICATOR	066-03063-0000	0.7	15.8
	- ADF ANTENNA	3960187-1	4.2	39.3
	- ADF CABLE ASSEMBLY	3922102-1	2.3	29.0
34-12-A	GPS INSTALLATION	3930408-1	4.4*	15.3*
	- KING GPS-VFR, KLN-89	066-01148-1111	3.3	12.4
	- GPS ANTENNA	3960190-1	0.3	43.5
	- GPS CABLE ASSEMBLY		0.8	14.1
34-13-S	MODE C TRANSPONDER INSTL	3930404-1	4.1*	18.7*
	- KT 76C TRANSPONDER	066-01156-0101	2.4	13.5
	- TRANS CAL BLIND ENCODER	3930402-1	0.9	10.9
	- TRANSPONDER ANTENNA	3960191-1	0.2	85.3
	- HARDWARE & CABLE ASSEMBLY	3923102-1	0.6	28.9
34-14-O	HORIZONTAL SITUATION INDICATOR INSTL - NET WT INCREASE, REQUIRES 37-01-S	3900016-1	15.3*	84.1*
	- HSI	066-03046-0001	3.4	13.4
	- GYRO SLAVING METER	071-01242-0006	0.3	15.8
	- FLUX DETECTOR INSTL	3940264	0.7	52.6
	- REMOTE DIR GYRO-SLAVED	3940265	5.1	112.5
	- NAV CONVERTER INSTL	3940266	1.6	117.0
	- WIRING	3900016	8.0	60.7
	- STD GYRO INSTL - REMOVED	0501135	-13.6	3.6
	- GYRO INSTL FOR HSI INSTALLED	0501171	11.0	1.6
	- REMOVE #1 NAV INDICATOR		-1.2	13.9
	37 - VACUUM			
37-01-S	DUAL PUMP ENGINE DRIVEN VACUUM SYSTEM	0501135	5.4*	-1.8*
	- AIRBORNE VACUUM PUMP	E211CC	1.9	-6.5
	- AIRBORNE VACUUM PUMP	E212CW	1.9	-3.9
	- COOLING SHROUD	1201998-1	0.1	-6.5
	- COOLING SHROUD	1201998-1	0.1	-3.9
	- FILTER INSTALLATION	1201075-2	0.3	5.3
	- COMBINATION VACUUM INDICATOR/AMMETER	S3280-1	0.3	14.3
	- VACUUM RELIEF VALVE	2H3-48	0.3	4.7
	- MANIFOLD	1H5-25	0.5	-0.2
37-02-R	COMBINATION VACUUM GAGE/AMMETER	S3280-1	0.3	14.3

Figure 6-9. Equipment List Description (Sheet 5 of 8)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS.
	53 - FUSELAGE			
53-01-S	REFUELING STEPS AND HANDLE INSTL	0513415-2	1.7	16.3
	56 - WINDOWS			
56-01-S	WINDOW - RIGHT HAND DOOR, OPENABLE	0517001-40	5.8*	48.5*
56-02-S	WINDOW - LEFT HAND DOOR, OPENABLE	0517001-39	5.8*	48.5*
	57 - WINGS			
57-01-O	HEAVY DUTY FLAPS, WT SHOWN NET CHG	0501165	- - -	- - -
	- TWO (2) FLAPS EXCHANGED	0523902	2.2	83.2
	- ONE (1) FLAP EXCHANGED	0523902	1.1	83.2
	61 - PROPELLER			
61-01-R	FIXED PITCH PROPELLER INSTALLATION	0550320-11	38.8*	-38.2*
	- MCCAULEY 76 INCH PROPELLER	1A170E/JHA7660	35.0	-38.4
	- MCCAULEY 3.5 INCH PROPELLER SPACER	C5464	3.6	-36.0
61-02-R	SPINNER INSTALLATION, PROPELLER	0550320-11	1.8*	-41.0*
	- SPINNER DOME ASSEMBLY	0550236-14	1.0	-42.6
	- FWD SPINNER BULKHEAD	0552231-1	0.3	-40.8
	- AFT SPINNER BULKHEAD	0550321-10	0.4	-37.3
61-03-O	POLISHED SPINNER - MILLENNIUM INSTL (NET CHANGE)	0550371-1	0.0	-41.0*
	71 - POWERPLANT			
71-01-R	AIR INTAKE FILTER, DONALDSON	P198281	0.3	-27.5
71-02-S	WINTERIZATION KIT INSTALLATION (STOWED) (INSTALLED ARM SHOWN)	0501128-3	0.8*	-20.3*
	- BREATHER TUBE INSULATION	0552011	0.4	-13.8
	- COWL INLET COVERS (INSTALLED)	0552229-3,-4	0.3	-32.0
	- COWL INLET COVERS (STOWED)	0552229-3,-4	0.3	95.0
71-03-R	ENGINE, LYCOMING IO-360-L2A	0550365-1	297.8*	-18.6*
	- FUEL INJECTOR, PAC RSA-5AD1		7.6	-13.9
	- MAGNETOS & HARNESS, SLICK 4371 (SET OF 2)		9.0	-5.0
	- OIL FILTER AND ADAPTER (CHAMPION)	CH48110	2.5	-18.5
	- SPARK PLUGS (CHAMPION)		1.9	-13.9
	- STARTER, LAMAR 31B22207		11.2	-23.0
71-04-O	MILLENNIUM ENGINE INSTL LYCOMING IO-360-L2A9918 (NET CHANGE)	0550372-1	0.0	-18.6

Figure 6-9. Equipment List Description (Sheet 6 of 8)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS.
	73 - ENGINE FUEL & CONTROL			
73-01-S	EGT/FUEL FLOW INDICATOR	S3277-4	0.6	7.8
	77 - ENGINE INDICATING			
77-01-R	RECORDING TACHOMETER INSTALLATION	S3329-5	1.0	12.1
	78 - EXHAUST			
78-01-R	EXHAUST SYSTEM INSTALLATION	9954100-1	16.3*	-20.0*
	- MUFFLER & TAILPIPE WELD ASSY	9954000-2	4.6	-22.7
	- SHROUD ASSEMBLY, MUFFLER HEATER	9954100-3	0.8	-22.7
	79 - OIL			
79-01-R	OIL COOLER INSTALLATION	0550365-1	3.3*	-11.0*
	- OIL COOLER, STEWART WARNER	10877A	2.3	-11.0
79-02-R	OIL PRESSURE & TEMPERATURE INDICATOR	S3279-1	0.4	16.5
	90 - MISCELLANEOUS			
90-01-A	MILLENNIUM EQUIPMENT OPTION	0501300-1, -2	10.5	39.1
	- 11-04-O MILLENNIUM EXTERIOR STYLING	0504055-1, -2	0.0	95.4
	- 25-08-O SUNVISOR INSTALLATION MILLENNIUM	0519004-1		
	- MILLENNIUM UPHOLSTERY OPTION	0519005-1		
	- 25-03- O PILOT'S LEATHER/VINYL SEATS	0519005-1		
	- SIDEWALL INSERT MILLENNIUM UPHOLSTERY	0519006-1		
	- MILLENNIUM FLOOR MATS (SET OF 2)	0519005-1	2.1	15.0
	- STORAGE CONSOLE INSTALLATION	0519005-2	2.3	27.0
	- 32-04-O PREMIUM TIRE INSTL	0501166-1	4.1	47.1
	- 61-03-O POLISHED SPINNER INSTL	0550371-1	0.0	-41.0*
	- 72-02-O ENGINE INSTL	0550372-1	0.0	-18.6
	- POLISHED FASTENER INSTL	0552236-1	0.0	
	- MILLENNIUM CONTROL WHEEL PAD	1219012-1	0.0	
	98 - AVIONICS PACKAGES			
98-01-S	STANDARD AVIONICS PACKAGE	3900003-1	28.0	32.2
	- 22-01-S -WING LEVELER PROVISIONS	3900003	2.2	23.0
	- 23-05-S -BASIC AVIONICS INSTL	3900003-1	11.3	27.4
	- 23-04-S -MARKER BEACON/INTERCOM INSTL	3930407-1	2.5	19.7
	- 23-02-S -NAV/COM #1 INSTALLATION	3930407-1	7.9	52.7
	- 34-11-S -MODE C TRANSPONDER INSTL	3930407-1	4.1	18.7

Figure 6-9. Equipment List Description (Sheet 7 of 8)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS.
98-02-A	NAV I AVIONICS PKG (NET CHANGE OVER STANDARD AVIONICS PKG)	3900004-1	21.3*	21.5*
	- 34-10-A -GPS INSTALLATION	3930408-1	4.4	15.3
	- 23-03-A -NAV/COM INSTL WITH G.S.	3930408-1	6.5	17.1
	- 34-09-A -ADF INSTALLATION	3930408-1	10.4	26.9
98-03-A	NAV II AVIONICS PKG (NET CHANGE OVER STANDARD AVIONICS PKG)	3900005-1	28.5*	27.1*
	- 98-02-A -NAV I AVN PKG	3900004-1	21.3	21.5
	- 22-02-A -SINGLE AXIS AUTOPILOT	3900005-1	7.2	43.6
98-04-A	NAV II WITH HSI AVIONICS PKG (NET CHANGE OVER STANDARD AVIONICS PKG)	3900016	43.8*	47.0*
	- 98-02-A -NAV I AVN PKG	3900004-1	21.3	21.5
	- 22-02-A -SINGLE AXIS AUTOPILOT	3900005-1	7.2	43.6
	- 34-12-O -HSI GYRO INSTL	3900016-1	15.3	84.1
98-05-A	NAV III WITH HSI AVIONICS PKG (NET CHANGE OVER STANDARD AVIONICS PKG)	3900018	56.3*	67.5*
	- 98-02-A -NAV I AVN PKG	3900004-1	21.3	21.5
	- 22-03-A -2-AXIS AUTOPILOT	3900003	19.7	104.4
	- 34-12-O -HSI GYRO INSTL	3900016-1	15.3	84.1
98-06-A	NAV III WITHOUT HSI AVIONICS PKG (NET CHANGE OVER STANDARD AVIONICS PKG)	3900021	41.0*	61.3*
	- 98-02-A -NAV I AVN PKG	3900004-1	21.3	21.5
	- 22-03-A -2-AXIS AUTOPILOT	3900003	19.7	104.4

Figure 6-9. Equipment List Description (Sheet 8 of 8)

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AIRPLANE & SYSTEMS DESCRIPTION

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INTRODUCTION

This section provides description and operation of the airplane and its systems. Some equipment described herein is optional and may not be installed in the airplane. Refer to the Supplements, Section 9, for details of other optional systems and equipment.

AIRFRAME

The airplane is an all metal, four-place, high wing, single engine airplane equipped with tricycle landing gear and is designed for general utility and training purposes.

The construction of the fuselage is a conventional formed sheet metal bulkhead, stringer, and skin design referred to as semimonocoque. Major items of structure are the front and rear carry through spars to which the wings are attached, a bulkhead and forgings for main landing gear attachment at the base of the rear door posts, and a bulkhead with attach fittings at the base of the forward door posts for the lower attachment of the wing struts. Four engine mount stringers are also attached to the forward door posts and extend forward to the firewall.

The externally braced wings, containing integral fuel tanks, are constructed of a front and rear spar with formed sheet metal ribs, doublers, and stringers. The entire structure is covered with aluminum skin. The front spars are equipped with wing-to-fuselage and wing-to-strut attach fittings. The aft spars are equipped with wing-to-fuselage attach fittings, and are partial span spars. Conventional hinged ailerons and single slot type flaps are attached to the trailing edge of the wings. The ailerons are constructed of a forward spar containing balance weights, formed sheet metal ribs and "V" type corrugated aluminum skin joined together at the trailing edge. The flaps are constructed basically the same as the ailerons, with the exception of the balance weights and the addition of a formed sheet metal leading edge section.

The empennage (tail assembly) consists of a conventional vertical stabilizer, rudder, horizontal stabilizer, and elevator. The vertical stabilizer consists of a spar, formed sheet metal ribs and reinforcements, a wraparound skin panel, formed leading edge skin and a dorsal. The rudder is constructed of a formed leading edge skin and spar with attached hinge brackets and ribs, a center spar, a wrap around skin, and a ground adjustable trim tab at the base of the trailing edge. The top of the rudder incorporates a leading edge extension which contains a balance weight.

The horizontal stabilizer is constructed of a forward and aft spar, ribs and stiffeners, center, left, and right wrap around skin panels, and formed leading edge skins. The horizontal stabilizer also contains the elevator trim tab actuator.

Construction of the elevator consists of formed leading edge skins, a forward spar, aft channel, ribs, torque tube and bellcrank, left upper and lower "V" type corrugated skins, and right upper and lower "V" type corrugated skins incorporating a trailing edge cutout for the trim tab. The elevator tip leading edge extensions incorporate balance weights. The elevator trim tab consists of a spar, rib, and upper and lower "V" type corrugated skins.

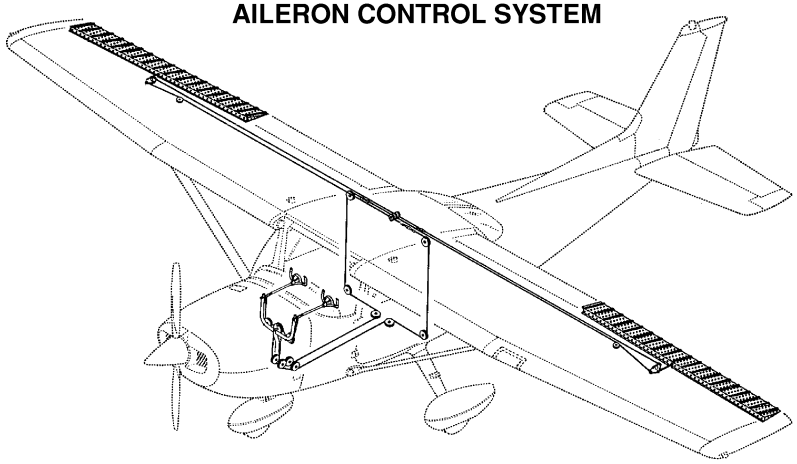
FLIGHT CONTROLS

The airplane's flight control system (Refer to Figure 7-1) consists of conventional aileron, rudder, and elevator control surfaces. The control surfaces are manually operated through cables and mechanical linkage using a control wheel for the ailerons and elevator, and rudder/brake pedals for the rudder.

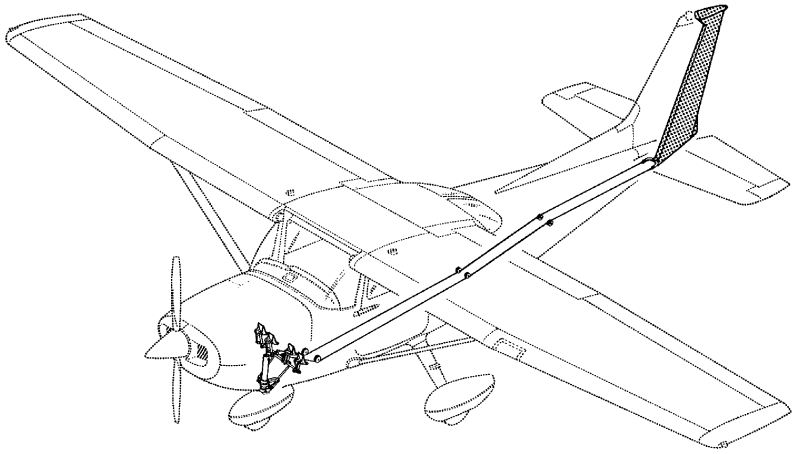
TRIM SYSTEM

A manually operated elevator trim system is provided (Refer to Figure 7-1). Elevator trimming is accomplished through the elevator trim tab by utilizing the vertically mounted trim control wheel in the cockpit. Forward rotation of the trim wheel will trim nose down; conversely, aft rotation will trim nose up.

AILERON CONTROL SYSTEM



RUDDER CONTROL SYSTEM



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Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)

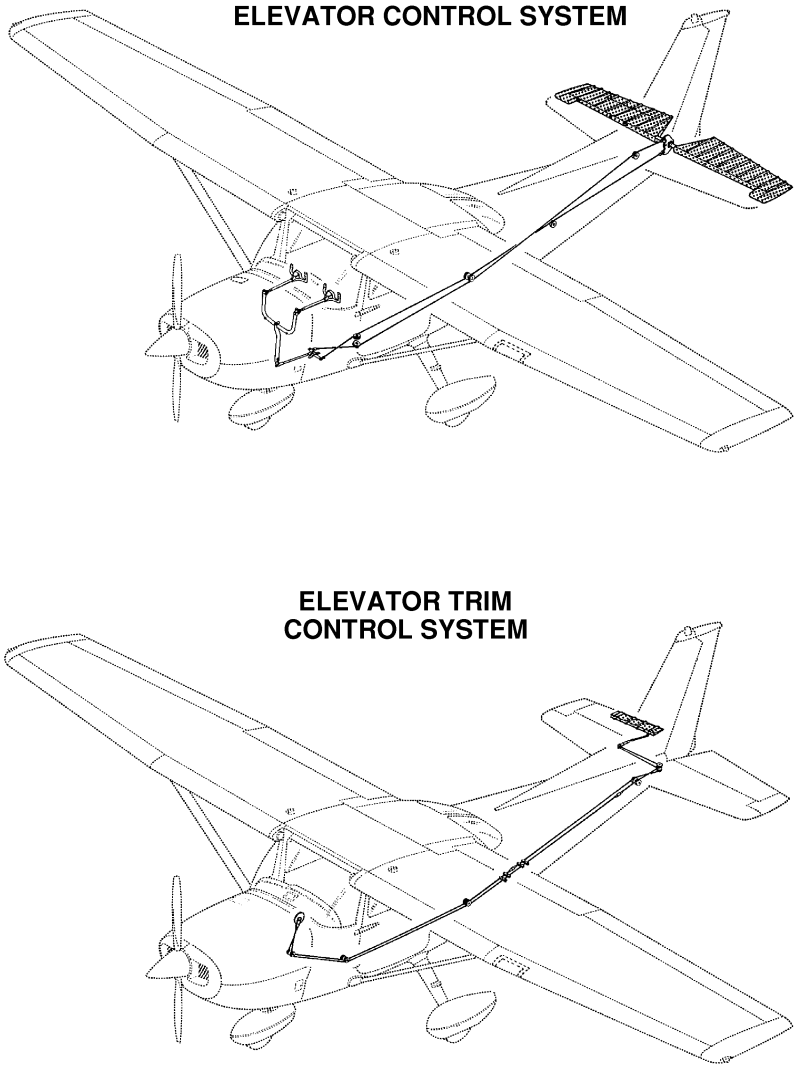


Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

INSTRUMENT PANEL

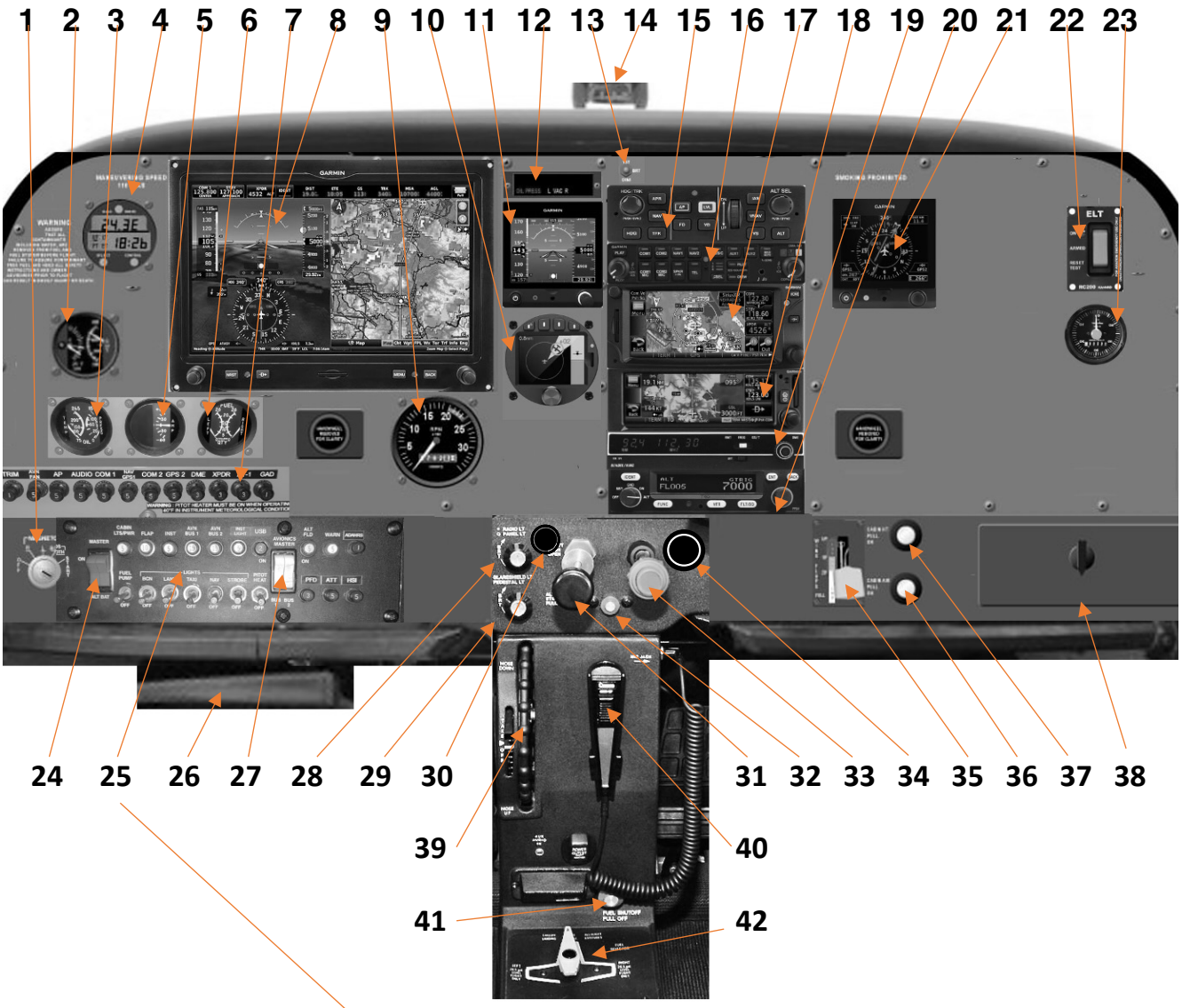
The instrument panel (Refer to figure 7-2) is of all-metal construction, and is designed in segments to allow related groups of instruments, switches and controls to be removed without removing the entire panel. For specific details concerning the instruments, switches, circuit breakers, and controls on the instrument panel, refer to related topics in this section.

PILOT SIDE PANEL LAYOUT

Flight instruments are contained in a single panel located in front of the pilot. These instruments are designed on a touchscreen flight display (Garmin G3X touch) with the capability to combine full primary display (PFD) attitude/ directional guidance with detailed moving-map multifonction display (MFD). The airspeed indicator displays airspeed on a rolling number gauge using a moving tape on the left part. The true airspeed (TAS) is displayed in knots above the airspeed indicator. The attitude information is displayed over a virtual blue sky and brown ground with a white horizon line in the middle part of the screen. The attitude indicator displays the pitch (indicated by the yellow symbolic aircraft on the pitch scale), roll, and slip/skid information. The altimeter displays 400 feet of barometric altitude values at a time on a rolling number gauge using a moving tape on the right part. An annunciator panel is located above a Garmin G5 standby flight instrument synchronized with the G3X and provides caution and warning messages for fuel quantity, oil pressure, and low voltage situations. To the right of the flight instruments is a sub panel which contains engine tachometer and analogic navigational headind instruments. To the left of the flight instruments is a sub panel which contains a left/right fuel quantity indicator, an oil temperature/oil pressure indicator, an ammeter, an EGT/fuel flow indicator, a digital clock/OAT indicator and the avionics circuit breaker panel. below the engine and flight instruments are circuit breakers ans switches for the airplane systems and equipment. Master, Avionics Master and ignition switches are also located in this area of the panel. The parking brake control is positionned below the switch and circuit breaker panel.

CENTER PANEL LAYOUT

The center panel contains various avionics equipment arranged in a vertical rack. This arrangement allows each component to be removed without having to acces the backside of the panel. Below the panel are the throttle, mixture, alternate static air and lighting controls.





Circuit breakers and switchs



Avionics circuit breaker panel (all ones dijonctable)

Figure 7-2. Instrument Panel (Sheet 1 of 2)

1. **Ignition switch**
2. **EGT/Fuel Flow Indicator**
3. **Oil Temperature and oil pressure indication**
4. **Digital Clock/OAT indicator**
5. **Ammeter**
6. **Fuel quantity indication**
7. **Avionics Circuit Breakers panel**
8. **PFD/MFD (G3X Touch)**
9. **Thachometer**
10. **Air Traffic anti-collision**
11. **G5-PFD Standby Flight instruments**
12. **Annonciator panel**
13. **Test annonciator panel**
14. **Compass**
15. **A/P- GMC507**
16. **Audio control panel (GMA342)**
17. **COM1/NAV/GPS- GTN650**
18. **COM2/GPS- GNC355**
19. **DME Receiver - KN62**
20. **Transpondeur – TT31**
21. **G5-HSI Standby Flight instruments**
22. **ELT remote switch**
23. **Hour meter**
24. **Master switch**
25. **Circuit breakers & switch**
26. **Parking brakes**
27. **Avionics master switch 1 & 2**
28. **Radio & panel dimming control**
29. **Glareshied & pedestal dimming control**
30. **GA Button**
31. **Throttle control**
32. **Alternate Static Air Control**
33. **Mixture control**
34. **USB connector**
35. **Flap switch & position indicator**
36. **Cabin air control**
37. **Cabin Heat control**
38. **Glove box**
39. **Elevator trim control & position indicator**
40. **Hand held microphone**
41. **Fuel shutoff valve control**
42. **fuel selector**

Figure 7-2. Instrument Panel (Sheet 2)

RH SIDE PANEL LAYOUT

The RH panel contains a standby altimeter, the hour meter, ELT switch, and room for expansion of indicators and other avionics equipment. Below this sub panel are the glove box, cabin heat and cabin air controls, and wing flap switch.

CENTER PEDESTAL LAYOUT

The center pedestal, located below the center panel, contains the elevator trim control wheel, position indicator, handheld microphone bracket and fuel shutoff valve control. The fuel selector valve handle is located at the base of pedestal.

GROUND CONTROL

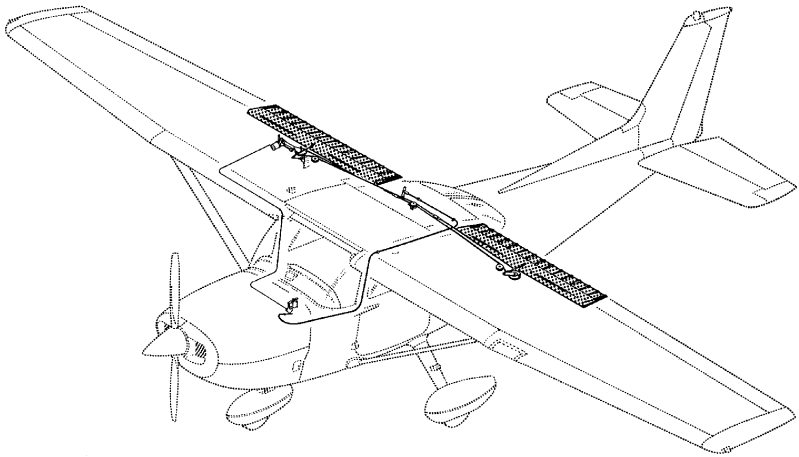
Effective ground control while taxiing is accomplished through nose wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a spring loaded steering bungee (which is connected to the nose gear and to the rudder bars) will turn the nose wheel through an arc of approximately 10° each side of center. By applying either left or right brake, the degree of turn may be increased up to 30° each side of center.

Moving the airplane by hand is most easily accomplished by attaching a tow bar to the nose gear strut. If a tow bar is not available, or pushing is required, use the wing struts as push points. Do not use the vertical or horizontal surfaces to move the airplane. If the airplane is to be towed by vehicle, never turn the nose wheel more than 30° either side of center or structural damage to the nose gear could result.

The minimum turning radius of the airplane, using differential braking and nose wheel steering during taxi, is approximately 27 feet. To obtain a minimum radius turn during ground handling, the airplane may be rotated around either main landing gear by pressing down on a tailcone bulkhead just forward of the horizontal stabilizer to raise the nose wheel off the ground. Care should be exercised to ensure that pressure is exerted only on the bulkhead area and not on skin between the bulkheads. Pressing down on the horizontal stabilizer is not recommended.

WING FLAP SYSTEM

The single-slot type wing flaps (Refer to Figure 7-3), are extended or retracted by positioning the wing flap switch lever on the instrument panel to the desired flap deflection position. The switch lever is moved up or down in a slotted panel that provides mechanical stops at the 10°, 20° and 30° positions. To change flap setting, the flap lever is moved to the right to clear mechanical stops at the 10° and 20° positions. A scale and pointer to the left of the flap switch indicates flap travel in degrees. The wing flap system circuit is protected by a 10-ampere circuit breaker, labeled FLAP, on the left side of the control panel.



0585X1021

Figure 7-3. Wing Flap System

LANDING GEAR SYSTEM

The landing gear is of the tricycle type, with a steerable nose wheel and two main wheels. Wheel fairings are standard equipment for both the main and nose wheels. Shock absorption is provided by the tubular spring steel main landing gear struts and the air/oil nose gear shock strut. Each main gear wheel is equipped with a hydraulically actuated disc type brake on the inboard side of each wheel.

BAGGAGE COMPARTMENT

The baggage compartment consists of two areas, one extending from behind the rear passengers seat to the aft cabin bulkhead, and an additional area aft of the bulkhead. Access to both baggage areas is gained through a lockable baggage door on the left side of the airplane, or from within the airplane cabin. A baggage net with tiedown straps is provided for securing baggage and is attached by tying the straps to tiedown rings provided in the airplane. For baggage area and door dimensions, refer to Section 6.

SEATS

The seating arrangement consists of two vertically adjusting crew seats for the pilot and front seat passenger, and a single bench seat with adjustable back for rear seat passengers.

Seats used for the pilot and front seat passenger are adjustable fore and aft, and up and down. Additionally, the angle of the seat back is infinitely adjustable.

Fore and aft adjustment is made using the handle located below the center of the seat frame. To position the seat, lift the handle, slide the seat into position, release the handle and check that the seat is locked in place. To adjust the height of the seat, rotate the large crank under the right hand corner of the seat until a comfortable height is obtained. To adjust the seat back angle, pull up on the release button, located in the center front of seat, just under the seat bottom, position the seat back to the desired angle, and release the button. When the seat is not occupied, the seat back will automatically fold forward whenever the release button is pulled up.

The rear passengers' seat consists of a fixed, one piece seat bottom and a three-position, reclining back. The reclining back is adjusted by a lever located below the center of the seat frame. To adjust the seat back, raise the lever, position the seat back to the desired angle, release the lever and check that the back is locked in place.

Headrests are installed on both the front and rear seats. To adjust the headrest, apply enough pressure to it to raise or lower it to the desired level.

INTEGRATED SEAT BELT/SHOULDER HARNESS

All seat positions are equipped with integrated seat belts/shoulder harness assemblies (Refer to Figure 7-4). The design incorporates an overhead inertia reel for the shoulder portion, and a retractor assembly for the lap portion of the belt. This design allows for complete freedom of movement of the upper torso area while providing restraint in the lap belt area. In the event of a sudden deceleration, reels lock up to provide positive restraint for the user.

In the front seats, the inertia reels are located on the centerline of the upper cabin. In the rear seats, the inertia reels are located outboard of each passenger in the upper cabin.

To use the integrated seat belt/shoulder harness, grasp the link with one hand, and, in a single motion, extend the assembly and insert into the buckle. Positive locking has occurred when a distinctive ”snap” sound is heard.

Proper locking of the lap belt can be verified by ensuring that the belts are allowed to retract into the retractors and the lap belt is snug and low on the waist as worn normally during flight. No more than one additional inch of belt should be able to be pulled out of the retractor once the lap belt is in place on the occupant. If more than one additional inch of belt can be pulled out of the retractor, the occupant is too small for the installed restraint system and the aircraft should not be occupied until the occupant is properly restrained.

Removal is accomplished by lifting the release mechanism on the buckle or by pressing the release button on the buckle and pulling out and up on the harness. Spring tension on the inertia reel will automatically stow the harness.

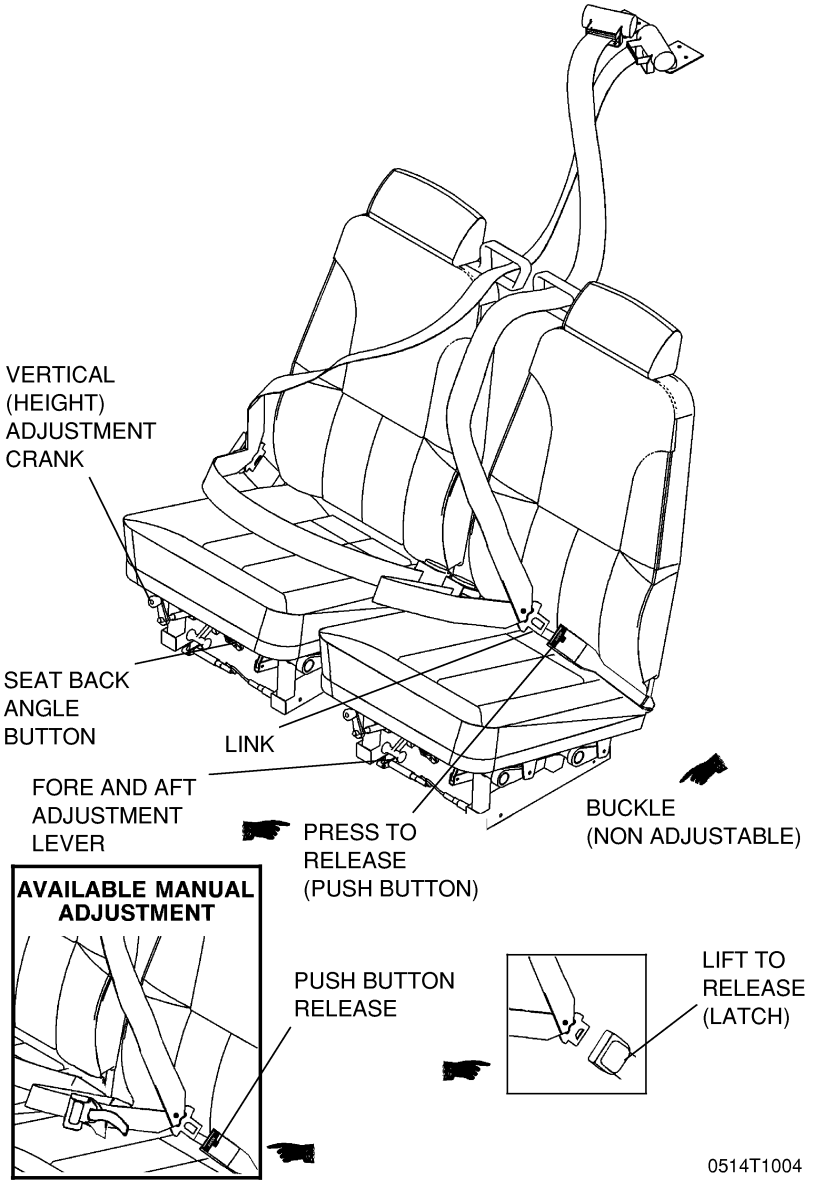


Figure 7-4. Crew Seats, Seat Belts and Shoulder Harnesses

A manually adustable seat belt/shoulder harness assembly is available for all seats.

To use the manually adjustable seat belt/shoulder harness, fasten and adjust the seat belt/shoulder harness first. Lengthen the seat belt as required by pulling on the release strap on the belt. Snap the connecting link firmly into the buckle, then adjust to length. A properly adjusted harness will permit the occupant to lean forward enough to sit erect, but prevent excessive forward movement and contact with objects during sudden deceleration. Also, the pilot must have the freedom to reach all controls easily.

Disconnecting the manually adjustable seat belt/shoulder harness is accomplished by pushing the button on the buckle to release the connecting link.

ENTRANCE DOORS AND CABIN WINDOWS

Entry to, and exit from the airplane is accomplished through either of two entry doors, one on each side of the cabin at the front seat positions (refer to Section 6 for cabin and cabin door dimensions). The doors incorporate a recessed exterior door handle, a conventional interior door handle, a key operated door lock (left door only), a door stop mechanism, and openable windows in both the left and right doors.

NOTE

The door latch design on this model requires that the outside door handle on the pilot and front passenger doors be extended out whenever the doors are open. When closing the door, do not attempt to push the door handle in until the door is fully shut.

To open the doors from outside the airplane, utilize the recessed door handle near the aft edge of either door by grasping the forward edge of the handle and pulling outboard. To close or open the doors from inside the airplane, use the combination door handle and arm rest. The inside door handle has three positions and a placard at its base which reads OPEN, CLOSE, and LOCK. The handle is spring loaded to the CLOSE (up) position. When the door has been pulled shut and latched, lock it by rotating the door handle forward to the LOCK position (flush with the arm rest). When the handle is rotated to the LOCK position, an over center action will hold it in that position. Both cabin doors should be locked prior to flight, and should not be opened intentionally during flight.

NOTE

Accidental opening of a cabin door in flight due to improper closing does not constitute a need to land the airplane. The best procedure is to set up the airplane in a trimmed condition at approximately 75 KIAS, momentarily shove the door outward slightly, and forcefully close and lock the door.

Exit from the airplane is accomplished by rotating the door handle from the LOCK position, past the CLOSE position, aft to the OPEN position and pushing the door open. To lock the airplane, lock the right cabin door with the inside handle, close the left cabin door, and using the ignition key, lock the door.

The left and right cabin doors are equipped with openable windows which are held in the closed position by a detent equipped latch on the lower edge of the window frame. To open the windows, rotate the latch upward. Each window is equipped with a spring-loaded retaining arm which will help rotate the window outward, and hold it there. If required, either window may be opened at any speed up to 163 KIAS. The rear side windows and rear windows are of the fixed type and cannot be opened.

CONTROL LOCKS

A control lock is provided to lock the aileron and elevator control surfaces to prevent damage to these systems by wind buffeting while the airplane is parked. The lock consists of a shaped steel rod and flag. The flag identifies the control lock and cautions about its removal before starting the engine. To install the control lock, align the hole in the top of the pilot's control wheel shaft with the hole in the top of the shaft collar on the instrument panel and insert the rod into the aligned holes. Installation of the lock will secure the ailerons in a neutral position and the elevators in a slightly trailing edge down position. Proper installation of the lock will place the flag over the ignition switch. In areas where high or gusty winds occur, a control surface lock should be installed over the vertical stabilizer and rudder. The control lock and any other type of locking device should be removed prior to starting the engine.

ENGINE

The airplane is powered by a horizontally opposed, four cylinder, overhead valve, air-cooled, fuel-injected engine with a wet sump lubrication system. The engine is a Lycoming Model IO-360-L2A and is rated at 180 horsepower at 2700 RPM. Major accessories include a starter and belt driven alternator mounted on the front of the engine, and dual magnetos, dual vacuum pumps, and a full flow oil filter mounted on the rear of the engine accessory case.

ENGINE CONTROLS

Engine power is controlled by a throttle located on the switch and control panel above the center pedestal. The throttle is open in the full forward position and closed in the full aft position. A friction lock, which is a round knurled knob, is located at the base of the throttle and is operated by rotating the lock clockwise to increase friction or counterclockwise to decrease it.

The mixture control, mounted adjacent to the throttle control, is a red knob with raised points around the circumference and is equipped with a lock button in the end of the knob. The rich position is full forward, and full aft is the idle cutoff position. For small adjustments, the control may be moved forward by rotating the knob clockwise, and aft by rotating the knob counterclockwise. For rapid or large adjustments, the knob may be moved forward or aft by depressing the lock button in the end of the control, and then positioning the control as desired.

ENGINE INSTRUMENTS

Engine operation is monitored by the following instruments: oil pressure/oil temperature indicator, tachometer and exhaust gas temperature (EGT) indicator. In addition, the annunciator panel contains a red OIL PRESS annunciator which comes on when the oil pressure is low.

See Section 2, Limitations, for engine operating limitations and instrument markings.

Oil pressure signals are generated from an oil pressure line/transducer combination. An oil pressure line is routed from the upper front of the engine case to the rear engine baffle. At the baffle, the oil pressure line is connected to a transducer. This transducer produces an electrical signal which is translated into a pressure reading by the oil pressure gage located on the LH instrument panel.

In addition, a separate low oil pressure indication is provided through the panel annunciator. This annunciator is wired to a pressure switch located on the rear of the engine accessory case. When oil pressure is below 20 PSI, the switch grounds and completes the annunciator circuit, illuminating the red OIL PRESS light. When pressure exceeds 20 PSI, the ground is removed and the OIL PRESS annunciator goes out.

NOTE

The low oil pressure switch is also connected to the hour (Hobbs) meter. When pressure exceeds 20 PSI, a ground is supplied to the hour meter, completing the hour meter circuit.

Oil temperature signals are generated from a resistance-type probe located in the engine accessory case. As oil temperature changes, the probe resistance changes. This resistance is translated into oil temperature readings on the cockpit indicator.

The engine driven mechanical tachometer is located on the instrument panel to the right of the pilot's control wheel. The instrument is calibrated in increments of 100 RPM and indicates both engine and propeller speed. An hour meter in the lower section of the dial records elapsed engine time in hours and tenths. Instrument markings include the normal operating range (green arc) from 1900 to 2400 RPM.

The exhaust gas temperature (EGT) indicator is located on the LH instrument panel as part of the EGT/Fuel Flow indicator. Since exhaust gas temperature varies with fuel-air ration (mixture), density altitude, throttle position and RPM, the instrument is a useful aid in adjusting the mixture for best economy or performance. The EGT indicator allows the pilot to lean (reduce the proportion of fuel in the fuel-air mixture) to a known value using the maximum or "peak" exhaust gas temperature as a reference. An index pointer which can be positioned manually is provided for the pilot to mark the location of the peak. **Never lean using EGT when operating at more than 75% power.**

The EGT system uses a thermocouple in the engine exhaust (tailpipe) to supply a voltage proportional to exhaust gas temperature. The EGT indicator responds to the voltage developed by the thermocouple. As the mixture is leaned (from full rich), the exhaust gas temperature will increase to a maximum value as the stoichiometric (most chemically efficient) fuel-air ratio is achieved and will decrease if the mixture continues to be leaned.

NEW ENGINE BREAK-IN AND OPERATION

The engine underwent a run in at the factory and is ready for the full range of use. It is, however, suggested that cruising be accomplished at 75% power as much as practicable until a total of 50 hours has accumulated or oil consumption has stabilized. This will ensure proper seating of the piston rings.

ENGINE LUBRICATION SYSTEM

The engine utilizes a full-pressure, wet-sump type lubrication system with aviation-grade oil used as the lubricant. The capacity of the engine sump (located on the bottom of the engine) is eight quarts. Oil is drawn from the sump through an oil suction strainer screen into the engine-driven oil pump. From the pump, oil is routed to a bypass valve. If the oil is cold, the bypass valve allows the oil to bypass the oil cooler and go directly from the pump to the full flow oil filter. If the oil is hot, the bypass valve routes the oil out of the accessory housing and into a flexible hose leading to the oil cooler on the right, rear engine baffle. Pressure oil from the cooler returns to the accessory housing where it passes through the full flow oil filter. The filter oil then enters a pressure relief valve which regulates engine oil pressure by allowing excessive oil to return to the sump while the balance of the oil is circulated to various engine parts for lubrication. Residual oil is returned to the sump by gravity flow.

An oil filler cap/oil dipstick is located at the right rear of the engine. The filler cap/ dipstick is accessible through an access door on the top right side of the engine cowling. The engine should not be operated on less than five quarts of oil. For extended flight, fill to eight quarts (dipstick indication only). For engine oil grade and specifications, refer to Section 8 of this handbook.

IGNITION AND STARTER SYSTEM

Engine ignition is provided by two engine-driven magnetos, and two spark plugs in each cylinder. The right magneto fires the lower right and upper left spark plugs, and the left magneto fires the lower left and upper right spark plugs. Normal operation is conducted with both magnetos due to the more complete burning of the fuel/air mixture with dual ignition.

Ignition and starter operation is controlled by a rotary-type switch located on the left switch and control panel. The switch is labeled clockwise, OFF, R, L, BOTH, and START. The engine should be operated on both magnetos (BOTH position) except for magneto checks. The R and L positions are for checking purposes and emergency use only. When the switch is rotated to the spring loaded START position, (with the master switch in the ON position), the starter contactor is closed and the starter, now energized, will crank the engine. When the switch is released, it will automatically return to the BOTH position.

AIR INDUCTION SYSTEM

The engine air induction system receives ram air through an intake on the lower front portion of the engine cowling. The intake is covered by an air filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an air box. The air box has a spring-loaded alternate air door. If the air induction filter should become blocked, suction created by the engine will open the door and draw unfiltered air from inside the lower cowl area. An open alternate air door will result in an approximate 10% power loss at full throttle. After passing through the air box, induction air enters a fuel/air control unit under the engine, and is then ducted to the engine cylinders through intake manifold tubes.

EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies to a muffler and tailpipe. Outside air is pulled in around shrouds which are constructed around the outside of the muffler to form heating chambers which supply heat to the cabin.

COOLING SYSTEM

Ram air for engine cooling enters through two intake openings in the front of the engine cowling. The cooling air is directed around the cylinders and other areas of the engine by baffling, and is then exhausted through an opening at the bottom aft edge of the cowling. No manual cowl flap cooling system control is required.

PROPELLER

The airplane is equipped with a two bladed, fixed pitch, one-piece forged aluminum alloy propeller which is anodized to retard corrosion. The propeller is 76 inches in diameter.

FUEL SYSTEM

The airplane fuel system (see Figure 7-6) consists of two vented integral fuel tanks (one tank in each wing), a three-position selector valve, auxiliary fuel pump, fuel shutoff valve, fuel strainer, engine driven fuel pump, fuel/air control unit, fuel distribution valve and fuel injection nozzles.

⚠ WARNING

UNUSABLE FUEL LEVELS FOR THIS AIRPLANE WERE DETERMINED IN ACCORDANCE WITH FEDERAL AVIATION REGULATIONS. FAILURE TO OPERATE THE AIRPLANE IN COMPLIANCE WITH FUEL LIMITATIONS SPECIFIED IN SECTION 2 MAY FURTHER REDUCE THE AMOUNT OF FUEL AVAILABLE IN FLIGHT.

FUEL TANKS	FUEL LEVEL (QUANTITY EACH TANK)	TOTAL FUEL	TOTAL UNUSABLE	TOTAL USABLE ALL FLIGHT CONDITIONS
Two	Full (28.0)	56.0	3.0	53.0
Deu	**Plein (0 L)**	**L**	**L**	**00 L**

Figure 7-5. Fuel Quantity Data in U.S. Gallons

FUEL DISTRIBUTION

Fuel flows by gravity from the two wing tanks to a three-position selector valve, labeled BOTH, RIGHT and LEFT and on to the reservoir tank. From the reservoir tank fuel flows through the auxiliary fuel pump, past the fuel shutoff valve, through the fuel strainer to an engine driven fuel pump.

From the engine-driven fuel pump, fuel is delivered to the fuel/air control unit, where it is metered and directed to a fuel distribution valve (manifold) which distributes it to each cylinder. Fuel flow into each cylinder is continuous, and flow rate is determined by the amount of air passing through the fuel/air control unit.

Starting at serial number 172S9491 and on, and airplanes incorporating MK172-28-01, a fuel return system was added to promote smooth engine operation on the ground during hot weather. The return system carries a metered amount of fuel from the engine fuel-air control unit to the fuel reservoir tank. The increased fuel flow due to the return system results in lower fuel temperatures at the engine inlet, and helps to minimize the amount of fuel vapor generated in the fuel lines during high OAT operations.

FUEL INDICATING

Fuel quantity is measured by two float type fuel quantity transmitters (one in each tank) and indicated by an electrically operated fuel quantity indicator on the left side of the instrument panel. The gauges are marked in gallons of fuel. An empty tank is indicated by a red line and the number 0. When an indicator shows an empty tank, approximately 1.5 gallons remain in each tank as unusable fuel. The indicators should not be relied upon for accurate readings during skids, slips, or unusual attitudes.

Each fuel tank also incorporates warning circuits which can detect low fuel conditions and erroneous transmitter messages. Anytime fuel in the tank drops below approximately 5 gallons (and remains below this level for more than 60 seconds), the amber LOW FUEL message will flash on the annunciator panel for approximately 10 seconds and then remain steady amber. The annunciator cannot be turned off by the pilot. If the left tank is low, the message will read L LOW FUEL. If the right tank is low, the message will read LOW FUEL R. If both tanks are low, the message will read L LOW FUEL R.

In addition to low fuel annunciation, the warning circuitry is designed to report failures with each transmitter caused by shorts, opens or transmitter resistance which increases over time. If the circuitry detects any one of these conditions, the fuel level indicator needle will go to the OFF position (below the 0 mark on the fuel indicator), and the amber annunciator will illuminate. If the left tank transmitter has failed, the message will read L LOW FUEL. If the right tank transmitter has failed, the message will read LOW FUEL R. If both tanks transmitters have failed, the message will read L LOW FUEL R.

Fuel pressure is measured by use of a transducer mounted near the fuel manifold. This transducer produces an electrical signal which is translated for the cockpit-mounted indicator in gallons-per-hour.

FUEL VENTING

Fuel system venting is essential to system operation. Blockage of the system will result in decreasing fuel flow and eventual engine stoppage. Venting is accomplished by an interconnecting line from the right fuel tank to the left tank. The left fuel tank is vented overboard through a vent line, equipped with a check valve, which protrudes from the bottom surface of the left wing near the wing strut. Both fuel filler caps are also vented.

REDUCED TANK CAPACITY

The airplane may be serviced to a reduced capacity to permit heavier cabin loadings. This is accomplished by filling each tank to the bottom edge of the fuel filler tab, thus giving a reduced fuel load of 17.5 gallons usable in each tank.

FUEL SELECTOR VALVE

The fuel selector valve should be in the BOTH position for takeoff, climb, landing, and maneuvers that involve prolonged slips or skids of more than 30 seconds. Operation from either LEFT or RIGHT tank is reserved for cruising flight.

NOTE

When the fuel selector valve handle is in the BOTH position in cruising flight, unequal fuel flow from each 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. 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 and, therefore, some sloshing of fuel between tanks can be expected when the tanks are nearly full and the wings are not level.

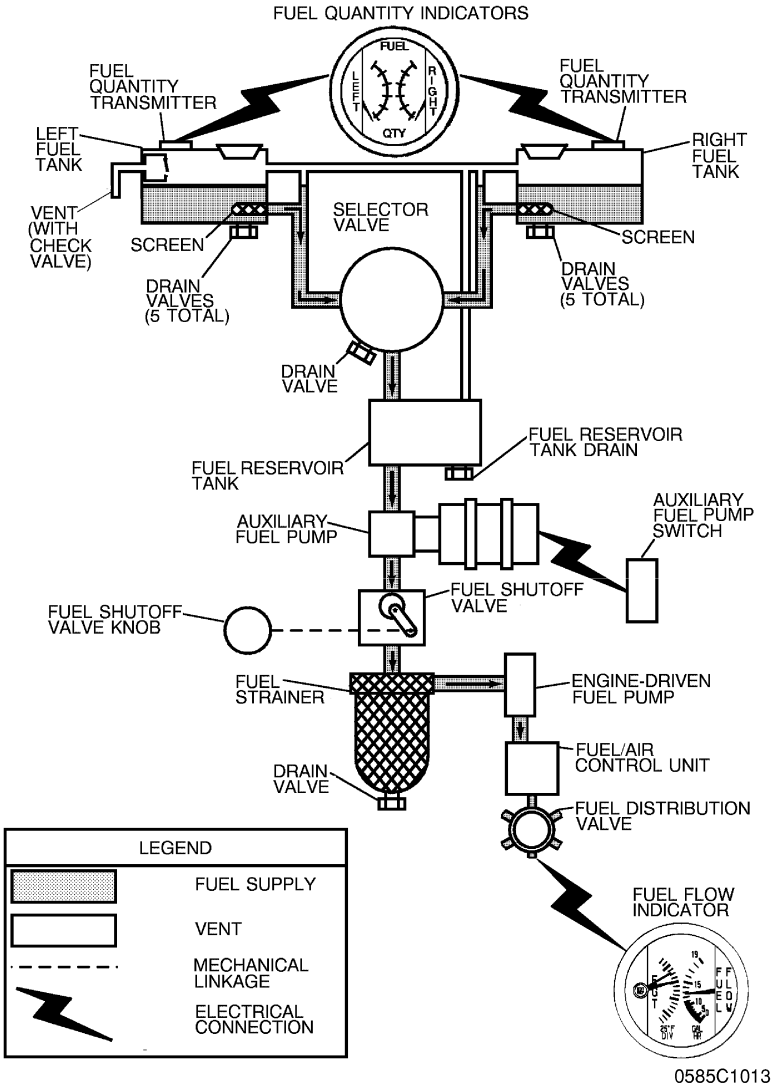


Figure 7-6. Fuel System Schematic
(Sheet 1 of 2)
172S8001 thru 172S9490

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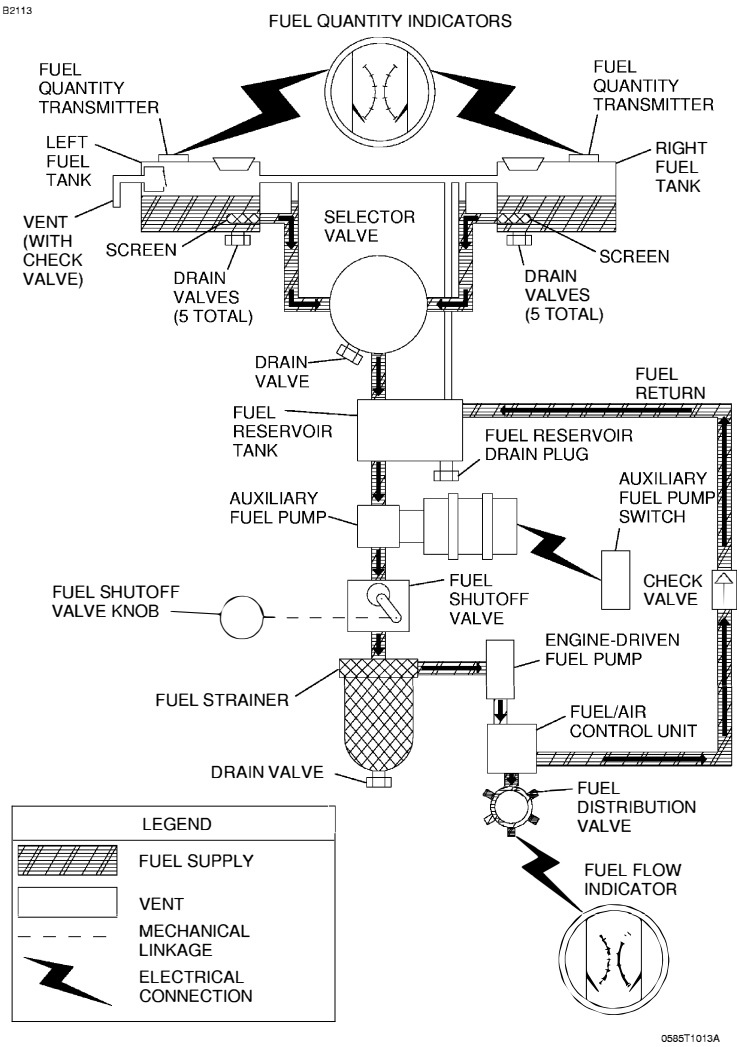


Figure 7-6. Fuel system Schematic
(Sheet 2 of 2)
172S9491 and On
and airplanes incorporating MK172-28-01.

NOTE

When the fuel tanks are 1/4 full or less, prolonged uncoordinated flight such as slips or skids can uncover the fuel tank outlets. Therefore, if operating with one fuel tank dry or if operating on LEFT or RIGHT tank when 1/4 full or less, do not allow the airplane to remain in uncoordinated flight for periods in excess of 30 seconds.

FUEL DRAIN VALVES

The fuel system is equipped with drain valves to provide a means for the examination of fuel in the system for contamination and grade. The system should be examined before each flight and after each refueling, by using the sampler cup provided to drain fuel from each wing tank sump, the fuel reservoir sump, the fuel selector drain and the fuel strainer sump. If any evidence of fuel contamination is found, it must be eliminated in accordance with the Preflight Inspection checklist and the discussion in Section 8 of this publication. If takeoff weight limitations for the next flight permit, the fuel tanks should be filled after each flight to prevent condensation.

BRAKE SYSTEM

The airplane has a single-disc, hydraulically actuated brake on each main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot's rudder pedals. The brakes are operated by applying pressure to the top of either the left (pilot's) or right (copilot's) set of rudder pedals, which are interconnected. When the airplane is parked, both main wheel brakes may be set by utilizing the parking brake which is operated by a handle under the left side of the instrument panel. To apply the parking brake, set the brakes with the rudder pedals, pull the handle aft, and rotate it 90° down.

For maximum brake life, keep the brake system properly maintained, and minimize brake usage during taxi operations and landings.

Some of the symptoms of impending brake failure are: gradual decrease in braking action after brake application, noisy or dragging brakes, soft or spongy pedals, and excessive travel and weak braking action. If any of these symptoms appear, the brake system is in need of immediate attention. If, during taxi or landing roll, braking action decreases, let up on the pedals and then reapply the brakes with heavy pressure. If the brakes become spongy or pedal travel increases, pumping the pedals should build braking pressure. If one brake becomes weak or fails, use the other brake sparingly while using opposite rudder, as required, to offset the good brake.

ELECTRICAL SYSTEM

The airplane is equipped with a 28-volt, direct current electrical system (Refer to Figure 7-7). The system is powered by a belt-driven, 60-amp alternator and a 24-volt battery, located on the left forward side of the firewall. Power is supplied to most general electrical circuits through a split primary bus bar, with an essential bus wired between the two primaries to provide power for the master switch, annunciator circuits and interior lighting.

Each primary bus bar is also connected to an avionics bus bar via a single avionics master switch. The primary buses are on anytime the master switch is turned on, and are not affected by starter or external power usage. The avionics buses are on when the master switch and avionics master switch are in the ON position.

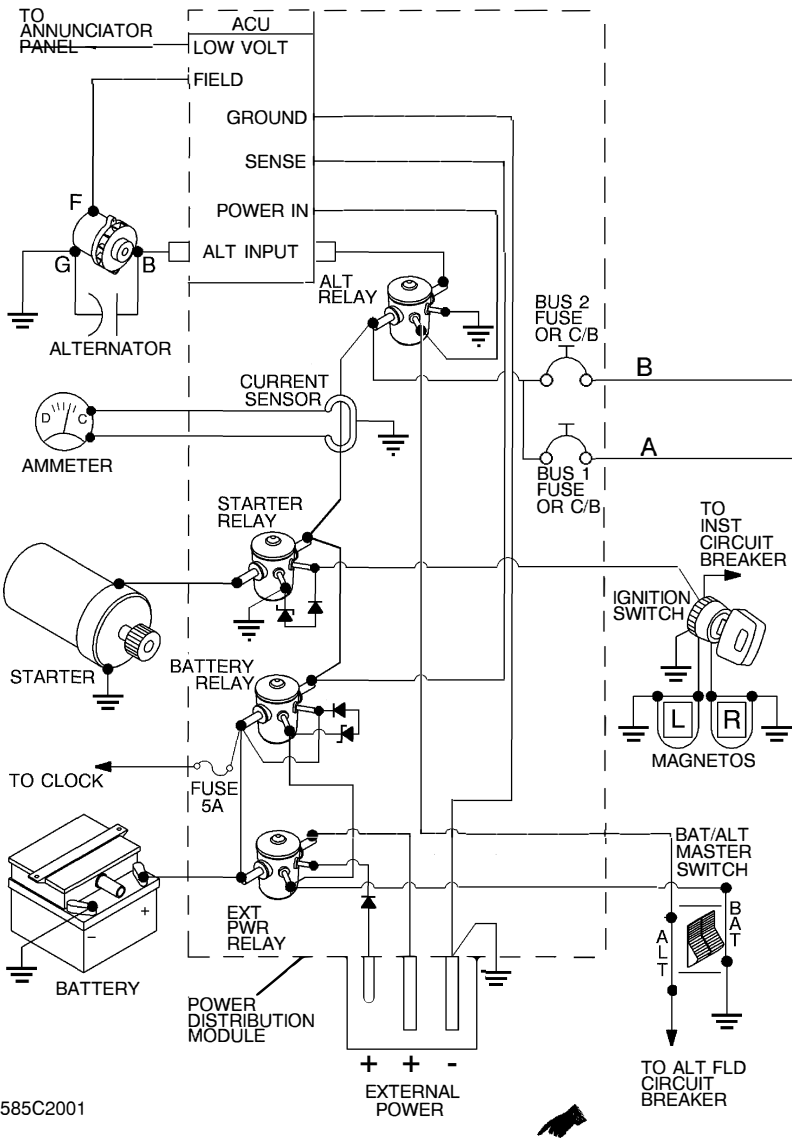


Figure 7-7. Electrical Schematic (Serials 172S8001 thru 172S8703)
(Sheet 1 of 2)

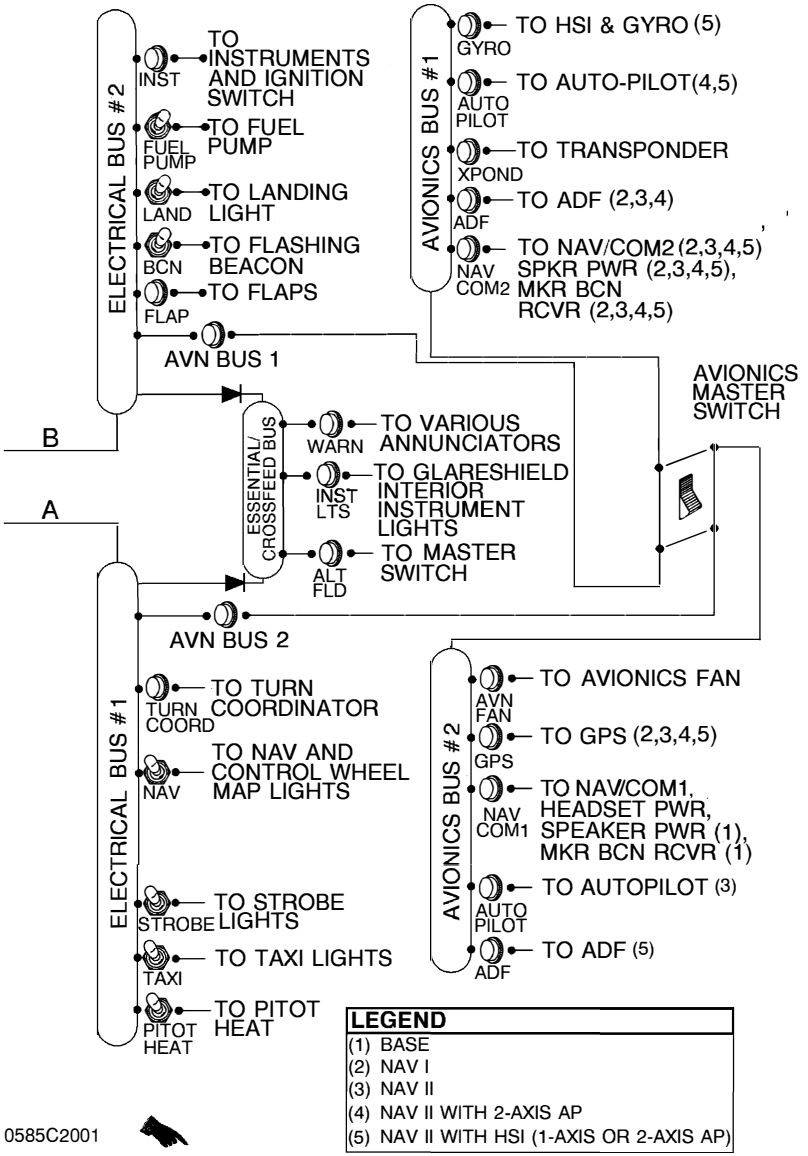


Figure 7-7. Electrical Schematic (Serials 172S8001 thru 172S8703)
(Sheet 2 of 2)

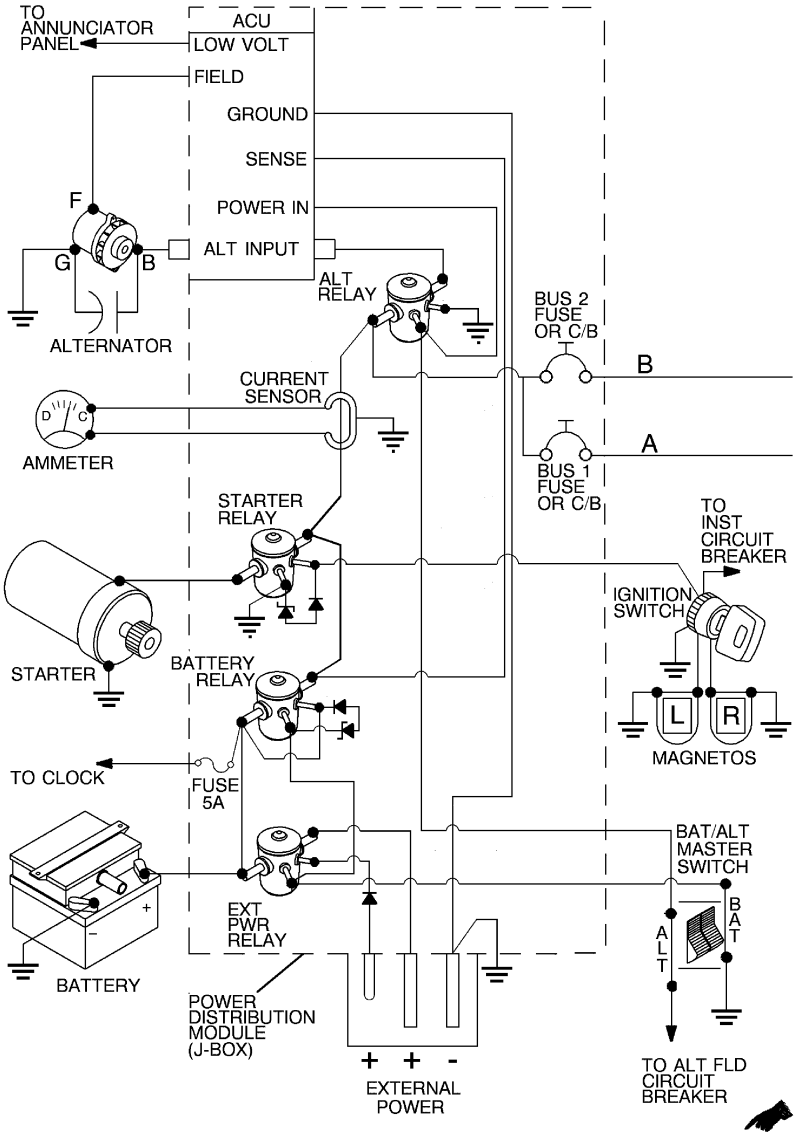


Figure 7-7A. Electrical Schematic (Serials 172S8704 and On)
(Sheet 1 of 2)

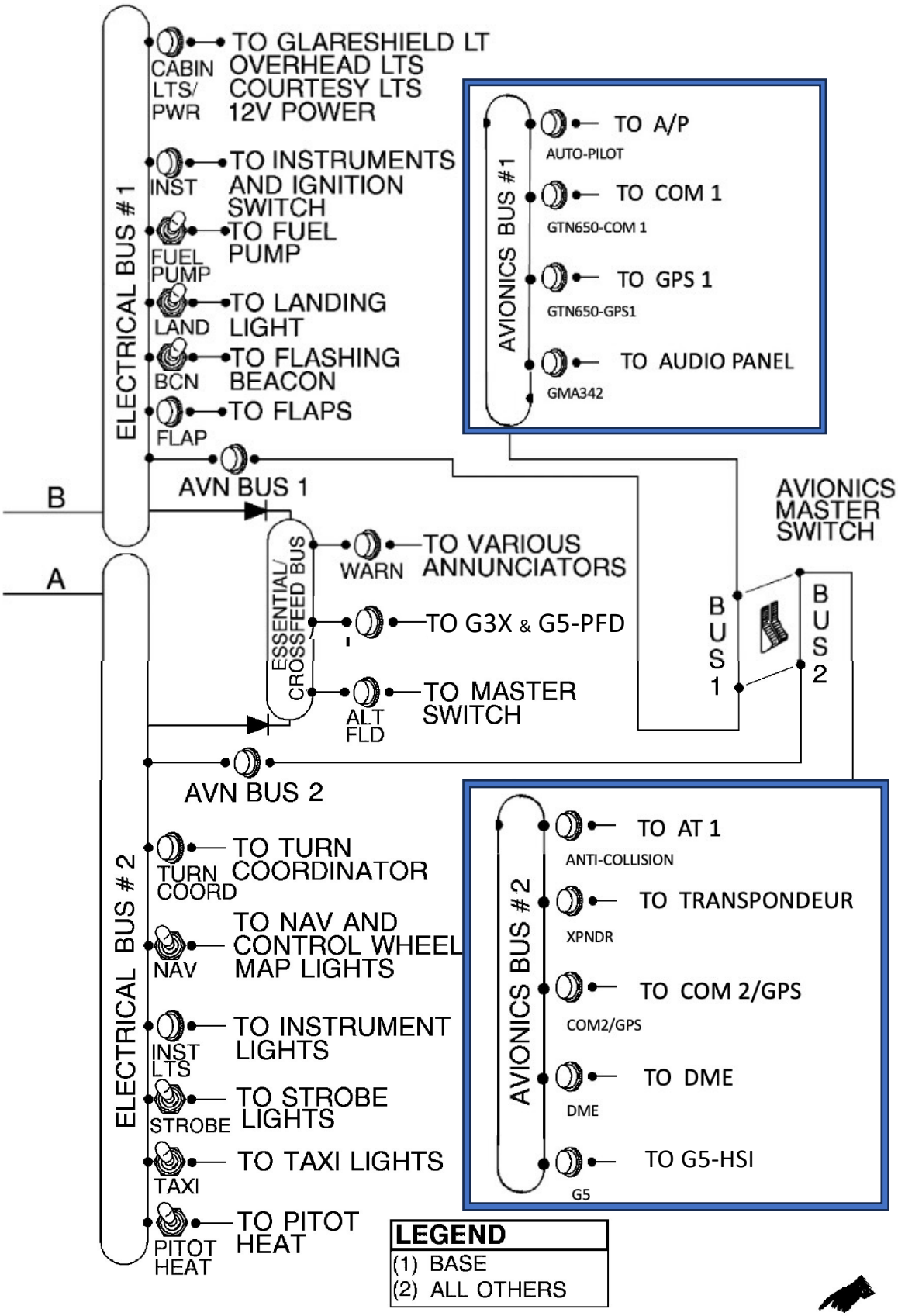


Figure 7-7A. Electrical Schematic (Serials 172S8704 and On)
(Sheet 2 of 2)

The airplane uses a power distribution module (J-Box), located on the left forward side of the firewall, to house all relays used throughout the airplane electrical system. In addition, the alternator control unit and the external power connector are housed within the module.

ANNUNCIATOR PANEL

An annunciator panel (with integral toggle switch) is located on the left side of the instrument panel and provides caution (amber) and warning (red) messages for selected portions of the airplane systems. The annunciator is designed to flash messages for approximately 10 seconds to gain the attention of the pilot before changing to steady on. The annunciator panel cannot be turned off by the pilot.

Inputs to the annunciator come from each fuel transmitter, the low oil pressure switch, and the alternator control unit (ACU). Individual LED bulbs illuminate each message and may be replaced through the rear of the annunciator. Illumination intensity can be controlled by placing the toggle switch in either the DIM or BRT positions (earlier serial number airplanes) or the DAY or NIGHT positions (later serial number airplanes).

The annunciator panel can be tested by placing the Master switch in the ON position and holding the annunciator panel test switch in the TST (earlier serial number airplanes) or the TEST (later serial number airplanes) position. All amber and red messages will flash until the switch is released.

NOTE

When the Master switch is turned ON, some annunciators will flash for approximately 10 seconds before illuminating steadily. When the annunciator panel test switch is held in the TST (earlier serial number airplanes) or the TEST (later serial number airplanes) position, all remaining lights will flash until the switch is released.

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

⚠ CAUTION

PRIOR TO TURNING THE MASTER SWITCH ON OR OFF, STARTING THE ENGINE OR APPLYING AN EXTERNAL POWER SOURCE, THE AVIONICS MASTER SWITCH SHOULD BE TURNED OFF TO PREVENT ANY HARMFUL TRANSIENT VOLTAGE FROM DAMAGING THE AVIONICS EQUIPMENT.

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. To check or use avionics equipment or radios while on the ground, the avionics power switch must also be turned on. 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 in the OFF position will reduce battery power low enough to open the battery contactor, remove power from the alternator field, and prevent alternator restart.

AVIONICS MASTER SWITCH

Electrical power for each Avionics Bus is supplied from a primary Electrical Bus. For airplane serial numbers 172S8001 through 172S8703, except for certain non-U.S. certified airplanes, both Avionics Buses are controlled by a single-section rocker-type Avionics Master switch. At serial number 172S8704 and on, a two-section or "split" rocker-type Avionics Master switch controls power to each Avionics Bus independently. Placing the rocker in the up (ON) position provides power to the Avionics Bus. Placing the rocker in the down (OFF) position removes power from the Avionics Bus. The Avionics Master switch is located on the lower left side of the instrument panel.

NOTE

For airplane serial numbers 172S8001 through 172S8703, aircraft certified outside the United States can have a two-section or "split" Avionics Master switch. The two-section Avionics Master switch enables independent operation of Avionics Bus 1 and Avionics Bus 2.

With the Avionics Master rocker in the OFF position, no electrical power is provided to the avionics, even when the Master switch or the individual avionics component equipment switches are in their ON positions. The Avionics Master switch (both sides, if two-section) should be placed in the OFF position before switching the Master switch ON or OFF, starting the engine, or applying an external power source.

Each avionics bus also incorporates a separate circuit breaker installed between the primary bus and the avionics master switch. In the event of an electrical malfunction, this breaker will trip and take the effected avionics bus off-line.

AMMETER

The ammeter/vacuum gage is located on the lower left side of the instrument panel. It indicates the amount of current, in amperes, from the alternator to the battery or from the battery to the airplane electrical system. When the engine is operating and the master switch is turned 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 battery discharge rate.

LOW VOLTAGE ANNUNCIATION

The low voltage warning annunciator is incorporated in the annunciator panel and activates when voltage falls below 24.5 volts. If low voltage is detected, the red annunciation VOLTS will flash for approximately 10 seconds before illuminating steadily. The pilot cannot turn off the annunciator.

In the event an overvoltage condition occurs, the alternator control unit automatically opens the ALT FLD circuit breaker, removing alternator field current and shutting off the alternator. The battery will then supply system current as shown by a discharge rate on the ammeter. Under these conditions, depending on electrical system load, the low voltage warning annunciator will illuminate when system voltage drops below normal. The alternator control unit may be reset by resetting the circuit breaker. If the low voltage warning annunciator extinguishes, normal alternator charging has resumed; however, if the annunciator illuminates again, a malfunction has occurred, and the flight should be terminated as soon as practicable.

NOTE

Illumination of the low voltage annunciator and ammeter discharge indications may occur during low RPM conditions with an electrical load on the system, such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM.

CIRCUIT BREAKERS AND FUSES

All circuit breakers inside the airplane are of the "push to reset" or “switch/breaker” type. The power distribution module uses spade type (automotive style) fuses and one glass type fuse (controlling the clock).

Spare fuses for the power distribution module are located inside the module. If one of the spare fuses is used, a replacement spare should be obtained and reinstalled before the next flight.

EXTERNAL POWER RECEPTACLE

An external power receptacle is integral to the power distribution module and allows the use of an external electrical power source for cold weather starting, and during lengthy maintenance work on electrical and avionics equipment. The receptacle is located on the left side of the engine cowling, just forward of the firewall and midway up the side. Access to the receptacle is gained by removing the cover plate (earlier serial number airplanes) or opening the hinged access door (later serial number airplanes).

The power distribution module (J-Box) incorporates a circuit which will close the battery contactor when external power is applied through the ground service plug receptacle with the master switch turned on. This feature is intended as a servicing aid when battery power is too low to close the contactor, and should not be used to avoid performing proper maintenance procedures on a low battery.

NOTE

- If no avionics equipment is to be used or serviced, the avionics master switch should be in the OFF position. If maintenance is required on the avionics equipment, use a regulated external power source to prevent damage to the avionics equipment by transient voltage. Do not crank or start the engine with the avionics master switch in the ON position.
- Before connecting an external power source (generator type or battery cart), the avionics master switch and the master switch should be turned off.

LIGHTING SYSTEMS

EXTERIOR LIGHTING

Exterior lighting consists of navigation lights on the wing tips and top of the rudder, a dual landing/taxi light configuration located in the left wing leading edge, a flashing beacon mounted on top of the vertical fin, and a strobe light on each wing tip. In addition, two courtesy lights are recessed into the lower surface of each wing and provide illumination for each cabin door area.

The exterior courtesy lights (and the rear cabin dome light) are turned on by pressing the rear cabin light switch. Pressing the rear cabin light switch again will extinguish the three lights. The remaining exterior lights are operated by breaker/switches located on the lower left instrument panel. To activate these lights, place switch in the UP position. To deactivate light, place in the DOWN position.

NOTE

The strobes and 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.

INTERIOR LIGHTING

Interior lighting is controlled by a combination of flood lighting, glareshield lighting, pedestal lighting, panel lighting, radio lighting and pilot control wheel lighting.

Flood lighting is accomplished using two lights in the front and a single dome light in the rear. All flood lights are contained in the overhead console, and are turned on and off with push type switches located near each light. The two front lights are individually rotatable, providing directional lighting for the pilot and front passenger. The rear dome light is a fixed position light and provides for general illumination in the rear cabin area.

Glareshield lighting is provided by either a fluorescent light or a series of LED lights recessed into the lower surface of the glareshield. This light is controlled by rotating the GLARESHIELD LT dimmer, located below the nav indicators. Rotating the dimmer clockwise increases light intensity, and rotating the dimmer counterclockwise decrease light intensity.

Pedestal lighting consists of a single, hooded light located above the fuel selector.This light is controlled by rotating the PEDESTAL LT dimmer, located below the nav indicators. Rotating the dimmer clockwise increases light intensity, and rotating the dimmer counterclockwise decreases light intensity.

Panel lighting is accomplished using individual lights mounted in each instrument and gauge. These lights are wired in parallel and are controlled by the PANEL LT dimmer, located below the nav indicators. Rotating the dimmer clockwise increases light intensity, and rotating the dimmer counterclockwise decreases light intensity.

Pilot control wheel lighting is accomplished by use of a rheostat and light assembly, located underneath the pilot control wheel. The light provides downward illumination from the bottom of the control wheel to the pilot's lap area. To operate the light, first turn on the NAV light switch, then adjust the map light intensity with the knurled rheostat knob. Rotating the dimmer clockwise increases light intensity, and rotating the dimmer counterclockwise decreases light intensity.

In addition to the RADIO LT dimmer, lighting intensity for the avionics displays and the NAV indicators (pilot's panel) is controlled by the annunciator panel test switch. When the switch is in the BRT position (earlier serial number airplanes) or the DAY position (later serial number airplanes), this lighting may be off regardless of the RADIO LT dimmer position.

Regardless of the light system in question, the most probable cause of a light failure is a burned out bulb. However, in the event any of the lighting systems fail to illuminate when turned on, check the appropriate circuit breaker. If the circuit breaker has opened, and there is no obvious indication of a short circuit (smoke or odor), turn off the light switch of the affected light, reset the breaker, and turn the switch on again. If the breaker opens again, do not reset it.

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

The temperature and volume of airflow into the cabin can be regulated by manipulation of the push-pull CABIN HT and CABIN AIR controls (Refer to Figure 7-8). Both controls are the double-button locking type and permit intermediate settings.

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 inch 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 just aft of the rudder pedals at floor level. Windshield defrost air is also supplied by two ducts leading from the cabin manifold to defroster outlets near the lower edge of the windshield. Two knobs control sliding valves in either defroster outlet to 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 ventilators are available for the rear cabin area to supply air to the rear seat passengers. There are additional ventilators located in various positions in the cockpit.

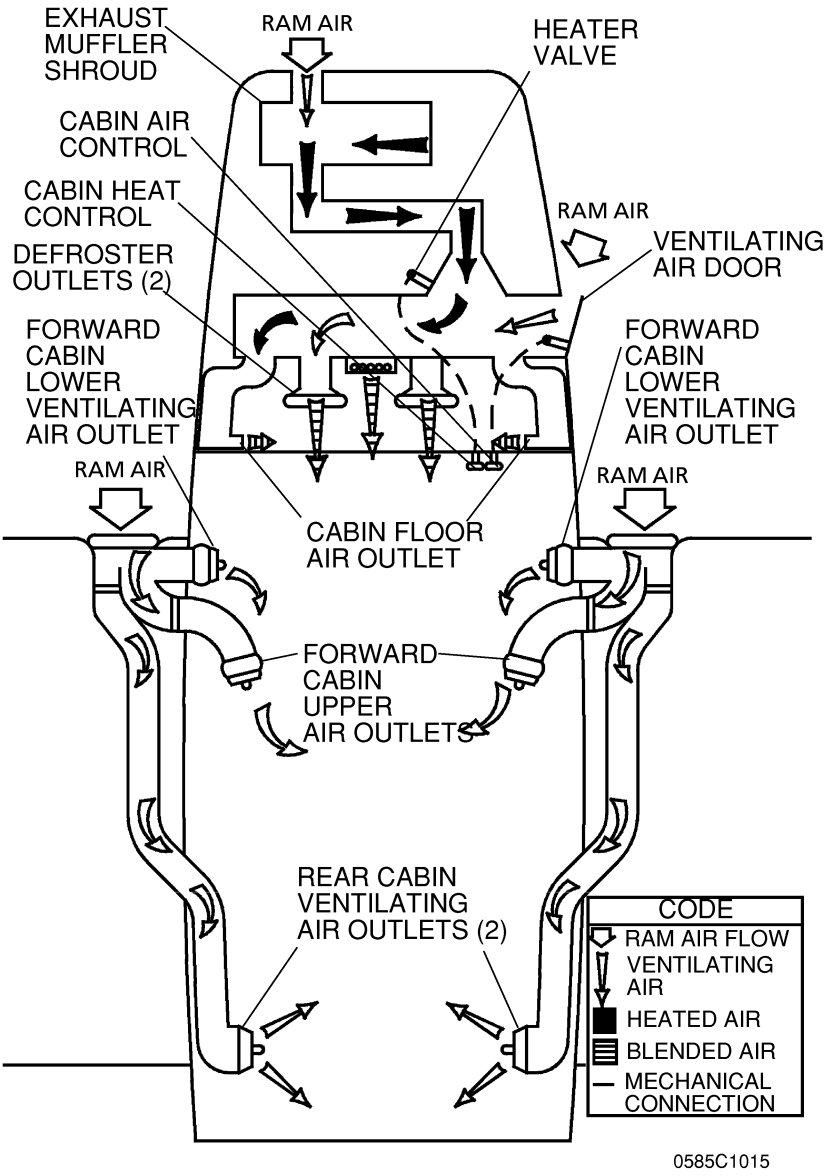


Figure 7-8. Cabin Heating, Ventilating and Defrosting System.

PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, vertical speed indicator and altimeter. The system is composed of a heated pitot tube mounted on the lower surface of the left wing, an external static port on the lower left side of the forward fuselage, and the associated plumbing necessary to connect the instruments to the sources.

The heated pitot system consists of a heating element in the pitot tube, a 5-amp switch/breaker labeled PITOT HEAT, and associated wiring. The switch/breaker is located on the lower left side of the instrument panel. When the pitot heat switch is turned on, the element in the pitot tube is heated electrically to maintain proper operation in possible icing conditions.

A static pressure alternate source valve is installed below the throttle, and can be used if the external static source is malfunctioning. This valve supplies static pressure from inside the cabin instead of the external static port.

If erroneous instrument readings are suspected due to water or ice in the pressure line going to the standard external static pressure source, the alternate static source valve should be pulled on.

Pressures within the cabin will vary with open heater/vents and windows. Refer to Section 5 for the effect of varying cabin pressures on airspeed readings.

VACUUM

The vacuum system is not applicable, because, it was removed

INSTRUMENTS

The G3X (full primary flight display -PFD) and G5 use solid-state AHRS reference to provide smooth, steady and reliable horizon-based pitch and roll indications. In addition to aircraft attitude, these EFIS will also support display of airspeed, altitude, vertical speed, slip/skid, turn rate, configurable V-speed references, barometric setting and selected altitude — as well as visual alerts upon arriving at a preselected altitude. A built-in GPS receiver provides highly accurate groundspeed and ground track readouts. Plus, a dedicated rotary knob on the unit allows for easy adjustments to altitude bugs and barometric pressure settings.

AIRSPEED INDICATOR

The Airspeed Indicator displays airspeed on a rolling number gauge using a moving tape. The true airspeed (TAS) is displayed in knots above the Airspeed Indicator. The numeric labels and major tick marks on the moving tape are marked at intervals of 10 knots, miles per hour, or kilometers (depending on system configuration). Speed indication starts at 30 knots. The actual airspeed is displayed inside the black pointer. The pointer remains black until reaching never-exceed speed (VNE), at which point it turns red. A color-coded (red, white, green, yellow, and red/white “barber pole”) speed range strip is located on the moving tape. The colors denote flaps operating range, normal operating range, caution range, and never-exceed speed (VNE). A red range is also present for low speed awareness.

VERTICAL SPEED INDICATOR

The Vertical Speed Indicator displays the aircraft vertical speed using a non-moving tape labeled in fpm with minor tick marks every 100 feet up to 1000 fpm and major tick marks every 500 feet. The current vertical speed is displayed using a white arrow along the tape.

ALTIMETER

The Altimeter displays 400 feet of barometric altitude values at a time on a rolling number gauge using a moving tape. Numeric labels and major tick marks are shown at intervals of 100 feet. Minor tick marks are at intervals of 20 feet. The current altitude is displayed in the black pointer.

If a G5 Standby Flight Instrument is installed, the barometric pressure setting can be synchronized between the G5 and the G3X Touch PFD. When the barometric setting is changed on one of them, the barometic setting on the other turns inverse video cyan while the value is changing.

ATTITUDE INDICATOR

Attitude information is displayed over a virtual blue sky and brown ground with a white horizon line. The Attitude Indicator displays the pitch (indicated by the yellow symbolic aircraft on the pitch scale), roll, and slip/skid information.
The horizon line is part of the pitch scale. Pitch markings occur at 2.5˚ intervals through all pitch ranges.
The inverted white triangle indicates zero on the roll scale. Major tick marks at 30˚ and 60˚ and minor tick marks at 10˚, 20˚, and 45˚ are shown to the left and right of the zero. Angle of bank is indicated by the position of the pointer on the roll scale. Slip/skid is indicated by the location of the ball.
The Standard Rate Turn Bank Angle Pointers are green pointers displayed on the roll scale that shows the bank angle that is needed for a standard rate turn.

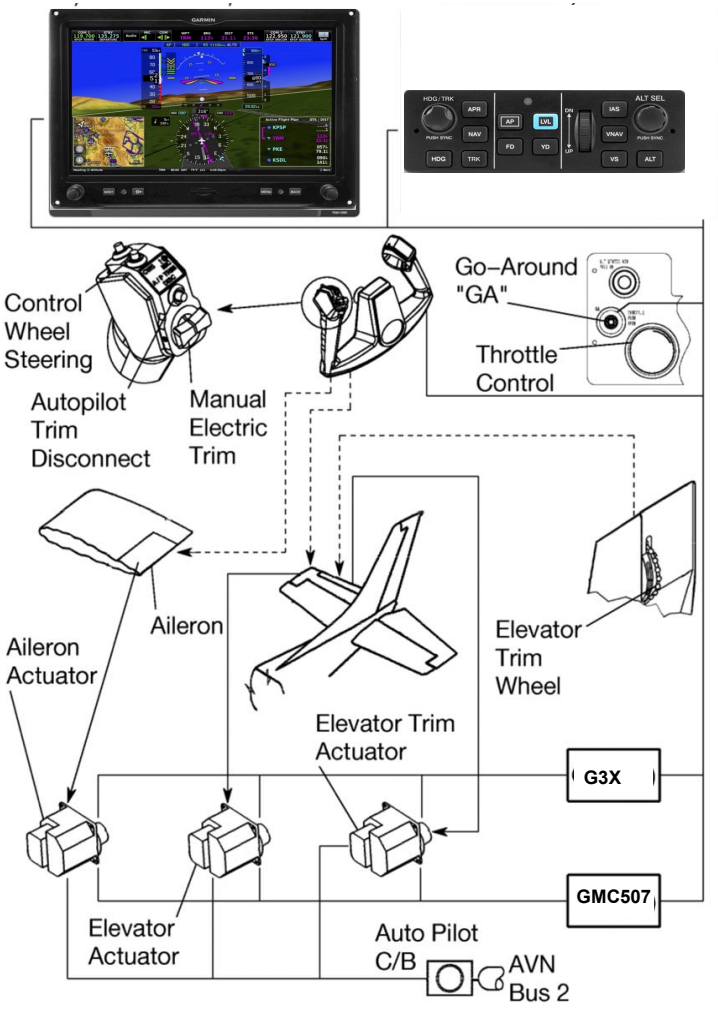
HORIZONTAL SITUATION INDICATOR (HSI)

The Horizontal Situation Indicator (HSI) displays a rotating compass card in a heading-up orientation at the bottom of the page. Letters indicate the cardinal points and numeric labels occur every 30˚. Major tick marks are at 10˚ intervals and minor tick marks at 5˚ intervals. The current track is represented on the HSI by a magenta triangle and dashed line. The HSI also presents course deviation, bearing, and navigation source information.

The Selected Heading is shown to the left of the HSI The cyan bug on the compass rose corresponds to the Selected Heading.

GFC 500 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

Refer to the Garmin GFC500 pilot guide for more information on system operation.



~~CONTROL WHEEL STEERING (CWS)~~

~~The Control Wheel Steering (CWS) button, located on the pilot's control wheel, immediately disconnects the pitch and roll servos when activated. Large pitch changes while using CWS will cause the airplane to be out of trim. Retrim the airplane as necessary during CWS operation to reduce control forces or large pitch oscillations that may occur after releasing the CWS button~~.

WARNING
WHEN THE AUTOPILOT IS ENGAGED IN NAV, APR OR BC OPERATING MODES, IF THE HSI NAVIGATION SOURCE IS CHANGED MANUALLY, USING THE CDI SOFTKEY, THE CHANGE WILL INTERRUPT THE NAVIGATION SIGNAL TO THE AUTOPILOT AND WILL CAUSE THE AUTOPILOT TO REVERT TO ROL MODE OPERATION. NO AURAL ALERT WILL BE PROVIDED. IN ROL MODE, THE AUTOPILOT WILL ONLY KEEP THE WINGS LEVEL AND WILL NOT CORRECT THE AIRPLANE HEADING OR COURSE. SET THE HDG BUG TO THE CORRECT HEADING AND SELECT THE CORRECT NAVIGATION SOURCE ON THE HSI, USING THE CDI SOFTKEY, BEFORE ENGAGING THE AUTOPILOT IN ANY OTHER OPERATING MODE.

CLOCK / O.A.T. INDICATOR

An integrated clock / O.A.T. / voltmeter is installed in the upper left side of the instrument panel as standard equipment. For a complete description and operating instructions, refer to the Supplements, Section 9.

STALL WARNING SYSTEM

The airplane is equipped with a pneumatic type stall warning system consisting of an inlet in the leading edge of the left wing, an air-operated horn near the upper left corner of the windshield, and associated plumbing. As the airplane approaches a stall, the low pressure on the upper surface of the wings moves forward around the leading edge of the wings. This low pressure creates a differential pressure in the stall warning system which draws air through the warning horn, resulting in an audible warning at 5 to 10 knots above stall in all flight conditions.

AVIONICS

This aircraft was modified by certified FAA/EASA STC with the following equipment:

GTN650	Nav/Com/GPS 1 linked with the G3X
GNC355	GPS/Com 2 Together
TT31	Transponder mode S & ADS-B
GMA342	Audio Panel
GFC500	Autopilot
G3X Touch	PFD/MFD
DUAL-G5	PFD/HSI standby instruments
Kannag	Emergency Locator Transmitter (EL T)

Additional equipment:

AT1	Air Traffic Anti-collision
KN-62	DME

For complete operating instructions on the standard and optional avionics systems, refer to the Supplements, Section 9.

AVIONICS SUPPORT EQUIPMENT

Avionics operations are supported by the avionics cooling fan, microphone and headset installations and static discharge wicks.

AVIONICS COOLING FAN

An avionics cooling fan is installed on the left side of the interior firewall. The system utilizes a single electric fan and associated ductwork to force-cool the center stack radios.

Power to the electric fan is supplied through the AVN FAN circuit breaker. The fan operates whenever the Master and Avionics Master switches are both ON.

MICROPHONE AND HEADSET INSTALLATIONS

Standard equipment for the airplane includes a hand-held microphone, an overhead speaker, two remote-keyed microphone switches on the control wheels, and provisions for boom mic/headsets at each pilot and passenger station.

The hand-held microphone contains an integral push-to-talk switch. This microphone is plugged into the center pedestal and is accessible to both the pilot and front passenger. Depressing the push-to-talk switch allows audio transmission on the Com radios.

The overhead speaker is located in the center overhead console. Volume and output for this speaker is controlled through the audio panel.

Each control wheel contains a miniature push-to-talk switch. This switch allows the pilot or front passenger to transmit on the Com radios using remote mics.

Each station of the airplane is wired for aviation-style headsets. Mic and headphone jacks are located on each respective arm rest and allow for communications between passengers and pilot. The system is wired so that microphones are all voice-activated. Additional wiring provisions inside the audio panel ensure that only the pilot or front passenger can transmit through the com radios.

NOTE

To ensure audibility and clarity when transmitting with the handheld microphone, always hold it as closely as possible to the lips, then key the microphone and speak directly into it. Avoid covering opening on back side of microphone for optimum noise canceling.

STATIC DISCHARGERS

Static wicks (static dischargers) are installed at various points throughout the airframe to reduce interference from precipitation static. Under some severe static conditions, loss of radio signals is possible even with static dischargers installed. Whenever possible, avoid known severe precipitation areas to prevent loss of dependable radio signals. If avoidance is impractical, minimize airspeed and anticipate temporary loss of radio signals while in these areas.

Static dischargers lose their effectiveness with age, and therefore, should be checked periodically (at least at every annual inspection) by qualified avionics technicians, etc.

CABIN FEATURES

EMERGENCY LOCATOR TRANSMITTER (ELT)

A remote switch/annunciator is installed on the right top location of the copilot's instrument panel.

The test must be carried out with a VHF receiver either with the aircraft VHF receiver or with a not onboard VHF receiver.

IMPORTANT: Aircraft VHF receiver may be used only if 406 MHz test was carried out with a Cospas-Sarsat decoder, otherwise check 121.5 MHz using a VHF receiver (not the onboard VHF receiver) several dozens meters away from the antenna. This ensures to validate the antenna.

The short 121.5 MHz transmission may be received by a nearby control tower. According to your local regulations, it may be recommended to conduct this test during the first five minutes of any UTC hour.
This test must be carried out with a VHF receiver.

- Tune aircraft radio to 121.5 MHz and ensure you can hear it.
- Switch from the “OFF” position to the “ARM” position or press RESET & TEST on the Remote Control Panel (ensure that the ELT switch is in the “ARM” position).
- Close to the end of self-test as short (3-4sweeps) 121.5 transmission is made.
- Check on the VHF receiver that the 121.5 signal is received with a strong level.

NOTE: at the end of the self-test, the test result is displayed with the red visual indicator and the buzzer will sound:

- One long flash indicates that the system is operational and that no error conditions were found.
- A series of short flashes indicates the test has failed.

CABIN FIRE EXTINGUISHER ***as been removed***

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SECTION 8

AIRPLANE HANDLING, SERVICE & MAINTENANCE

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INTRODUCTION

This section contains factory recommended procedures for proper ground handling and routine care and servicing of your airplane. It also identifies certain inspection and maintenance requirements which must be followed if your airplane is to retain that new airplane performance and dependability. It is important to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered in your local area.

Keep in touch with your local Cessna Service Station and take advantage of their knowledge and experience. Your Cessna Service Station knows your airplane and how to maintain it, and will remind you when lubrications and oil changes are necessary, as well as other seasonal and periodic services.

The airplane should be regularly inspected and maintained in accordance with information found in the airplane maintenance manual and in company issued service bulletins and service newsletters. All service bulletins pertaining to the aircraft by serial number should be accomplished and the airplane should receive repetitive and required inspections. Cessna does not condone modifications, whether by Supplemental Type Certificate or otherwise, unless these certificates are held and/or approved by Cessna. Other modifications may void warranties on the airplane since Cessna has no way of knowing the full effect on the overall airplane. Operation of an airplane that has been modified may be a risk to the occupants, and operating procedures and performance data set forth in the operating handbook may no longer be considered accurate for the modified airplane.

IDENTIFICATION PLATE

All correspondence regarding your airplane should include the Serial Number. The Serial Number, Model Number, Production Certificate Number (PC) and Type Certificate Number (TC) can be found on the Identification Plate, located on the aft left tailcone. A secondary Identification Plate is installed on the lower part of the left forward doorpost on earlier serial number airplanes. The Finish and Trim Plate, located on the lower part of the left forward doorpost, contains a code describing the exterior paint configuration for the airplane. The code may be used in conjunction with an applicable Illustrated Parts Catalog if finish and trim information is needed.

CESSNA OWNER ADVISORIES

Cessna Owner Advisories are sent to Cessna Aircraft FAA Registered owners of record at no charge to inform them about mandatory and/or beneficial aircraft service requirements and product changes. Copies of the service bulletins are available from Cessna Service Stations and Cessna Customer Service.

UNITED STATES AIRPLANE OWNERS

If your airplane is registered in the U. S., appropriate Cessna Owner Advisories will be mailed to you automatically according to the latest aircraft registration name and address which you have provided to the FAA. Therefore, it is important that you provide correct and up-to-date mailing information to the FAA.

If you require a duplicate Owner Advisory to be sent to an address different from the FAA aircraft registration address, please complete and return an Owner Advisory Application (otherwise no action is required on your part).

INTERNATIONAL AIRPLANE OWNERS

To receive Cessna Owner Advisories, please complete and return an Owner Advisory Application.

Receipt of a valid Owner Advisory Application will establish your Cessna Owner Advisory service for one year, after which you will be sent a renewal notice. It is important that you respond promptly to update your address for this critical service.

PUBLICATIONS

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

- Customer Care Program Handbook
- Pilot's Operating Handbook and FAA Approved Airplane Flight Manual
- Pilot's Checklist
- Passenger Briefing Card
- Cessna Sales and Service Directory

To obtain additional publications or Owner Advisory information, you may contact Cessna's Product Support Department at (316) 517-5800. Fax (316) 942-9006 or write to The Cessna Aircraft Company, P.O. Box 7706, Wichita, KS 67277, Dept 751C.

The following additional publications, plus many other supplies that are applicable to your airplane, are available from your local Cessna Service Station.

- Information Manual (contains Pilot's Operating Handbook Information)
- Maintenance Manual, Wiring Diagram Manual and Illustrated Parts Catalog

Your local Cessna Service Station has a Customer Care Supplies and Publications Catalog covering all available items, many of which the Service Station keeps on hand. The Service Station can place an order for any item which is not in stock.

NOTE

A Pilot's Operating Handbook and FAA Approved Airplane Flight Manual which is lost or destroyed may be replaced by contacting your local Cessna Service Station. An affidavit containing the owner's name, airplane serial number and reason for replacement must be included in replacement requests since the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual is identified for specific serial numbered airplanes only.

AIRPLANE FILE

There are miscellaneous data, information and licenses that are a part of the airplane file. The following is a checklist 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.

To be displayed in the airplane 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 applicable).

To be carried in the airplane at all times:

1. Current Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.
2. Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
3. Equipment List.

To be made available upon request:

1. Airplane Logbook.
2. Engine Logbook.

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 airplanes not registered in the United States should check with their own aviation officials to determine their individual requirements.

Cessna recommends that these items, plus the Pilot's Checklists, Customer Care Program Handbook and Customer Care Card, be carried in the airplane at all times.

AIRPLANE INSPECTION PERIODS

FAA REQUIRED INSPECTIONS

As required by U.S. 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.

The FAA may require other inspections by the issuance of airworthiness directives applicable to the airplane, engine, propeller and components. It is the responsibility of the owner/operator to ensure compliance with all applicable airworthiness directives, and when the inspections are repetitive, to take appropriate steps to prevent inadvertent noncompliance.

CESSNA INSPECTION PROGRAMS

In lieu of the 100 hour and annual inspection requirements, an airplane may be inspected in accordance with a Progressive Care Inspection Program or a PhaseCard Inspection Program. Both programs offer systems which allow the work load to be divided into smaller operations that can be accomplished in shorter time periods.

The Cessna Progressive Care Inspection Program allows an airplane to be inspected and maintained in four operations. The four operations are recycled each 200 hours and are recorded in a specially provided Aircraft Inspection Log as each operation is conducted.

The PhaseCard Inspection Program offers a parallel system for high-utilization flight operations (approximately 600 flight hours per year). This system utilizes 50 hour intervals (Phase 1 and Phase 2) to inspect high-usage systems and components. At 12 months or 600 flight hours, whichever occurs first, the airplane undergoes a complete (Phase 3) inspection.

Regardless of the inspection method selected, the owner should keep in mind that FAR Part 43 and FAR Part 91 establishes the requirement that properly certified agencies or personnel accomplish all required FAA inspections and most of the manufacturer recommended inspections.

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 Handbook supplied with your airplane. The Customer Care Program Handbook should be thoroughly reviewed and kept in the airplane at all times.

You will also want to return to your Cessna Service Station 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 airplane. While these important inspections will be performed for you by any Cessna Service Station, in most cases you will prefer to have the Cessna Service Station from whom you purchased the airplane accomplish this work.

PILOT CONDUCTED PREVENTIVE MAINTENANCE

A certified pilot who owns or operates an airplane not used as an air carrier is authorized by FAR Part 43 to perform limited maintenance on his airplane. Refer to FAR Part 43 for a list of the specific maintenance operations which are allowed.

NOTE

Pilots operating airplanes of other than U.S. registry should refer to the regulations of the country of certification for information on preventive maintenance that may be performed by pilots.

A Maintenance Manual must be obtained prior to performing any preventive maintenance to ensure that proper procedures are followed. Your local Cessna Service Station should be contacted for further information or for required maintenance which must be accomplished by appropriately licensed personnel.

ALTERATIONS OR REPAIRS

It is essential that the FAA be contacted prior to any alterations on the airplane to ensure that airworthiness of the airplane is not violated. Alterations or repairs to the airplane must be accomplished by licensed personnel, utilizing only FAA Approved components and FAA Approved data, such as Cessna Service Bulletins.

GROUND HANDLING

TOWING

The airplane is most easily and safely maneuvered by hand with the tow bar attached to the nose wheel (the tow bar is stowed on the side of the baggage area). When towing with a vehicle, do not exceed the nose gear turning angle of 30° either side of center, or damage to the nose landing gear will result.

⚠ CAUTION

REMOVE ANY INSTALLED RUDDER LOCK BEFORE TOWING.

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 tire or deflated strut will also increase tail height.

PARKING

When parking the airplane, head into the wind and set the parking brake. Do not set the parking brake during cold weather when accumulated moisture may freeze the brakes, or when the brakes are overheated. Install the control wheel lock and chock the wheels. In severe weather and high wind conditions, tie the airplane down as outlined in the following paragraph.

TIE-DOWN

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

1. Set the parking brake and install the control wheel lock.
2. Install a surface control lock over the fin and rudder.
3. Tie sufficiently strong ropes or chains (700 pounds tensile strength) to the wing, tail and nose tie-down fittings and secure each rope or chain to a ramp tie-down.
4. Install a pitot tube cover.

JACKING

When a requirement exists to jack the entire airplane off the ground, or when wing jack points are used in the jacking operation, refer to the Maintenance Manual for specific procedures and equipment required.

Individual main gear may be jacked by using the jack pad which is incorporated in the main landing gear strut step bracket. When using the individual gear strut jack pad, flexibility of the gear strut will cause the main wheel to slide inboard as the wheel is raised, tilting the jack. The jack must then be lowered for a second jacking operation. Do not jack both main wheels simultaneously using the individual main gear jack pads.

⚠ CAUTION

DO NOT APPLY PRESSURE ON THE ELEVATOR OR HORIZONTAL STABILIZER SURFACES. WHEN PUSHING ON THE TAILCONE, ALWAYS APPLY PRESSURE AT A BULKHEAD TO AVOID BUCKLING THE SKIN.

If nose gear maintenance is required, the nose wheel may be raised off the ground by pressing down on a tailcone bulkhead, just forward of the horizontal stabilizer, and allowing the tail to rest on the tail tie-down ring.

To assist in raising and holding the nose wheel off the ground, ground anchors should be utilized at the tail tie down point.

NOTE

Ensure that the nose will be held off the ground under all conditions by means of suitable stands or supports under weight supporting bulkheads near the nose of the airplane.

LEVELING

Longitudinal leveling of the airplane is accomplished by placing a level on leveling screws located on the left side of the tailcone. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level. Corresponding points on both upper door sills may be used to level the airplane laterally.

FLYABLE STORAGE

Airplanes 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 helps prevent any accumulation of corrosion on engine cylinder walls.

⚠ WARNING

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 airplane 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 airplane is to be stored temporarily, or indefinitely, refer to the Maintenance Manual for proper storage procedures.

SERVICING

In addition to the Preflight Inspection covered in Section 4 of this handbook, complete servicing, inspection and test requirements for your airplane are detailed in the Maintenance Manual. The Maintenance Manual outlines all items which require attention at specific intervals plus those items which require servicing, inspection, and/or testing at special intervals.

Since Cessna Service Stations conduct all service, inspection, and test procedures in accordance with applicable Maintenance Manuals, it is recommended that you contact your local Cessna Service Station concerning these requirements and begin scheduling your airplane 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 airplane is being operated.

For quick and ready reference, quantities, materials and specifications for frequently used service items are as follows.

OIL

OIL SPECIFICATION

MIL-L-6082 or SAE J1966 Aviation Grade Straight Mineral Oil: Used when the airplane was delivered from the factory and should be used to replenish the supply during the first 25 hours. This oil should be drained and filter replaced after the first 25 hours of operation. Refill the engine and continue to use until a total of 50 hours has accumulated or oil consumption has stabilized.

MIL-L-22851 or SAE J1899 Aviation Grade Ashless Dispersant Oil: Oil conforming to Textron Lycoming Service Instruction No. 1014, and all revision and supplements thereto, must be used after first 50 hours, or when oil consumption has stabilized.

RECOMMENDED VISCOSITY FOR TEMPERATURE RANGE

Multiviscosity or straight grade oil may be used throughout the year for engine lubrication. Refer to the following table for temperature verses viscosity ranges.

Temperature	MIL-L-6082 or SAE J1966 Straight Mineral Oil SAE Grade	MIL-L-22851 or SAE J1899 Ashless Dispersant SAE Grade
Above 27°C (80°F)	60	60
Above 16°C (60°F)	50	40 or 50
-1°C (30°F) to 32°C (90°F)	40	40
-18°C (0°F) to 21°C (70°F)	30	30, 40 or 20W-40
Below -12°C (10°F)	20	30 or 20W-30
-18°C (0°F) - 32°C (90°F)	20W-50	20W-50 or 15W-50
All Temperatures	---	15W-50 or 20W-50

CAPACITY OF ENGINE SUMP

The engine lubrication system has a total capacity of 9 quarts of oil, with the oil filter accounting for 1 quart of that total. The engine oil sump (crankcase) has a capacity of 8 quarts. The engine must not be operated with less than 5 quarts in the sump. For extended flights, the engine oil level should be at 8 quarts.

OIL AND OIL FILTER CHANGE

After the first 25 hours of operation, drain the engine oil sump and replace the filter. Refill sump with straight mineral oil and use until a total of 50 hours has accumulated or oil consumption has stabilized; then change to ashless dispersant oil. Ashless dispersant oil (and oil filter) should then be changed at time intervals set forth by the engine manufacturer.

NOTE

During the first 25 hour oil and filter change, a general inspection of the overall engine compartment is required. Items which are not normally checked during a preflight inspection should be given special attention. Hoses, metal lines and fittings should be inspected for signs of oil and fuel leaks, and checked for abrasions, chafing, security, proper routing and support, and evidence of deterioration. Inspect the intake and exhaust systems for cracks, evidence of leakage, and security of attachment. Engine controls and linkages should be checked for freedom of movement through their full range, security of attachment and evidence of wear. Inspect wiring for security, chafing, burning, defective insulation, loose or broken terminals, heat deterioration, and corroded terminals. Check the alternator belt in accordance with Maintenance Manual instructions, and retighten if necessary. A periodic check of these items during subsequent servicing operations is recommended.

FUEL

APPROVED FUEL GRADES (AND COLORS)

100LL Grade Aviation Fuel (Blue).
100 Grade Aviation Fuel (Green).

NOTE

Isopropyl alcohol or diethylene glycol monomethyl ether (DiEGME) may be added to the fuel supply in quantities not to exceed 1% (alcohol) or 0.15% (DiEGME) of total volume. Refer to Fuel Additives in later paragraphs for additional information.

FUEL CAPACITY

56.0 U.S. Gallons Total: 28.0 U.S. Gallons per tank.

NOTE

To ensure maximum fuel capacity when refueling and minimize cross feeding, the fuel selector valve should be placed in either the LEFT or RIGHT position and the airplane parked in a wings level, normal ground attitude. Refer to Figure 1-1 for a definition of normal ground attitude.

Service the fuel system after each flight, and keep fuel tanks full to minimize condensation in the tanks.

FUEL ADDITIVES

Strict adherence to recommended preflight draining instructions as called for in Section 4 will eliminate any free water accumulations from the tank sumps. While small amounts of water may still remain in solution in the gasoline, it will normally be consumed and go unnoticed in the operation of the engine.

One exception to this can be encountered when operating under the combined effect of: (1) use of certain fuels, with (2) high humidity conditions on the ground (3) followed by flight at high altitude and low temperature. Under these unusual conditions, small amounts of water in solution can precipitate from the fuel stream and freeze in sufficient quantities to induce partial icing of the engine fuel system.

While these conditions are quite rare and will not normally pose a problem to owners and operators, they do exist in certain areas of the world and consequently must be dealt with, when encountered.

Therefore, to help alleviate the possibility of fuel icing occurring under these unusual conditions, it is permissible to add isopropyl alcohol or diethylene glycol monomethyl ether (DiEGME) compound to the fuel supply.

The introduction of alcohol or DiEGME compound into the fuel provides two distinct effects: (1) it absorbs the dissolved water from the gasoline and (2) alcohol has a freezing temperature depressant effect.

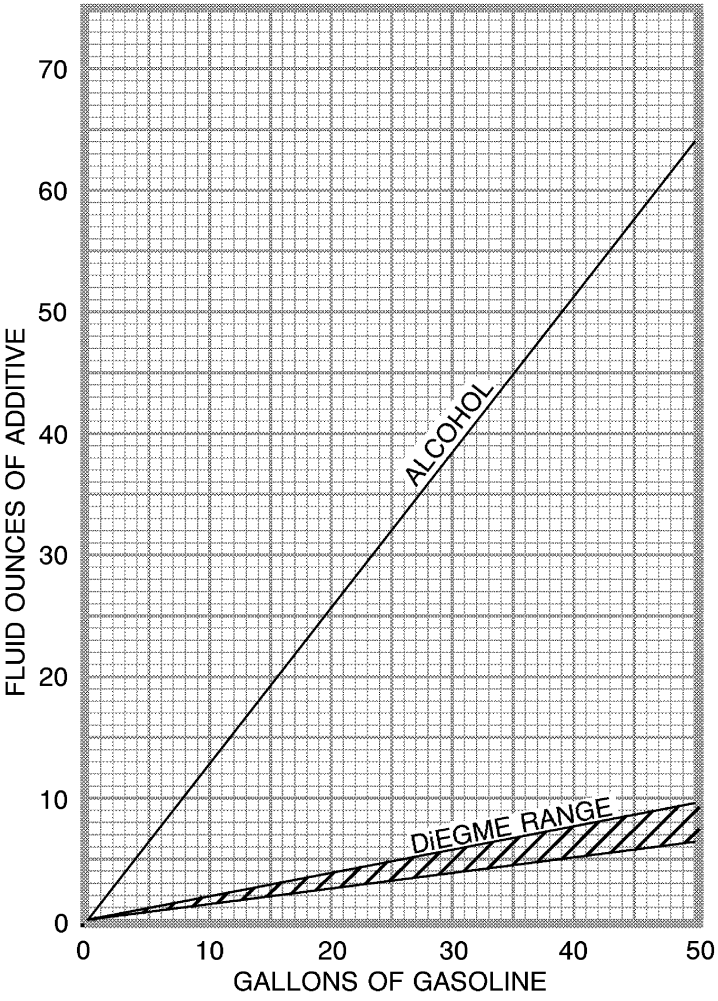
NOTE

When using fuel additives, it must be remembered that the final goal is to obtain a correct fuel-to-additive ratio in the tank, and not just with fuel coming out of the refueling nozzle. For example, adding 15 gallons of correctly proportioned fuel to a tank which contains 20 gallons of untreated fuel will result in a lower-than-acceptable concentration level to the 35 gallons of fuel which now reside in the tank.

Alcohol, if used, is to be blended with the fuel in a concentration of 1% by volume. Concentrations greater than 1% are not recommended since they can be detrimental to fuel tank materials.

The manner in which the alcohol is added to the fuel is significant because alcohol is most effective when it is completely dissolved in the fuel. To ensure proper mixing, the following is recommended:

1. For best results, the alcohol should be added during the fueling operation by pouring the alcohol directly on the fuel stream issuing from the fueling nozzle.



0585C1001

Figure 8-1. Fuel Mixing Ratio

2. An alternate method that may be used is to premix the complete alcohol dosage with some fuel in a separate clean container (approximately 2-3 gallon capacity) and then transferring this mixture to the tank prior to the fuel operation.

Diethylene glycol monomethyl ether (DiEGME) compound must be carefully mixed with the fuel in concentrations between 0.10% (minimum) and 0 .15% (maximum) of total fuel volume. Refer to Figure 8-1 for a DiEGME-to-fuel mixing chart.

⚠ CAUTION

ANTI-ICING ADDITIVE IS DANGEROUS TO HEALTH WHEN BREATHED AND/OR ABSORBED INTO THE SKIN.

⚠ CAUTION

MIXING OF DiEGME WITH FUEL IS EXTREMELY IMPORTANT. A CONCENTRATION IN EXCESS OF THAT RECOMMENDED (0.15% BY VOLUME MAXIMUM) MAY RESULT IN DETRIMENTAL EFFECTS TO THE FUEL TANK SEALANT, AND DAMAGE TO O-RINGS AND SEALS USED IN THE FUEL SYSTEM AND ENGINE COMPONENTS. A CONCENTRATION OF LESS THAN THAT RECOMMENDED (0.10% BY TOTAL VOLUME MINIMUM) WILL RESULT IN INEFFECTIVE TREATMENT. USE ONLY BLENDING EQUIPMENT THAT IS RECOMMENDED BY THE MANUFACTURER TO OBTAIN PROPER PROPORTIONING.

Prolonged storage of the airplane will result in a water buildup in the fuel which "leeches out" the additive. An indication of this is when an excessive amount of water accumulates in the fuel tank sumps. The concentration can be checked using a differential refractometer. It is imperative that the technical manual for the differential refractometer be followed explicitly when checking the additive concentration.

FUEL CONTAMINATION

Fuel contamination is usually the result of foreign material present in the fuel system, and may consist of water, rust, sand, dirt, microbes or bacterial growth. In addition, additives that are not compatible with fuel or fuel system components can cause the fuel to become contaminated.

Before each flight and after each refueling, use a clear sampler cup and drain at least a cupful of fuel from each fuel tank drain location and from the fuel strainer quick drain valve to determine if contaminants are present, and to ensure the airplane has been fueled with the proper grade of fuel.

If contamination is detected, drain **all** fuel drain points including the fuel reservoir and fuel selector quick drain valves and then gently rock the wings and lower the tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from all fuel drain points until **all** contamination has been removed. If, after repeated sampling, evidence of contamination still exists, the airplane should not be flown. Tanks should be drained and system purged by qualified maintenance personnel. All evidence of contamination must be removed before further flight. If the airplane has been serviced with the improper fuel grade, defuel completely and refuel with the correct grade. Do not fly the airplane with contaminated or unapproved fuel.

In addition, Owners/Operators who are not acquainted with a particular fixed base operator should be assured that the fuel supply has been checked for contamination and is properly filtered before allowing the airplane to be serviced. Fuel tanks should be kept full between flights, provided weight and balance considerations will permit, to reduce the possibility of water condensing on the walls of partially filled tanks.

To further reduce the possibility of contaminated fuel, routine maintenance of the fuel system should be performed in accordance with the airplane Maintenance Manual. Only the proper fuel, as recommended in this handbook, should be used, and fuel additives should not be used unless approved by Cessna and the Federal Aviation Administration.

LANDING GEAR

Consult the following table for servicing information on the landing gear.

COMPONENT	SERVICING CRITERIA
Nose Wheel (5.00-5, 6-Ply Rated Tire)	45.0 PSI
Main Wheel (6.00-6, 6-Ply Rated Tire)	38.0 PSI
Brakes	MIL-H-5606
Nose Gear Shock Strut	MIL-H-5606; 45.0 PSI *

* Keep strut filled with MIL-H-5606 hydraulic fluid per filling instructions placard, and with no load on the strut, inflate with air to 45.0 PSI. Do not over inflate.

CLEANING AND CARE

WINDSHIELD AND 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.

⚠ CAUTION

NEVER USE GASOLINE, BENZENE, ALCOHOL, ACETONE, FIRE EXTINGUISHER, ANTI-ICE FLUID, LACQUER THINNER OR GLASS CLEANER TO CLEAN THE PLASTIC. THESE MATERIALS WILL ATTACK THE PLASTIC AND MAY CAUSE IT TO CRAZE.

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

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.

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. Take special care to make sure that the exterior graphics are not touched by the solvent. For complete care of exterior graphics refer to the Maintenance Manual.

To seal any minor surface chips or scratches and protect against corrosion, the airplane should be waxed regularly with a good automotive wax applied in accordance with the manufacturer's instructions. If the airplane is operated in a seacoast or other salt water environment, it must be washed and waxed more frequently to assure adequate protection. Special care should be taken to seal around rivet heads and skin laps, which are the areas most susceptible to corrosion. A heavier coating of wax on the leading edges of the wings and tail and on the cowl nose cap and propeller spinner will help reduce the abrasion encountered in these areas. Reapplication of wax will generally be necessary after cleaning with soap solution or after chemical deicing operations.

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. Isopropyl alcohol will satisfactorily remove ice accumulations without damaging the paint. However, keep the isopropyl alcohol away from the windshield and cabin windows since it will attack the plastic and may cause it to craze.

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 blade life. 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 or failure of the propeller blade. Never use an alkaline cleaner on the blades; remove grease and dirt with Stoddard solvent.

ENGINE CARE

The engine may be cleaned, using a suitable solvent, in accordance with instructions in the airplane Maintenance Manual. Most efficient cleaning is done using a spray type cleaner. Before spray cleaning, ensure that protection is afforded for components which might be adversely affected by the solvent. Refer to the Maintenance Manual for proper lubrication of controls and components after engine cleaning. The induction air filter should be replaced when its condition warrants, not to exceed 500 hours.

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. Do not 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.

For complete information related to interior cleaning, refer to the Maintenance Manual.

SUPPLEMENTS

INTRODUCTION

The supplements in this section contain expanded operational procedures for both standard and optional equipment installed in the airplane. Operators should refer to each supplement to ensure that all limitations and procedures appropriate for their airplane are observed.

LOG OF SUPPLEMENTS

It is the aircraft owners' responsibility to ensure that all added or modified components are notified by the FAA/EASA AFMS (Airplane Flight Manual Supplement) in this pilot's operating handbook. The latest avionics modification, dated 03/04/2026, is approved by the following certificate of release to service

SIBA Maintenance - Services

CERTIFICATE OF RELEASE TO SERVICE

SOCIETE NOUVELLE SIBA
Aérodrome de Dinan-Trélivan – 22100 TRELIVAN - France

Certificate Ref. No.: **CM 8160**
Work Order/Contract ref: **332/25**

Registration	Manufacturer	Model	Serial number	Operator	Work package Ref
F-HAAM	**CESSNA AIRCRAFT COMPANY**	**172S**	**172S8743**	**CAPAM**	**OT 8160**

Work performed

INSTALLATION AND TESTS GARMIN ADI G5 IAW GARMIN EASA STC 10060846 REV. 4 MAY/2023
INSTALLATION AND TESTS GARMIN PFD G3X AND ASSOCIATED LRUs IAW GARMIN EASA STC 10073816 REV. 5 MAR/2025
INSTALLATION AND TESTS GARMIN AUTOPILOT GFC500 (PITCH, ROLL, TRIM) IAW GARMIN EASA STC 10069439 REV. 9 AUG/2025
INSTALLATION AND TESTS GARMIN GPS/COM GNC355 IAW GARMIN EASA STC EASA STC 10071756 REV. 1 SEP/2023
INSTALLATION AND TESTS GARMIN GPS/COM/NAV GTN 650Xi IAW GARMIN EASA STC EASA STC 10037574 REV. 12 JAN/2024
INSTALLATION AND TEST HONEYWELL DME KN62A IAW SIBA CS-STAN SC 0749-2026
INSTALLATION AND TEST ANTENNAS CI105, AV75, GA35, GA35S IAW SIBA CS-STAN SC 0749-2026
INSTALLATION AND TEST GARMIN GMA AUDIO PANEL 342 IAW SIBA CS-STAN SC 0749-2026
INSTALLATION AND TEST AIR AVIONICS TRAFFIC AT-1, ATD80 IAW SIBA CS-STAN SC 0749-2026
INSTALLATION AND TEST HOBBS METER P/N FSZN IAW SIBA CS-STAN SC 0749-2026

Exemption:

Subject to the satisfactory performance of the Maintenance Check Flight : **NO ☐ YES ☒**
Concession / Other : N/A

PART 145 -50 Release to Service
'Certifies that the work specified, except as otherwise specified, was carried out in accordance with Part-145 and in respect to that work the aircraft/aircraft component is considered ready for release to service'

Location	Start Date (dd mmm yyyy)	End Date (dd mmm yyyy – hh)	Approval Number	Name	Visa
LFEB	**8/JAN/2026**	**02/APR/2026 – 12H00**	**FR.145.0017**	**CARRISSANT**	

SIBA-FORM-Q18 – ED 1 – MAR 2024

SUPPLEMENT NAME

SUPP. NO.	
1.	GTN650-COM/NAV/GPS
2.	GNC355-COM-GPS
3.	G3X Touch EFIS- PFD/MFD
4.	GFC500 - Digital Autopilot
5.	DUAL-G5 - standby instruments
6.	GMA342 - Audio panel
7.	TT31 - Transponder mode S & ADS-B
8.	DAVTRON model 803 - Clock/OAT Volt Indicator
9.	GPS/XM antenna STC
10.	Kannad - Emergency Locator Transmitter (ELT)
11.	Bendix/King KN62 - DME
12.	Air Traffic-AT1

Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 72S8001 AND ON

SUPPLEMENT 1

GTN650Xi
COM/NAV/GPS

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

CESSNA COMPANY AIRCRAFT C172S
Make and Model Airplane

Registration Number: F-HAAM Serial Number: 172S8743

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 labeled "NOT FAA APPROVED" are for guidance only.

FAA Approved by: JR Brownell

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

Date: 6/20/2025

LOG OF REVISIONS				
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Revision Number	Date	Number	Description	FAA Approved
		48	Updated section 7.1 Pilot's Guide description	
		49	Updated section 7.2.5 missed approach note Updated section 7.2.6 Descent Baro VNAV description	
		51	Added section 7.2.9 for GPS Approach Downgrade	
		52	Added section 7.2.10 for Loss of GPS/SBAS Navigation Data	
		53	Updated section 7.3.1 description for glideslope warnings	
		56	Updated section 7.3.2 description for GPWS and included alerts in table 7-2	
		60	Added CPDLC to table 7-3 in section 7.6	
		65	Updated section 7.17	
		76	Updated section 7.25 description	
		82	Updated section 7.36 description	
		83	Added section 7.37 for ATC Data Link System (CPDLC)	
		86	Added section 7.38 for GCO 14	

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7.38 GCO 14 (OPTIONAL) 86

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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~~	~~GTN636X~~	GTN 650Xi	~~GTN 725Xi~~	~~GTN 750Xi~~
GPS SBAS Navigation: • Oceanic, enroute, terminal, and non-precision approach guidance • Precision approach guidance (LP, LPV)			X		
VHF Com Radio, 118.00 to 136.990, MHz, 8.33 or 25 kHz increments			X		
VHF Nav Radio, 108.00 to 117.95 MHz, 50 kHz increments			X		
LOC and Glideslope non-precision and precision approach guidance for Cat 1 minimums, 328.6 to 335.4 MHz tuning range			X		
Moving map including topographic, terrain, aviation, and geopolitical data			X		
Display of datalink weather products, SiriusXM, FIS-B, Connext (all optional)			X		
Control of GDR 66 FAA Datacomm (optional)					
Control and display of airborne weather radar (optional)					
Display of terminal procedures data (optional)					
Display of traffic data, including ADS-B (optional)			X		
Display of StormScope® data (optional)			X		
Display of GCO 14 Carbon Monoxide Data (optional)			X		
Display of marker beacon annunciators (optional)			X*		
Remote audio panel control (optional)					
Remote transponder control (optional)			X		
Remote audio entertainment datalink control (optional)			X		
TSO-C151dClass B TAWS (optional)			X		
TSO-C151dClass A TAWS (optional)			X		
Supplemental calculators and timers			X		
Control of GSR 56 Iridium Satellite Phone and SMS Text			X		
Control of Flight Stream 210 (optional)			X		
Control of Flight Stream 510 (optional)			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.

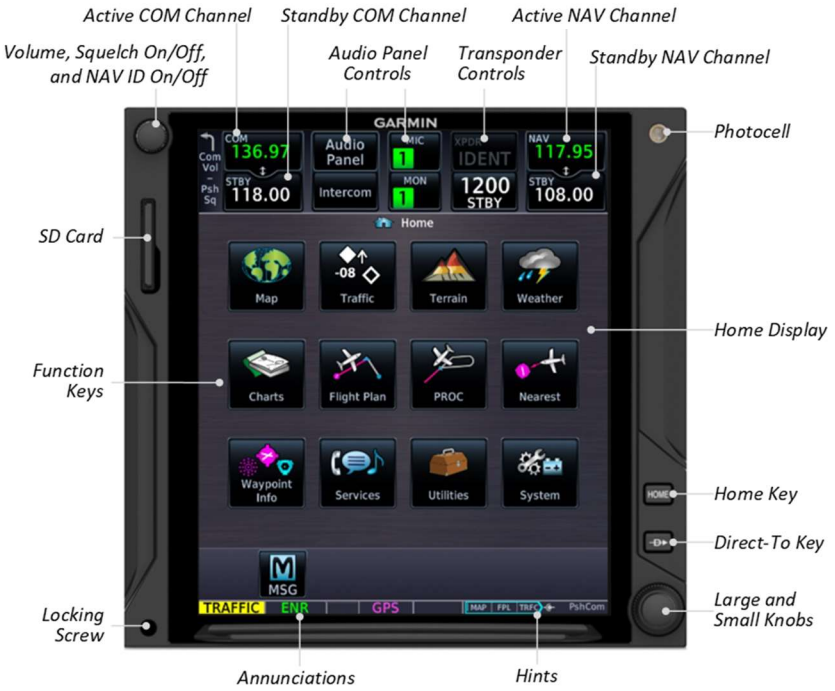


Figure 1 - GTN 750Xi Control and Display Layout

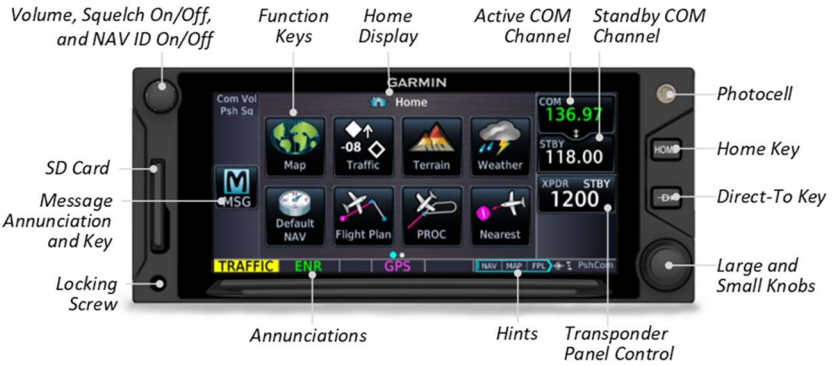


Figure 2 - GTN 635Xi/650Xi Control and Display Layout

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	21.02
GPS SW Version	8.6
Com SW Version	2.11
Nav SW Version	2.04
Flight Stream 210	2.90
Flight Stream 510	2.9X
GDL 60	2.50
GDR 66	2.31

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-C151d Terrain Awareness and Warning System – See section 2.9
- Enroute Baro-VNAV
- Smart Glide
- ATC Data Link System (CPDLC)
- Cabin Carbon Monoxide Levels

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 ATC Data Link System (CPDLC) (Optional)

The FAA has approved the optional aircraft data link system meeting the criteria in AC 20-140C for the following datalink capabilities:

	FAA Data Comm
Interoperability Designators	FANS 1/A – CPDLC (with automation)*
Subnetworks	VDL M2 (TSO-C160a)
Aircraft-Allocated Performance	CPDLC: RCP 130, RCP 240, RCP 400

* Push to load is supported

This design approval does not constitute operational authorization.

When filing ICAO flight plans, use the following equipment codes for FAA Data Comm enroute enabled installations:

Field 10a: J4Z
Field 18: DAT/1FANSE [1]
REG/XXXXXX [2]
CODE/YYYYYY [3]

1. DAT/1FANSE2PDC can be used to specify PDC is secondary
2. XXXXXX is the aircraft registration number
3. YYYYYY is the 24 bit HEX ICAO address

1.5 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.

1.6 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.

1.7 Definitions

The following terminology is used within this document:

ACARS Aircraft Communications Addressing and Reporting System

ADF Automatic Direction Finder

ADS-B Automatic Dependent Surveillance Broadcast

AEG Aircraft Evaluation Group (FAA)

APR Approach

ASR Automated Speech Recognition

ATK Along TracK

ATN Aeronautical Telecommunication Network

ATS Air Traffic Services

CDI Course Deviation Indicator

CPDLC Controller Pilot Datalink Communications

DCL Departure Clearance

DEST Destination

DME Distance Measuring Equipment

ECAC European Civil Aviation Conference

EFB Electronic Flight Bag

EHSI Electronic Horizontal Situation Indicator

FANS Future Air Navigation System

FPA Flight Path Angle

FIS-B Flight Information Services Broadcast

GCO Garmin Carbon Monoxide

GDU Garmin Display Unit

GMA Garmin Multimedia Audio

GNSS Global Navigation Satellite System

GPA Glidepath Angle

GPS Global Positioning System

GPSS GPS Roll Steering

GPWS Ground Proximity Warning System

GTN Garmin Touchscreen Navigator

HOT Hazardous Obstacle Transmission wires

HSI Horizontal Situation Indicator

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

PDC Pre-Departure Clearance

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

XFR Transfer

1.8 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
☐	ATC Data Link (CPDLC)	GDR 66	DATACOMM

1.8.1 Installed Controllers and Annunciators

	Description
☐	Remote TAWS Annunciator
☐	Remote GPS Annunciator
☐	Remote CPDLC Annunciator

1.8.2 Interfaces and Connections

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

1.8.2.1 Heading

- [x] 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.

1.8.2.2 Altitude

- [x] 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.

1.8.2.3 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.
- [x] 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.
- [x] This installation is configured with VNAV Transition to Approach.

1.8.2.4 Traffic Systems

- [ ] No traffic system is interfaced to the GTN Xi.
- [x] 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.

1.8.3 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.

1.8.4 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.

1.8.5 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.

☐ This installation supports TAWS A on GTN 1. Aural and visual alerts *will be* provided. This installation *does* support the TAWS requirement of 91.223.

☐ This installation supports TAWS A on GTN 1 *and* GTN 2. Aural and visual alerts *will be* provided. This installation *does* support the TAWS requirement of 91.223.

1.8.6 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.

1.8.7 Smart Glide Configuration

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

MAX Desired Gust Speed 15 KT

Desired Effective Runway Length 535 ft

Supported Runway Surface Type:

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

☐ Smart Glide is not configured in this installation

1.8.8 ATC Data Link (CPDLC)

☐ CPDLC is configured in this installation.

☒ CPDLC is not configured in this installation.

1.8.9 GCO

☐ This installation *has* a GCO unit.

☒ This installation *does not have* a GCO unit.

2 LIMITATIONS

2.1 Kinds of Operation

Unless placarded as limited to VFR only operations, equipment installed in a certified aircraft is approved for Day and Night / VFR and IFR operations in accordance with 14 CFR Part 91, Part 121, and Part 135 when appropriately maintained. Minimum flight crew is unchanged by this STC.

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	VFR	IFR
External HSI/CDI/EHSI	1 or more	1*	1
External GPS Annunciator	1	1**	1**
GMA 35(c)	0 or 1	0	0
Flight Stream 510	0 or 1	0	0
Flight Stream 210	0 or 1	0	0
GDL 60	0 or 1	0	0
GDR 66	0 or 1	0	0
GCO 14	0 or 1	0	0

Table 2-1 – Required Equipment

* An external CDI is required for installations using the VOR navigation and glideslope information.

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

GTN 625Xi/635Xi/725Xi installations:
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

GTN 650Xi/750Xi installations:
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)~~

~~For TAWS-A operations, one of the following documents must be immediately available to the flight crew during all phases of flight:~~

- ~~For installations in the Textron Aviation (Cessna) Model 525A with the Garmin G600 TXi PFD installed under Garmin STC #SA02571SE, Garmin CE525A Cockpit Reference Guide, P/N 190-01717-BF, revision 1 (or later revision).~~
- ~~For all other installations, Garmin GTN 6XX Xi/7XX Xi TAWS-A Cockpit Reference Guide, P/N 190-01007-C5, revision 1 (or later revision).~~

~~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 must 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.~~

~~The use of the terrain awareness warning and terrain display functions is prohibited during QFE (atmospheric pressure at airport elevation) operations.~~

~~Terrain, and Obstacle databases must be current for TAWS-B functionality. Terrain, Obstacle, and Navigation databases must be current for TAWS-A functionality.~~

2.10 Polar Operations
Use of the GTN Xi for primary navigation or TAWS-A functionality 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.

2.19 Procedure Routes, Altitudes, and Speeds

Procedures loaded into the GTN default to turbojet routes, altitudes, and speeds. The crew must verify the route, altitudes, and speeds when any procedure is loaded into the GTN.

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3.1 Emergency Procedures

3.1.1 TAWS Alerting

PULL UP			
2 X “Terrain Ahead, Pull Up”	OR	“Terrain, Terrain; Pull Up, Pull Up”	OR
2 X “Obstacle Ahead, Pull Up”	OR	“Obstacle, Obstacle; Pull Up, Pull Up”	OR
2 X "Wire Ahead, Pull Up"	OR	“Wire, Wire; Pull Up, Pull Up”	OR
“[Whoop Whoop]; Pull-Up”			

Red annunciator and aural:
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

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.

NOTE

Operations in extreme cold temperatures, for example, -30 degrees Celsius, will result in a significant reduction in terrain clearance provided by TAWS alerts.

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



GPS/SBAS Receiver..... **INOP, NOT AVAILABLE, OR INVALID**

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

If GPS Receiver has Reduced Accuracy:

During an LPV, LP +V, LNAV/VNAV, or LNAV +V approach:
Approach .....**DOWNGRADED**
Vertical Deviation Indication.....**REMOVED**
Approach .....**MAY BE CONTINUED WITH LNAV MINIMUMS**

During a VISUAL approach:
Vertical Deviation Indication .....**REMOVED**

If GPS Receiver has Loss of Accuracy:

During any GPS or VISUAL approach:
CDI Guidance .....**FLAGGED**
System Message .....**ABORT APPROACH**
CDI.....**TERMINAL NAVIGATION MODE LIMITS**

If GPS Receiver Accuracy is Within Terminal Limits:
Missed Approach .....**EXECUTE USING GPS**

If GPS Receiver Accuracy is Not Restored:
Missed Approach....**EXECUTE USING ALTERNATE NAVIGATION**

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**

* Includes GMA 35 and GMA 35c Audio Panels

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.

3.2.5 LOSS OF ATC DATA LINK (CPDLC)



Communications ..... **USE VOICE**
DATACOMM Breaker ..... **PULL**

3.2.6 TAWS CAUTION

TERRAIN	OBSTCL	WIRE	GLIDESLOPE
2 X "Terrain Ahead"	OR	2 X "Caution, Terrain"	OR
2 X "Obstacle Ahead"	OR	2 X "Caution, Obstacle"	OR
2 X "Wire Ahead"	OR	2 X "Caution, Wire"	OR
"Too Low, Terrain"	OR	"Terrain, Terrain"	OR
"Don't Sink"	OR	"Too Low, Gear"	OR
"Too Low, Flaps"			

Pilot Action ..... **INITIATE CLIMB OR TURN OR BOTH**

TERRAIN "Sink Rate"
Vertical Speed ..... **ARREST DESCENT**

GLIDESLOPE "Glideslope"
Pilot Action ..... **RE-INTERCEPT GLIDESLOPE**

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.

3.2.7 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 Hard Key ..... **PRESS**
Terrain Button ..... **PRESS**
Menu Button ..... **PRESS**
TAWS Inhibit Button ..... **PRESS TO ACTIVATE**

CAUTION

Inhibiting TAWS function(s) outside those required by limitation in this document is discouraged.

3.2.8 GPWS INHIBIT (TAWS-A Only)

For airplanes equipped with TAWS-A, some GPWS functions may be inhibited to stop alerting if desired. Refer to GTN Xi Series Pilot's Guide for additional information.

To Inhibit GPWS:

Home Hard Key ..... **PRESS**
Terrain Button ..... **PRESS**
Menu Button ..... **PRESS**
GPWS Inhibit Button ..... **PRESS TO ACTIVATE**

CAUTION

Inhibiting GPWS function(s) outside those required by limitation in this document is discouraged.

NOTE

The GPWS INHIBIT feature will not inhibit Altitude Voice Callouts (VCO) or Glideslope Deviation (GSD) alerting.

3.2.9 TER N/A, TER FAIL, TAWS N/A, TAWS FAIL, GPWS N/A, GPWS FAIL

If the amber **TER N/A, TER FAIL, TAWS N/A, TAWS FAIL, GPWS N/A, GPWS 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.

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

Autopilot:

Autopilot Roll Steering ..... **UNAVAILABLE**
Autopilot ..... **ACTIVATE HDG MODE FOR HEADING LEGS**

Main Map Page:

Map – Heading Up View ..... **UNAVAILABLE**
TAS/TCAS I or Garmin ADS-B-IN Traffic Data Overlay ..... **UNAVAILABLE**
StormScope® Data Overlay ..... **UNAVAILABLE**
Onboard Weather Radar Data Overlay ..... **UNAVAILABLE**

NOTE

Utilize the dedicated Traffic, StormScope®, and Weather Radar pages when map overlays are unavailable. StormScope® must be operated in accordance with Section 7.26 when no heading is available.

3.2.11 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**

3.2.12 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**

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

If GTN Xi Is Forwarding Pressure Altitude Data to Transponder:

Pressure Altitude Source ..... **INOPERATIVE OR NOT CONNECTED**
Transponder..... **NO RECEIVED PRESSURE ALTITUDE DATA**

3.2.14 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

GTN #2 (NAV/GPS 2, COM 2) (if installed)..... **REMOVE POWER**
Flight Stream 210 (BT LINK) (if installed)..... **REMOVE POWER**
All Other Non-Essential Flight Equipment..... **REMOVE POWER**

3.2.15 IN-AIR RESTART OF GTN

Database Update Screen ..... **PRESS CANCEL BUTTON**

3.2.16 BARO-ALT INPUT FAILURE

Enroute Barometric VNAV ..... **UNAVAILABLE**
Altitude Terminated Legs ..... **MANUALLY SEQUENCE**

3.2.17 TEMPERATURE INPUT FAILURE

VNAV Transition Approach ..... **DISREGARD**
Vertical Guidance from Descent VNAV to Approach Guidance..... **VERIFY**
If Autopilot Is in Use:
Intercept Approach Vertical Guidance from Below..... **VERIFY**

3.2.18 SMART GLIDE FAILURE

If AHRS, ADC, Terrain Database, Navigation Database or GPS failure:
Smart Glide ..... **UNAVAILABLE**

If Smart Glide is Active:
System Message..... **SMART GLIDE FAILURE**
Alternate Landing Site ..... **CONSIDER**

3.2.19 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**

3.2.20 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 ..... **PULL**

If the display is still blank, consider the GTN and remote transponder and audio panel input inoperative.
If audio panel functions are lost, consider Section 3.2.4.

3.2.21 CARBON MONOXIDE (CO) CAUTION

CO LEVEL
"Carbon Monoxide"

The carbon monoxide level within the aircraft is unsafe.

Possible Sources of CO.....**OFF**
Cabin Ventilation.....**MAXIMIZE AIRFLOW**
Oxygen Mask (if equipped).....**DON**

3.3 Warning Messages

Alert Type	Alert Annunciation	Aural Message	Pilot Action
FLTA Terrain Warning or Reduced Required Terrain Clearance (RTC) Warning or Imminent Terrain Impact (ITI) 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 or Reduced Required Obstacle Clearance (ROC) Warning or Imminent Obstacle Impact (IOI) Caution	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 or Reduced Required Line Clearance (RLC) Warning or Imminent Line Impact (ILI) Warning	PULL UP	"Wire Ahead, Pull Up; Wire Ahead, Pull Up"* or “Wire, Wire; Pull Up, Pull Up”	Immediately execute a climb at obstacle clearance speed
Excessive Descent Rate (EDR) Warning	PULL UP	“[Whoop Whoop]; Pull-Up”	Immediately arrest the descent rate.
Excessive Closure Rate (ECR) Warning	PULL UP	“[Whoop Whoop]; 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 or Reduced Required Terrain Clearance (RTC) Caution or Imminent Terrain Impact (ITI) Caution	TERRAIN	"Terrain Ahead; Terrain Ahead"* or "Caution, Terrain; Caution, Terrain"	Execute a climb at obstacle clearance speed
FLTA Obstacle Caution or Reduced Required Obstacle Clearance (ROC) Caution or Imminent Obstacle Impact (IOI) Caution	OBSTCL	Obstacle Ahead; Obstacle Ahead"* or "Caution, Obstacle; Caution, Obstacle"	Execute a climb at obstacle clearance speed
FLTA Wire Caution or Reduced Required Line Clearance (RLC) Caution or Imminent Line Impact (ILI) Caution	WIRE	"Wire Ahead; Wire Ahead"* or "Caution, Wire; Caution, Wire"	Execute a climb at obstacle clearance speed
Premature Descent Alert (PDA) Caution	TERRAIN	"Too Low, Terrain"	Execute a climb at obstacle clearance speed
Excessive Descent Rate (EDR) Caution	TERRAIN	"Sink Rate"	Arrest the descent rate.
Excessive Closure Rate (ECR) Caution	TERRAIN	"Terrain-Terrain"	Execute a climb at obstacle clearance speed
Negative Climb Rate (NCR) Caution	TERRAIN	"Don't Sink" or "Too Low Terrain"	Execute a climb at obstacle clearance speed

Alert Type	Alert Annunciation	Aural Message	Pilot Action
Flight Into Terrain (FIT) Caution	TERRAIN	"Too Low Terrain" or "Too Low – Gear" or "Too Low – Flaps"	Execute a climb at obstacle clearance speed
Glide Slope Deviation (GSD) Caution	GLIDESLOPE	"Glideslope"	Climb to re-intercept glideslope, or execute missed approach.
Traffic Caution	TRAFFIC	"Traffic"	Visually acquire the traffic to see and avoid.
Carbon Monoxide Caution	CO LEVEL	"Carbon Monoxide"	Turn off possible sources of CO, increase cabin ventilation, don oxygen mask if equipped.

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

NOTE

The GTN Xi TAWS-A system does not differentiate between a Glideslope associated with a ILS approach or a Glidepath associated with a GPS approach. Both types of approach vertical guidance are referred to as Glideslope for TAWS-A annunciations and aural alerts.

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 GPWS N/A GPWS FAIL TER N/A TER FAIL	Status Bar	Loss of GPS Position Or Terrain Database Error	Use vigilance, Terrain Alerts no longer provided.

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Refer to the GTN Xi Pilot's Guide defined in Section 7.1 for additional 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.

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

HSI:
- Course Pointer ..... **SET**

EHSI GPS Navigation:
- Course Pointer ..... **AUTOSLEW VERIFY**

EHSI VLOC Navigation:
- Course Pointer ..... **SET**

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.

4.4 Autopilot Operation

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

Autopilot NAV Mode Coupling:

CDI ..... **SELECT SOURCE**
Autopilot ..... **NAV / APR SELECT**

Autopilot GPSS or GPS Roll Steering:

CDI ..... **SELECT GPS**
Flight Plan ..... **Activate**
Autopilot ..... **NAV / APR SELECT**

Supported autopilots for GPSS or GPS Roll Steering:

- Garmin
  - GFC 500
  - GFC 600
- Bendix
  - KFC 225
  - KFC 275
  - KFC 325
- S-TEC
  - System 55X

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.

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**

Supported autopilots for Approach Coupling:

- Garmin
  - GFC 500
  - GFC 600
- Bendix
  - M4C
  - M4D
- Century
  - III
  - IV
  - 31/41
  - 2000
  - Triden
- Cessna
  - 300B / 400B / 800B
  - 300 / 400 / 800 IFCS
  - 1000 IFCS
- Collins
  - APC 65 (A / B / C / E / F / G / H / J)
  - FGC-65 / FYD-65
  - APC 65A / 65G
- Honeywell
  - KAP 140
  - KAP150
  - KFC 150
  - KFC 200
  - KFC 225
  - KFC 300
  - KFC 250
  - KFC 275
  - KFC 325
- Sperry
  - SPZ-200A / 500
- S-TEC
  - 55
  - 55X
  - 60 PSS
  - 60-2 / 65

4.6 Coupling the Autopilot for Descent VNAV

Vertical Navigation Setup:

VNAV Altitude Profile ..... **LOAD INTO FLIGHT PLAN**
Flight Plan ..... **ACTIVATE LEG**
Flight Plan → Menu → VNAV:
    VNAV Enabled ..... **ACTIVATE**
    VS Target or Flight Path Angle ..... **SET DESIRED**
PFD Altitude Preselect ..... **SET TO ATC CLEARED ALTITUDE**
GFC 500:
    VNAV Key ..... **PRESS**
GFC 600:
    VNV Key ..... **PRESS**

4.7 Coupling the Autopilot during Search and Rescue Operations

Flight Plan SAR Pattern ..... **ACTIVATE**
CDI ..... **GPS**
Autopilot NAV Mode ..... **ACTIVATE**

4.8 Cold Weather Compensation

The GTN Xi can compute altitudes for cold weather compensation for applicable IFR approaches. 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.

Flight Plan Menu → TEMP COMP:
    Temp at Dest ..... **ENTER DEST TEMP**
Flight Plan ..... **LOAD or ACTIVATE APPROACH**
Flight Plan Menu → TEMP COMP:
    Temperature Compensation ..... **ACTIVATE**
    Destination / FAF / FAF ALT ..... **VERIFY**

NOTE

Pilots must coordinate with ATC when flying temperature compensated procedures. If equipped with a TXi PFD, ensure the TXi "TEMP COMP" minimums are selected.

4.9 TAWS-A Flap Inhibit

For TAWS-A installations and intentional landings with flaps not in landing position, the flight crew must use the flap override function.

Terrain → Menu:

Flap Override.....**ACTIVATE**

4.10 TAWS-A Glideslope Inhibit

Terrain → Menu:

G/S Inhibit .....**ACTIVATE**

NOTE

The GTN Xi TAWS-A system does not differentiate between a Glideslope associated with an ILS approach or a Glidepath associated with a GPS approach. Both types of approach vertical guidance are referred to as Glideslope for TAWS-A annunciations and aural alerts.

4.11 ATC Data Link (CPDLC) Log-On

IFR Flight Plan ..... **FILE**
Flight Plan..... **MATCH FILED ROUTE**
Transponder..... **MATCH FILED FLIGHT ID**
ATC Datalink Page:
Flight ID ..... **MATCH FILED FLIGHT ID**
Facility..... **KUSA**
Logon Button..... **PRESS**

CAUTION

Establishing a CPDLC session with ATC can take a few minutes. Do not cycle the Logon/Logoff button.

4.12 ATC Data Link Responding to Messages

ATC Datalink Page:

New Message..... **OPEN**
If an importable route is included:
Proposed Route.....**PREVIEW**
Response.....**SELECT**
Send Button ..... **PRESS**

NOTE

A pilot response is expected within 60 seconds. If more time is needed, send STANDBY before the final response.

4.13 GCO Inhibit

Utilities → CO Monitor:

Inhibit CO Alerts .....**ACTIVATE**

5 PERFORMANCE

No change.

6 WEIGHT AND BALANCE

See current weight and balance data.

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 G or later

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.

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 segment (including the hold), the pilot can change, remove, or replace the approach procedure and the original missed approach will remain the active navigation. If the GTN active navigation is a missed approach segment and the flight plan is deleted, the missed approach will also be removed, removing active navigation. If a new approach is loaded while on a missed approach segment, reverify the missed approach altitude constraints.

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. 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.

Turbojet 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). Altitudes in magenta on the GTN Xi are active VNAV guidance waypoints. Altitudes colored white are advisory only (unpublished/interpolated) or published and not used in VNAV calculations.

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.

For aircraft with multiple GDUs (TXi software v3.61 or later), a GFC 600, and the Selected Side function enabled, VNAV will use the barometer setting for the selected GDU. For aircraft with multiple GDUs (without Selected Side enabled) 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.

7.2.9 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.

7.2.10 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.

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.

In installations of more than one GTN Xi with TAWS-B or TAWS-A, TAWS should be enabled on both GTN Xi units. If both GTN Xi units are configured for TAWS-B, then failure of a single GTN results in TAWS-B still being available within the cockpit from the other GTN. If TAWS-A is configured and installed for both GTN Xi units, loss of one GTN Xi will result in TAWS-A still being available from the second GTN Xi unit. If TAWS-A is configured on both GTN Xi units, but only installed to one unit, then failure of the TAWS-A unit will result in a downgrade to TAWS-B from the second GTN Xi.

7.3.1 TAWS-A

TAWS-A can be broken down into two types of alerting categories, FLTA and GPWS alerts. The GTN Xi TAWS-A system provides the following functionality:

a) Forward Looking Terrain Avoidance (FLTA)
    a. Required Terrain Clearance (RTC) / Required Obstacle Clearance (ROC) / Required Line Clearance (RLC)
    b. Imminent Terrain Impact (ITI) / Imminent Obstacle Impact (IOI) / Imminent Line Impact (ILI)

b) Premature Descent Alert (PDA)

c) GPWS Mode 1 – Excessive Descent Rate (EDR)

d) GPWS Mode 2 – Excessive Closure Rate (ECR)

e) GPWS Mode 3 – Negative Climb Rate (NCR)

f) GPWS Mode 4 – Flight Into Terrain (FIT)

g) GPWS Mode 5 – Glide Slope Deviation (GSD)

h) GPWS Mode 6 – Voice Call Out (VCO)
i) GPWS Inhibit
j) Glideslope Inhibit
k) Flap Override

TAWS-A installations will provide glideslope warnings for ILS, LPV, or LNAV/VNAV approaches. The GTN Xi TAWS-A system does not differentiate between a Glideslope associated with an ILS approach or a Glidepath associated with a GPS approach. Both types of approach vertical guidance are referred to as Glideslope for TAWS-A annunciations and aural alerts.

With TAWS-A, Voice Callouts are available from 500 ft down through 10 ft. Individual callouts may be turned on and off in the Terrain page menu, under Voice Callouts.

ALERT TYPE	ALERT SEVERITY	AURAL ALERT (TEXT MESSAGE SIMILAR)
RTC Reduced Required Terrain Clearance (FLTA Alert) (TAWS)	Caution	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead" (Optional)
	Warning	"Terrain, Terrain; Pull-Up, Pull-Up" or "Terrain Ahead, Pull-Up; Terrain Ahead, Pull-Up" (Optional)
ITI Imminent Terrain Impact (FLTA Alert) (TAWS)	Caution	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead" (Optional)
	Warning	"Terrain, Terrain; Pull-Up, Pull-Up" or "Terrain Ahead, Pull-Up; Terrain Ahead, Pull-Up" (Optional)
ROC Reduced Required Obstacle Clearance (FLTA Alert) (TAWS)	Caution	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead" (Optional)
	Warning	"Obstacle, Obstacle; Pull-Up, Pull-Up" or "Obstacle Ahead, Pull-Up; Obstacle Ahead, Pull-Up" (Optional)

ALERT TYPE	ALERT SEVERITY	AURAL ALERT (TEXT MESSAGE SIMILAR)
IOI Imminent Obstacle Impact (FLTA Alert) (TAWS)	Caution	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead" (Optional)
	Warning	"Obstacle, Obstacle; Pull-Up, Pull-Up" or "Obstacle Ahead, Pull-Up; Obstacle Ahead, Pull-Up" (Optional)
RLC Reduced Required Line Clearance (FLTA Alert) (TAWS)	Caution	"Caution, Wire; Caution, Wire" or "Wire Ahead; Wire Ahead" (Optional)
	Warning	"Wire, Wire; Pull-Up, Pull-Up" or "Wire Ahead, Pull-Up; Wire Ahead, Pull-Up" (Optional)
ILI Imminent Line Impact (FLTA Alert) (TAWS)	Caution	"Caution, Wire; Caution, Wire" or "Wire Ahead; Wire Ahead" (Optional)
	Warning	"Wire, Wire; Pull-Up, Pull-Up" or "Wire Ahead, Pull-Up; Wire Ahead, Pull-Up" (Optional)
PDA Premature Descent Alert (TAWS)	Caution	"Too Low Terrain"
	Warning	N/A
EDR Excessive Descent Rate (GPWS Alert)	Caution	"Sink Rate"
	Warning	"[Whoop Whoop], Pull-Up"
ECR (GPWS Alert)	Caution	"Terrain-Terrain"
	Warning	"[Whoop Whoop], Pull-Up"
NCR Negative Climb Rate (GPWS Alert)	Caution	"Don't Sink" or "Too Low Terrain"
	Warning	N/A
FIT (GPWS Alert)	Caution	"Too Low Terrain" Or "Too Low – Gear" Or "Too Low – Flaps"
	Warning	N/A
GSD (GPWS Alert)	Caution	"Glideslope"
	Warning	N/A

ALERT TYPE	ALERT SEVERITY	AURAL ALERT (TEXT MESSAGE SIMILAR)
500' 500' Voice Call Out (GPWS Alert)	Advisory	"Five Hundred"
400' 400' Voice Call Out (GPWS Alert)	Advisory	"Four Hundred"
300' 300' Voice Call Out (GPWS Alert)	Advisory	"Three Hundred"
200' 200' Voice Call Out (GPWS Alert)	Advisory	"Two Hundred"
100' 100' Voice Call Out (GPWS Alert)	Advisory	"One Hundred"
50' 50' Voice Fall Out (GPWS Alert)	Advisory	"Fifty"
40' 40' Voice Fall Out (GPWS Alert)	Advisory	"Forty"
30' 30' Voice Fall Out (GPWS Alert)	Advisory	"Thirty"
20' 20' Voice Fall Out (GPWS Alert)	Advisory	"Twenty"
10' 10' Voice Fall Out (GPWS Alert)	Advisory	"Ten"

Table 7-1: TAWS-A Alerts

7.3.2 TAWS-B

The GTN Xi TAWS-B system provides the following functionality:

a) Forward Looking Terrain Avoidance (FLTA)
   a. Required Terrain Clearance (RTC) / Required Obstacle Clearance (ROC)
   b. Imminent Terrain Impact (ITI) / Imminent Obstacle Impact (IOI)

b) Premature Descent Alert (PDA)

c) GPWS Mode 1 – Excessive Descent Rate (EDR)

d) GPWS Mode 3 – Negative Climb Rate (NCR)

ALERT TYPE	ALERT SEVERITY	AURAL ALERT (TEXT MESSAGE SIMILAR)
RTC Reduced Required Terrain Clearance (FLTA Alert) (TAWS)	Caution	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead" (Optional)
	Warning	"Terrain, Terrain; Pull-Up, Pull-Up" or "Terrain Ahead, Pull-Up; Terrain Ahead, Pull-Up" (Optional)
ITI Imminent Terrain Impact (FLTA Alert) (TAWS)	Caution	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead" (Optional)
	Warning	"Terrain, Terrain; Pull-Up, Pull-Up" or "Terrain Ahead, Pull-Up; Terrain Ahead, Pull-Up" (Optional)
ROC Reduced Required Obstacle Clearance (FLTA Alert) (TAWS)	Caution	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead" (Optional)
	Warning	"Obstacle, Obstacle; Pull-Up, Pull-Up" or "Obstacle Ahead, Pull-Up; Obstacle Ahead, Pull-Up" (Optional)
IOI Imminent Obstacle Impact (FLTA Alert) (TAWS)	Caution	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead" (Optional)
	Warning	"Obstacle, Obstacle; Pull-Up, Pull-Up" or "Obstacle Ahead, Pull-Up; Obstacle Ahead, Pull-Up" (Optional)
RLC Reduced Required Line Clearance (FLTA Alert) (TAWS)	Caution	"Caution, Wire; Caution, Wire" or "Wire Ahead; Wire Ahead" (Optional)
	Warning	"Wire, Wire; Pull-Up, Pull-Up" or "Wire Ahead, Pull-Up; Wire Ahead, Pull-Up" (Optional)

ALERT TYPE	ALERT SEVERITY	AURAL ALERT (TEXT MESSAGE SIMILAR)
ILI Imminent Line Impact (FLTA Alert) (TAWS)	Caution	"Caution, Wire; Caution, Wire" or "Wire Ahead; Wire Ahead" (Optional)
	Warning	"Wire, Wire; Pull-Up, Pull-Up" or "Wire Ahead, Pull-Up; Wire Ahead, Pull-Up" (Optional)
PDA Premature Descent Alert (TAWS)	Caution	"Too Low Terrain"
	Warning	N/A
EDR Excessive Descent Rate (GPWS Alert)	Caution	"Sink Rate"
	Warning	"[Whoop Whoop], Pull-Up"
NCR Negative Climb Rate (GPWS Alert)	Caution	"Don't Sink" or "Too Low Terrain"
	Warning	N/A
500' 500' Voice Call Out (GPWS Alert)	Advisory	"Five Hundred"

Table 7-2: TAWS-B Alerts

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 7-3 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.

Switch Label	Function
CPDLC	Provides visual annunciations for CPDLC and opens the ATC Datalink page on the GTN Xi it's connected to when pressed.

Table 7-3 – 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 GWX 8000 Weather Radar (Optional)~~

~~The GWX 8000 Weather Radar contains the same features as the GWX 70/75, as well as supports predictive lightning and hail detection. Predictive lightning and hail are available out to 100 nm.~~

~~The GWX 8000 also contains an Auto mode. Auto mode is a volumetric scanning mode that will process several radar sweeps internally of varying tilts to analyze and compile the data to build a 3D model of the precipitation. The model then displays the system on the radar display as a 2D image. This removes the pilot UI for tilt, bearing, and radar gain.~~

~~7.11 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).~~

7.12 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.

7.13 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.

7.14 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.

7.14.1 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.

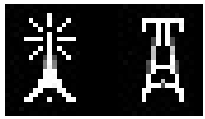


Figure 3 **– Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)**

7.14.2 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.

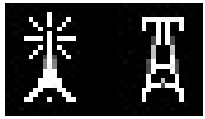


Figure 4 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.15 Map Page

7.15.1 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.

7.15.2 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.

7.15.3 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.

7.16 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.

7.17 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
- CPDLC Messages

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.

7.18 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.

7.19 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.

7.20 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.

7.21 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.

7.22 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.

7.23 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.

7.24 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 7-4: 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 7-5: 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 7-6: 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.

7.25 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.

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. See section 4.4 for autopilots that support NAV mode.

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. See section 4.4 for autopilots that support GPSS or GPS Roll Steering.

The GTN Xi supports autopilot roll steering for heading legs when an approved heading source is interfaced to the GTN Xi.

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

7.25.1 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.

7.25.2 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.

~~7.26 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.

7.27 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.

7.28 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.

7.29 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.

7.30 ~~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.~~

7.31 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.

~~7.32 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.~~

[2] Includes GMA 35 and GMA 35c Audio Panels

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.

~~7.33 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.~~

7.34 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

7.35 System Databases

7.35.1 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.

7.35.2 ~~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.~~

7.35.3 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.

7.35.4 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.

7.35.5 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.

~~7.35.6 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.~~

7.36 Core Procedure Selection

With GTN 20.41, runway selection may be deferred when loading a SID or STAR, if possible for that procedure. If the runway selection is deferred, this will result in only the procedure core being added to the flight plan. The core of the procedure is the section of the procedure that does not change *route or altitudes* based on the runway transition.

The runway may be selected in the flight plan page on next to the procedure header, in which case the runway transition will be added to the flight plan. If user modified altitudes exist within the route, a popup will be provided asking if the user would like the GTN to attempt to retain user modified data. When selecting a runway transition, verify flight plan and crossing altitudes remain correct per the published procedure.

The runway may also be selected by returning to the procedures page, a popup will be provided asking if the user would like the GTN to attempt to retain user modified data.

7.37 ~~ATC Data Link System (CPDLC) (Optional)~~

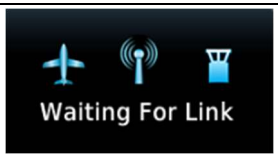
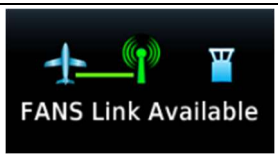
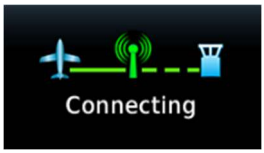
~~Controller Pilot Data Link Communications (CPDLC) provides data link communication between the flight crew and Air Traffic Control (ATC) facilities. Communication is in the form of text message elements that resemble phraseology used in voice communications with ATC. CPDLC is an application that runs within FAA Data Comm and is a reduced function of FANS 1/A+. CPDLC allows operators to use departure clearances (DCL) at participating airports and enroute services within continental US and above 16,000 ft. DCL is similar to a PDC, but with push-to-load capability for flight plan amendments.~~

~~With the proper software enablements, GDR 66 digital radio installed, and service registration through FltPlan.com, FAA Data Comm can be used. The GDR 66 VHF Data Link Transceiver provides the line-of-sight link between the aircraft and ground systems. FltPlan.com allows the user to register for FAA Data Comm service for access to the SITA ACARS network.~~

~~Prior to logging on to CPDLC, an ICAO flight plan must have been filed for the system to reference and the information entered into the Log-on display must match the filed flight plan. See Section 1.6, ATC Data Link System, for information regarding FAA Data Comm approvals and ICAO flight plan equipment codes. Refer to the GTN Xi Pilot's Guide Data Comm Addendum (190-02327-A2) for more detailed information regarding the use of CPDLC.~~

7.37.1 ~~System States~~

~~Once a successful logon has been completed by the flight crew, the system will go into a CPDLC waiting state. In this state, the system is waiting for a CPDLC session to be initiated by the ATC facility. When the ATC facility sends a CPDLC session start command and it is accepted by the system, the flight crew will have the ability to send and receive CPDLC messages.~~

~~Displayed Connection Status~~	~~Description~~
	~~The system is waiting for an ACARS connection or has initialized the VHF Data Link router but does not have an air-ground connection.~~
	~~The system has established ACARS communication. This state indicates that an AFN (ATS Facilities Notification) logon can be attempted to establish CPDLC communications.~~
	~~The system has initiated a network logon with an ATC facility.~~

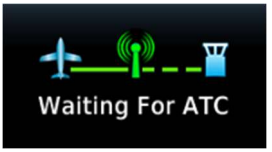
Displayed Connection Status	Description
	The system has successfully completed the network logon procedure. During this state the system is waiting for an ATC facility to initiate a CPDLC session. This state will exist during initial connection or if a CPDLC session has been closed and the network logon is still valid.
	The system has successfully established a CPDLC session with a ground facility. CPDLC messages can be exchanged in this state.
	Logon Failed The system was unable to establish a network logon.
	The system has disconnected from a CPDLC connection. This state will exist when ATC ends a session. If the network logon is still valid, the system is capable of another CPDLC session from an ATC facility.

Table 7-7: ATC Data Link Connection Status

7.37.2 Messages

CPDLC downlink messages are messages initiated by the flight crew and sent to ATC. CPDLC uplink messages are messages initiated by ATC and sent to the flight crew

Icon	Text	Description
	Sent	Message sent to ATC.
	Standby	‘Standby’ message response sent to ATC. The exclamation point notifies the flight crew that an action is needed to close the message.
	Send Fail / Expired	Message failed to send or the message timed out (270 seconds).
	Closed	Message sent to ATC and message thread closed.

Table 7-8: Downlink (Aircraft to ATC) Status Icons

Icon	Text	Description
	~~Standby (message not opened)~~	~~Unopened 'Standby' message response sent by ATC.~~
	~~Standby (message opened)~~	~~Opened 'Standby' message response sent by ATC.~~
	~~Need Response (message not opened)~~	~~Unopened message that requires a response to ATC.~~
	~~Need Response (message opened)~~	~~Opened message that requires a response to ATC.~~
	~~Expired (message not opened)~~	~~Unopened expired message sent by ATC (100 seconds).~~
	~~Expired (message opened)~~	~~Opened expired message sent by ATC (100 seconds).~~
	~~Closed (message not opened)~~	~~Unopened message that closed the message thread.~~
	~~Closed (message opened)~~	~~Opened message that closed the message thread.~~

Table 7-9: Uplink (ATC to Aircraft) Status Icons

7.38 GCO 14 (Optional)

The GTN Xi can be interfaced to a Garmin GCO 14 carbon monoxide (CO) monitor. When a GCO 14 is installed on the GTN 6XX/7XX or other interfaced LRU, the GTN can provide a readout of CO concentration in parts per million (PPM), CO alerts, and a separate customizable advisory message to alert the pilot to levels of CO below the alerting threshold. The readout of CO concentration can be selected as a user field on the GTN.

CO alerts will be provided when the CO level meets or exceeds the concentration and duration thresholds shown in table 7-10. The CO alert includes both an amber visual and aural annunciation "Carbon Monoxide".

A customizable advisory message can be set via the GCO settings menu to advise the pilot of CO levels below the alerting threshold. The pilot must select a concentration in PPM as well as a duration for the desired advisory. Once the CO concentration has been above the selected concentration threshold for the selected duration, a system message will be presented alerting the pilot to high CO levels.

Settings and information for the GCO can be found in Utilities > CO Monitor. The GCO 14 sensor has an expiry date. It is recommended to replace the sensor prior to expiration. If the sensor is not replaced prior to expiration, a system message will be issued to notify the pilot that the sensor has expired.

Concentration (PPM)	Alert After (minutes)
≤ 30	No Alert
> 30	120
> 50	60
> 100	10
> 300	*No delay*

Table 7-10 - CO (carbon monoxide) Alert Thresholds

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

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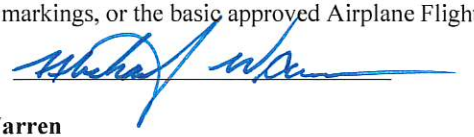
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GTN 625, 635, 650, 725, 750, 625Xi, 635Xi, 650Xi, 725Xi, or 750Xi GPS/SBAS Navigation System
as installed in

CESSNA AIRCRAFT COMPANY C172S
Make and Model Airplane

Registration Number: **F-HAAM** Serial Number: **172S8743**

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 10037574 for the installation and operation of the Garmin GTN 625, 635, 650, 725, 750, 625Xi, 635Xi, 650Xi, 725Xi, or 750Xi GPS/SBAS Navigation System. 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 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 approved Airplane Flight Manual.

Signed By: 

Michael Warren
ODA STC Unit Administrator
Garmin International Inc.
ODA-240087-CE

Date: 18-MAR-2020

EASA STC No.: 10037574

LOG OF REVISIONS				
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Revision Number	Date	Number	Description	EASA Approval
1	07-08-13	All	Complete Supplement	Jannes Neumann EASA Approved Date: *07-Aug-2013*
2	09-03-16	5	Added Flight Stream Limitation	Michael Warren [FAA] ODA Approved [on behalf of EASA] Date: *11-Apr-2016*
3	03-06-20	1	Added GTN Xi Series units	See Page 1
		1	Removed Revision Number from reference to EASA STC 10037574 to improve future maintenance	
		4	Added GTN Xi FAA AFMS part numbers	
		4	Changed TSO C146c to C146( )	
		5	Added references to GTN 7XX Xi and GTN 6XX Xi units	
		5	Added Section 2.4 Speed Constraints	

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Section 1. GENERAL

1.1 Garmin GTN Navigators

The information in this supplement is EASA-approved material and must be attached to the FAA Approved STC Airplane Flight Manual Supplement, P/N 190-01007-A2, 190-01007-A5, 190-01007-C2, or 190-01007-C3 when the airplane has been modified by installation of the Garmin GTN Navigation System in accordance with STC 10037574.

This EASA approved Airplane Flight Manual Supplement is required in addition to the FAA approved Airplane Flight Manual Supplement, P/N 190-01007-A2, 190-01007-A5, 190-01007-C2, or 190-01007-C3.

All references to TSO-C146( ) in 190-01007-A2, 190-01007-A5, 190-01007-C2, or 190-01007-C3 are replaced by ETSO-C146.

Electronic Flight Bag section information is pertinent to FAA certified aircraft only.

Additional References:

Temporary Guidance Leaflet 10, Rev 1: Airworthiness and Operational Approval for Precision RNAV Operations in Designated European Airspace

Acceptable Means of Compliance 20-4, Airworthiness Approval and Operational Criteria for the Use of Navigation Systems in European Airspace Designated for the Basic RNAV Operations

Acceptable Means of Compliance 20-27, Airworthiness Approval and Operational Criteria for RNP APPROACH (RNP APCH) Operations Including APV BARO-VNAV Operations

Acceptable Means of Compliance 20-28, Airworthiness Approval and Operational Criteria for RNAV GNSS Approach Operation to LPV Minima using SBAS

Section 2. LIMITATIONS

2.1 Display of Distance to Waypoint (for European registered aircraft only)

During installation, the GTN was configured to display distance to current waypoint on the Map Page (GTN 7XX or GTN 7XX Xi) or Default Navigation Page (GTN 6XX or GTN 6XX Xi). The display location of distance to current waypoint must not be altered or removed from these pages.

2.2 Phone/SMS Suppress Visuals Setting (for European registered aircraft only)

During installation, the GTN was configured to suppress visual alerts during approach, missed approach, and terminal operations for the GSR 56 Iridium Phone and SMS features. The Suppress Visuals setting on the Service-Phone page must not be changed from "On During APR/MAPR/TERM".

2.3 Flight Stream with Portable Electronic Devices

The Flight Stream interface and data provided to a portable electronic device is not approved to replace any required or installed aircraft display equipment, including navigation or traffic/weather display equipment. The data presented on the PED may not have the required integrity to be used as the sole source of information to base tactical or strategic decision making.

Use of the Flight Stream for flight plan importing during critical phases of flight by the pilot flying is prohibited.

2.4 Speed Constraints

The GTN does not display speed constraints that may be required on a SID, STAR or Approach. The flight crew is responsible for reviewing charts to identify any speed constraints that may be required and for managing the aircraft speed in compliance with those constraints.

Section 3. EMERGENCY PROCEDURES

No Change.

Section 4. NORMAL PROCEDURES

No Change.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

No Change.

Section 7. SYSTEM DESCRIPTIONS

No Change.

Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 72S8001 AND ON

SUPPLEMENT 2

GNC355A
GPS/COM

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 GPS 175/GNX 375/GNC 355 GPS/XPDR/COM Navigation System

as installed in

CESSNA AIRCRAFT COMPANY C172S
Make and Model Airplane

Registration Number: F-HAAM Serial Number: 172S8743

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 SA02636SE for the installation and operation of the Garmin GPS 175, GNC 355, or GNX 375 GPS/COM/XPDR 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: 3/1/2023

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
1	03/22/19	All	Complete Supplement	*JR Brownell* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *03/22/2019*
2	07/25/19	Through out Page 20 Page 34 Page 36 Page 37	Added information for GNC 355. Updated Software Versions Removed Narco 4 and 5 Indicators. Updated Pilot Guide references Added circuit breaker label for GNC 355	*JR Brownell* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *07/25/2019*
3	03/03/20	Page 3 Page 19 Page 21 Page 25 Page 37 Page 46	Added new FIS-B Weather Products Updated RAIM check wording. Updated software versions table Added Database Sync Exception to Database Updates Updated revision of Pilot's Guide Added Database Sync Discussion	*JR Brownell* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *03/03/2020*
4	03/01/23	 Page 45 Page 5	Added for Software Version 3.20: • Added Section 7.29 for crossfill description Updates for RNP 0.3: • Added Section 1.3.7 for RNP 0.3 capability	*See page i*

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	Page			
Revision Number	Date	Number	Description	FAA Approved
		Page 10 Page 44 Various	• Added RNP 0.3 to Section 1.4 GNSS Navigation System Equipment Approvals • Added Section 7.25.2 for RNP 0.3 capability AFMS Restructure based on recent FAA Guidance • Reorganized Section 1 to include appropriate content previously included in Section 2. • Moved all checkboxes in the flight manual supplement to Section 1.3, System Capabilities • Reworked all of Section 2, rewording limitations and moving appropriate content to Sections 1, 3, and 7. • Removed Section 2.21, Portable Electronic Devices • Added Table of Contents to Section 3, Emergency Procedures. • Moved and reworded appropriate content previously included in Section 2 to Section 3. • Added Table of Contents to Section 4, Normal Procedures. • Moved and reworded appropriate content previously included in Section 2 to Section 7.	

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Section 1. General

1.1 Garmin GPS 175/GNC 355/GNX 375 Navigators

The Garmin GPS 175/GNC 355/GNX 375 navigation system is a GPS system with a Satellite Based Augmentation System (SBAS) and optional transponder, comprised of a Garmin TSO-C146e navigator and a Garmin approved GPS/SBAS antenna(s). The GPS 175/GNC 355/GNX 375 navigation system is installed in accordance with AC 20-138D.

The GNX 375 also contains an ADS-B In/Out transponder capable of 1090ES out and UAT/1090 In. The transponder is 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.

The GNC 355(A) is a GPS 175 with an integrated com radio with either 8.33 or 25 kHz spacing.

	~~GPS 175~~	~~GNC 355~~	GNC 355A	~~GNX 375~~
GPS SBAS Navigation: • Oceanic, enroute, terminal, and non-precision approach guidance • Precision approach guidance (LP, LPV)			X	
Moving map including topographic, terrain, aviation, and geopolitical data			X	
Display of FIS-B weather products (optional for GPS 175 / GNC 355)			X	
Display of ADS-B traffic data (optional for GPS 175 / GNC 355)			X	
Built in transponder with 1090ES out, and1090/UAT In				
Visual Terrain Alerting			X	
Supplemental calculators and timers			X	
Control of Flight Stream 510 (optional)			X	
25 kHz Com Radio				
8.33 kHz Com Radio			X	

Table 1 – GPS 175/GNC 355/GNX 375 Functions

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

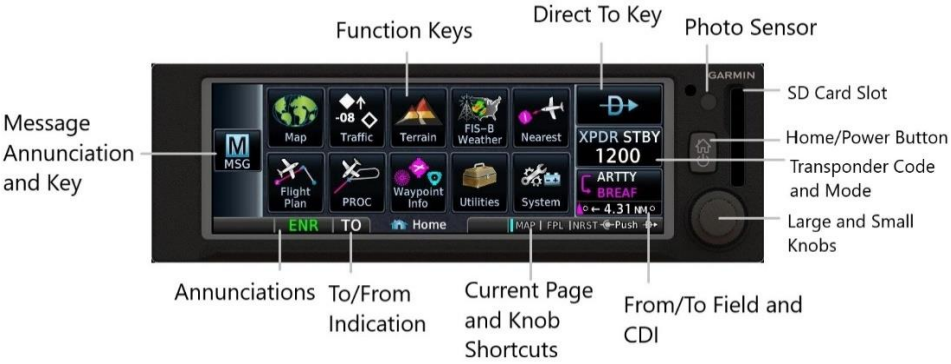


Figure 1 - GNX 375 Control and Display Layout



Figure 2 – GPS 175 Control and Display Layout



Figure 3 – GNC 355 Control and Display Layout

The GNX 375 transponder transmits ADS-B Out data on 1090 extended squitter (1090 MHz). It integrates 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

The transponder also receives ADS-B In data on 1090 MHz, including ADS-B and ADS-R Data. ADS-B is data directly from another transmitting aircraft, and the ADS-R data which is rebroadcasted ADS-B data from a ground station. The transponder also includes ADS-B In data on UAT (978 MHz). UAT In data includes ADS-B, ADS-R, TIS-B, and FIS-B data. TIS-B Data is a broadcast of secondary surveillance radar (SSR) derived traffic information from ground stations, and FIS-B data is broadcast of aviation data from a ground station. FIS-B data includes the following products:

- Graphical and textual weather products
  - NEXRAD
  - PIREPs
  - G AIRMETs
  - METARs
  - TAFs
  - Winds Aloft
  - Lightning
  - Icing
  - Turbulence
  - Center Weather Advisories
- Aviation Data
  - TFRs
  - NOTAMs

The transponder provides ADS-B traffic information and alerting to the pilot. The alerting includes aural and visual traffic alerting information on the display, as well as on interfaced displays where supported.

1.2 Applicable System Software

The Main and GPS software versions are displayed on the start-up page immediately after power-on. All software versions displayed in Table 2 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	3.20
Flight Stream 510	2.70

Table 2 - Software Versions

1.3 System Capabilities

This Flight Manual Supplement documents the installed capabilities of the GPS 175/GNC 355/GNX 375 specific to the aircraft for which this manual is created.

The following describes the GPS 175/GNC 355/GNX 375 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.

NOTE

In sections which contain a square checkbox (□) the installer will have placed an "X" in the boxes next to the capabilities applicable to the installation.

1.3.1 System Functions

The GPS 175/GNC 355/GNX 375 system and associated navigation interface in this aircraft have the following capabilities, in addition to the core multifunction display capability:

- ☒ Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below
- ☒ Primary GPS Approach Capability with Vertical Guidance (LNAV/VNAV, LPV) – See below
- ☐ Built in ADS-B In/Out Transponder (GNX 375)

1.3.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations. The following checkboxes indicate only if the navigator installation meets all STC requirements for VFR or IFR flight per the STC Installation Manual section 3.3.1.

- ☐ This GPS 175/GNC 355/GNX 375 navigator installation meets the STC requirements for VFR flight only
- ☒ This GPS 175/GNC 355/GNX 375 navigator installation meets the requirements for IFR flight

1.3.3 Placards (Section 2.17)

This installation includes the following placards

☐ A placard for composite indicators is installed.

☐ A placard for VFR only operations is installed.

☒ No placards are installed as a result of this STC.

1.3.4 GPS Coupling

This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

1.3.5 Autopilot Interface (Section 4.4)

☒ This installation *has* a heading source. The GPS 175/GNC 355/GNX 375 will provide roll steering on heading legs for the autopilot.

☐ This installation *does not have* a heading source. The crew cannot use the GPS 175/GNC 355/GNX 375 roll steering to fly heading legs with the autopilot.

1.3.6 Autopilot Coupling (Section 4.5)

☐ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode. See section 4.5.1

☒ This installation supports coupling to the autopilot in approach mode once vertical guidance is available. See section 4.5.2.

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

1.3.7 Navigation Capabilities (Section 2.7)

The GPS 175/GNC 355/GNX 375 allows for the utilization of IFR procedures that include RF (Radius to Fix) legs as part of RNP 1.0 capabilities.

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

☐ This installation is equipped to support *un-coupled* RF leg navigation up to 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.

1.3.8 Composite Indicators (Section 4.6)

☐ This installation is interfaced to a composite navigation indicator and the TO/FROM flag on the indicator *will not* function correctly.

☒ This installation *is not* interfaced to a composite nav indicator.

1.3.9 Altitude Input (Section 7.2)

☒ This installation *has* a barometric corrected altitude source. The GPS 175/GNC 355/GNX 375 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.

1.3.10 Traffic System (Section 7.4)

☒ GPS 175/GNC 355 with no external traffic source.

☐ GPS 175/GNC 355 with external ADS-B In Source.

☐ GNX 375 including built in ADS-B In Source.

1.4 GNSS (GPS/SBAS) Navigation system Equipment approvals

The Garmin GPS 175/GNC 355/GNX 375 navigator installed in this aircraft is a TSO-C145c Class 3 approved GPS navigator that complies with AC 20-138D. The Garmin GPS 175/GNC 355/GNX 375 system as installed in this aircraft is approved for navigation using GPS and GPS/SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR en route, terminal area, non-precision approach, and approach procedures with vertical guidance operations.

The Garmin GPS 175/GNC 355/GNX 375 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 GPS 175/GNC 355/GNX 375 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.

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
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 Navigation) .	GNSS FDE availability must be verified prior to flight. Maximum predicted FDE unavailability is 25 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 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 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)	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/	
	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.				
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 and coupled. 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 AC90-105A	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 coupled procedures with RF legs when the installation complies with limitation set forth in Section 2.7 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 1.3.7 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 2.7 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 1.3.7 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 2.7 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 1.3.7 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 2.7 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 1.3.7 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), following the	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 Section 2.7 of this

Navigation Spec.	Operational Requirements/ Authorization	Reference Documents	ICAO Flight Plan Code		Notes
			Item 10a Code	Item 18 PBN/	
	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.				document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 1.3.7 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 2.7 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 1.3.7 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.

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1. 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 WFDE Prediction program, part number 006-A0154-01 or later approved version with GPS SW >= 3.0 selected

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,

- Using the Garmin WFDE Prediction program,
- 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. The route planning and WFDE prediction program may be downloaded from the Fly-Garmin website on the internet (fly.garmin.com/fly-garmin/support/). For information on using the WFDE Prediction Program, refer to GARMIN WAAS FDE Prediction Program, part number 190-00643-01, 'WFDE Prediction Program Instructions'.

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".

Navigation information is referenced to the WGS-84 reference system.

1.5 Flight Planning

An acceptable means of compliance for FDE prediction programs is to use a certified service which meets the requirements of FAA AC 20-138D and FAA AC 90-105A for prediction.

The following table describes some of the available RAIM prediction programs.

Prediction Program	Internet address or program details	Coverage Area
Garmin RAIM Prediction Tool	https://fly.garmin.com/fly-garmin/support/raim/	Worldwide
FAA Service Availability Prediction Tool	http://sapt.faa.gov	US Only
Flight Service Station	1-800-WXBRIEF https://www.1800wxbrief.com	US Only
AUGUR GPS RAIM Prediction Tool	http://augur.ecacnav.com/augur/app/home	ECAC Airspace Only

Table 3 - RAIM Prediction Sources

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

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled,

or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

> For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin RAIM Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10, RNP-4, or RNP-2 oceanic/remote capability. If the Garmin RAIM Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, 25 minutes in accordance with FAA Order 8400.33 for RNP-4 requirements, or 5 minutes in accordance with FAA Order 8400.33 for RNP-2 oceanic/remote then the operation must be rescheduled when FDE is available.
>
> Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4, RNP-10, or RNP-2 oceanic/remote performance.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), Standard Terminal Arrival (STAR), and enroute RNAV "Q" and RNAV "T" routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

1.6 Definitions

The following terminology is used within this document:

ADF: Automatic Direction Finder

ADS-B: Automatic Dependent Surveillance Broadcast

APR: Approach

APPR: Approach

CDI: Course Deviation Indicator

DME: Distance Measuring Equipment

ECAC: European Civil Aviation Conference

EHSI: Electronic Horizontal Situation Indicator

FIS-B: Flight Information Services Broadcast

GNSS: Global Navigation Satellite System

GPA: Glidepath Angle

GPS: Global Positioning System

GPSS: GPS Roll Steering

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: Lateral Navigation 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 Airmen

OBS: Omni Bearing Selector

PED: Portable Electronic Device

RAIM: Receiver Autonomous Integrity Monitoring

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

RNAV: Area Navigation

RNP: Required Navigational Performance
SBAS: Satellite Based Augmentation System
SD: Secure Digital
SDF: Simplified Directional Facility
SUSP: Suspend
TACAN: Tactical Air Navigation System
TAWS: Terrain Awareness and Warning System
TCH: Threshold Crossing Height
TFR: Temporary Flight Restriction
TIS: Traffic Information Service
VFR: Visual Flight Rules
VGSI: Visual Glide-Slope Indicator
VLOC: VOR/Localizer
VMC: Visual Meteorological Conditions
VOR: VHF Omnidirectional Range
VRP: Visual Reporting Point
WAAS: Wide Area Augmentation System
WFDE: WAAS Fault Data Exclusion

Section 2. LIMITATIONS

2.1 Kinds of Operation

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

2.2 Minimum Equipment

The GPS 175/GNC 355/GNX 375 must have the following system interfaces fully functional in order 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 APPR and LOI Annunciator	See Note 1	1

Table 4 – Required Equipment

Note 1: Certain installations require an external APPR and LOI annunciator light. If installed, these annunciators must be fully functional to use the GPS 175/GNC 355/GNX 375 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 GPS 175/GNC 355/GNX 375 Navigator

All other aircraft:

Required Equipment for IFR operations utilizing GPS navigation: Single GPS 175/GNC 355/GNX 375 Navigator plus a second source of TSO-C146 approved GPS navigation or a separate source of VHF navigation.

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

The GNX 375 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

Table 5 – Required Equipment

2.3 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability.

2.4 System Use

The moving map and CDI depiction on the GPS 175/GNC 355/GNX 375 display must not be used for course guidance.

2.5 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.

2.6 Ground Operations

Using SafeTaxi functions as the sole basis for ground maneuvering is prohibited.

2.7 RNP Operations

Instrument flight procedures must be loaded from the 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 GPS 175/GNC 355/GNX 375 and/or the CDI.

2.7.1 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
- GPS 175/GNC 355/GNX 375 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

2.8 Terrain Alerting Function

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

2.9 Polar Operations

Use of the GPS 175/GNC 355/GNX 375 for primary navigation for latitudes above 89.00° N and below 89.00° S is prohibited.

2.10 ADS-B Weather (Optional for GPS 175/GNC355)

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 Airmen (NOTAM) information is prohibited.

2.11 Traffic Display (Optional for GPS 175/GNC355)

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

2.12 Demo Mode

Demo mode is prohibited in flight.

2.13 Wire Obstacle Database

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

2.14 Database Updates

In-flight database transfers or updates are prohibited.

2.15 OBS Mode

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

2.16 Advisory Visual Approaches

Use of advisory visual approaches in IMC is prohibited.

2.17 Placards

The GPS 175/GNC 355/GNX 375 STC adds placards if required per STC Installation Manual. The wording and locations of the placards are listed in the table below.

Placard	Location (If installed)
"TO/FROM FLAG WILL NOT FUNCTION CORRECTLY WHEN DISPLAYING GPS DEVIATION. USE TO/FROM INDICATION ON GPS"	Immediately adjacent to the composite CDI indicator.
"GPS LIMITED TO VFR USE ONLY"	Immediately adjacent to the GPS 175/GNC 355/GNX 375.

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3.1 Emergency Procedures

3.1.1 Terrain WARNING

Red annunciator "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

Terrain annunciators external to the GPS 175/GNC 355/GNX 375 may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

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 GPS 175/GNC 355/GNX 375 will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GPS 175/GNC 355/GNX 375 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 LOI occurs while the GPS 175/GNC 355/GNX 375 is in the ENR or OCN phase of flight, it may also display DR.

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. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially.

With a GNX 375, loss of GPS will result in the loss of ADS-B Out transmissions.

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 GPS 175/GNC 355/GNX 375**

NOTE

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

LOSS OF INTEGRITY (LOI) MODE (no DR annunciated on the GPS 175/GNC 355/GNX 375):

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 GPS 175/GNC 355/GNX 375 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 GPS 175/GNC 355/GNX 375 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 GPS 175/GNC 355/GNX 375 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 Terrain CAUTION

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

When a terrain 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

Terrain annunciators external to the GPS 175/GNC 355/GNX 375 may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2.4 Terrain INHIBIT

The Forward Looking Terrain Avoidance (FLTA) and Premature Descent Alerts (PDA) functions may be inhibited to prevent alerting, if desired. Refer to GPS 175/GNC 355/GNX 375 Pilot's Guide for additional information.

To Inhibit Terrain Alerting:

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

3.2.5 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 terrain alerting or display relative terrain and obstacle elevations. The crew must maintain compliance with procedures that ensure minimum terrain and obstacle separation.

3.2.6 DATA SOURCE - HEADING SOURCE INOPERATIVE OR CONNECTION LOST MESSAGE

Without a heading source to the GPS 175/GNC 355/GNX 375, 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 Garmin ADS-B-IN unit will not be displayed on the main map display. The flight crew must use the dedicated traffic page on the GPS 175/GNC 355/GNX 375 system to display ADS-B-IN traffic data.

3.2.7 DATA SOURCE – PRESSURE ALTITUDE SOURCE INOPERATIVE OR CONNECTION TO GNX 375 LOST MESSAGE

The GNX 375 will not be receiving pressure altitude while that message is present.

3.2.8 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

Remove power from all equipment which is not necessary for flight.

3.2.9 IN-AIR RESTART OF GPS 175/GNC 355/GNX 375

In the event of a GPS 175/GNC 355/GNX 375 restart in the air, the crew should utilize the Back button if presented with the database update screen after the GPS 175/GNC 355/GNX 375 is restarted. This will ensure restoration of the navigation functions as soon as possible.

3.2.10 ADS-B Out Transmit Failure

When the system is not operational, ADS-B Out transmit failure messages will be present on the display interface. The GNX 375 only complies with 14 CFR 91.227 for ADS-B Out when all required functions are operational.

3.2.11 Pressure Altitude Broadcast Inhibit (PABI)

ADS-B Out compliance requires the GNX 375 to be in ALT mode. If requested by Air Traffic Control to turn off altitude reporting on the transponder, select the GNX transponder mode to ON.

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Refer to the GPS 175/GNC 355/GNX 375 Pilot's Guide defined in Section 7.1 of this document for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, navigation, traffic, weather, and Multi-Function Display information.

The GPS 175/GNC 355/GNX 375 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**
Self-Test..... **VERIFY OUTPUTS TO NAV INDICATORS**
Self-Test - GPS Remote Annunciator:
LOI ..... **ILLUMINATED**
APPR ..... **ILLUMINATED**

For GNX 375:
Transponder Mode..... **VERIFY ALT**

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 GPS 175/GNC 355/GNX 375 the pilot should rotate the course pointer as prompted on the GPS 175/GNC 355/GNX 375.

If an EHSI is used to display navigation data from the GPS 175/GNC 355/GNX 375 the course pointer may autoslew to the correct course when using GPS navigation. 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 2.7 for RF leg capabilities related to EHSI.

4.4 Autopilot Operation

The GPS 175/GNC 355/GNX 375 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 GPS 175/GNC 355/GNX 375 system in an analog (NAV) mode will follow GPS 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 GPS 175/GNC 355/GNX 375 supports autopilot roll steering for heading legs when an approved heading source is interfaced to the GPS 175/GNC 355/GNX 375. This heading interface can also provide map orientation, traffic heading data, and wind calculations.

CAUTION

The GPS 175/GNC 355/GNX 375 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 GPS 175/GNC 355/GNX 375, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GPS 175/GNC 355/GNX 375. 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.

4.5.1 To couple an approach:

Once established on the final approach course with the final approach fix as the active waypoint, the GPS 175/GNC 355/GNX 375 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**

4.5.2 To couple an approach:

Once established on the final approach course with the final approach fix as the active waypoint, the GPS 175/GNC 355/GNX 375 will enable vertical guidance.

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

4.6 Composite Indicators

When the GPS 175/GNC 355/GNX 375 is interfaced to an existing composite CDI indicator, the TO/From Flag will not function on the indicator. A placard must be installed immediately adjacent to the indicator. The placard must read: "TO/FROM FLAG WILL NOT FUNCTION CORRECTLY WHEN DISPLAYING GPS DEVIATION. USE TO/FROM INDICATION ON GPS." The following navigation indicators require the placard:

- Narco VOA 50M
- Narco VOA 9
- Narco VOA 8
- ARC (Cessna) IN-386A
- ARC (Cessna) IN-481AC
- ARC (Cessna) IN-385AC
- Honeywell (Bendix King) KI 204
- Honeywell (Bendix King) KI 209
- Honeywell (Bendix King) KI 209A
- Bendix King KI 203
- Bendix King KI 208
- Bendix King KI 208A

These indicators will either show no To/From indication at all, or will only show the "TO" indication. Pilots must use the on screen TO/FROM indications when interfaced to these CDIs.

Pilot should set the selected course on the CDI to the desired track.

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 GPS 175/GNC 355/GNX 375 Pilot's Guides, part number and revision listed below, contain additional information regarding GPS 175/GNC 355/GNX 375 system description, control and function.

- GPS175/GNX375 Pilot's Guide P/N 190-02207-02 Rev B or later
- GPS175/GNC 355/GNX375 Pilot's Guide P/N 190-02488-01 Rev B or later

7.2 Leg Sequencing

The GPS 175/GNC 355/GNX 375 supports all ARINC 424 leg types. Certain leg types require altitude input in order to sequence (course to altitude, for example). If a barometric corrected altitude source is not interfaced to the GPS 175/GNC 355/GNX 375, a popup will appear prompting the flight crew to manually sequence the leg once the altitude prescribed in the procedure is reached.

It is possible to create flight plan waypoint sequences, which exceed the autopilot's bank angle capabilities. The pilot shall monitor autopilot performance with regard to flight path deviation.

7.3 Terrain Alerting

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.

CAUTION

Not all obstacles and wires are contained in the Obstacle/HOT Line database. The system provides depiction and alerts only for obstacles and wires contained in the database.

NOTE

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

The GPS 175/GNC 355/GNX 375 supports Terrain Alerting. Visual alerts are provided. Terrain Alerting *does not* satisfy the TAWS requirement of 91.223.

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 GPS 175/GNC 355/GNX 375 Pilot's Guide provides additional information regarding terrain and obstacle colors and grouped obstacle icons.

The terrain alerting is inhibited in the vicinity of airports in the navigation database. If an airport is not in the database, terrain alerting will still occur. Airports not in the database will not be viewable as airports in the unit. If flying into an airport that is not in the database, the inhibit terrain feature can be used to prevent alerting. The terrain inhibit option is in the menu on the terrain page, and provides a means to prevent all terrain alerts while inhibited. The bottom status bar of the GPS 175/GNC 355/GNX 375 will display TER INHB, and a message will persist in the message window indicating that the terrain alerts are inhibited.

7.4 Traffic System (Optional for GPS 175/GNC355)

Traffic is displayed on the GNX 375, and may be displayed on the GPS 175 when connected to an approved optional ADS-B traffic device. These systems are capable of providing 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.

Traffic is displayed in feet regardless of the unit settings.

This system is configured for the following type of traffic system. The Garmin GPS 175/GNC 355/GNX 375 Pilot's Guide provides additional information regarding the functionality of the traffic device.

7.5 Power

- Power to the GPS 175 or GNC 355 is provided through a circuit breaker labeled GPS or GPS 2.
- Power to the GNX 375 is provided through a circuit breaker labeled GPS/XPDR or GPS/XPDR 2.
- Power to the COM radio in a GNC 355 is provided through a circuit breaker labeled COM or COM2.
- Power to the optional Flight Stream 510 is provided through the GPS 175/GNC 355/GNX 375 MMC/SD card slot and protected via the GPS 175/GNC 355/GNX 375 circuit breaker.

7.6 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 GPS 175/GNC 355/GNX 375. 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 2.13.

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.

7.7 External Switches

External switches may be installed and interfaced to the GPS 175/GNC 355/GNX 375. Table 7 lists the switches and function they perform:

Switch Label	Function
TFC MUTE	Mutes the traffic alert audio (GNX 375 only)
GA	Remote Go Around
IDENT	Transponder IDENT

Table 7 – External Switches

7.8 Airspace Depiction and Alerts

The GPS 175/GNC 355/GNX 375 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.

~~7.9 ADS-B Traffic (Optional for GPS 175/GNC355)~~

~~The GNX 375 has a built in ADS-B In traffic system. A Garmin ADS-B traffic system may be interfaced to the GPS 175/GNC 355/GNX 375. The *nose* of the ownship symbol on the GPS 175/GNC 355/GNX 375 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.~~

~~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.~~

~~Traffic grouping can be enabled or disabled in the traffic page menu. If grouping is enabled, and more than one target is occupying the same area of the screen, the GPS 175/GNC 355/GNX 375 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. If traffic grouping is disabled, the traffic targets will draw on top of one another.~~

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 targets displayed on the dedicated traffic page may be selected in order 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 in close proximity to where the screen has been touched.

~~7.10 Transponder Control (GNX 375 Only)~~

~~The GNX 375 has a built in transponder with on screen controls for squawk code, mode, and additional transponder functions. The transponder is a 1090ES out, and 1090/UAT In device.~~

~~7.11 Depiction of Obstacles and Wires~~

~~7.11.1 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 4) 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 4 – Obstacle Overlay Icon (Left), Wire~~ Overlay Icon (Right)

7.11.2 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 5) 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 5 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

~~7.12 Flight Stream 510 (Optional)~~

~~The Flight Stream 510 is mounted in the GPS 175/GNC 355/GNX 375 SD card slot and includes a Wi-Fi transceiver. The Flight Stream product line uses a wireless transceiver to allow databases to be loaded onto the GPS 175/GNC 355/GNX 375 from a personal electronic devices (PEDs). Limitations regarding database operations are found in Section 2.14.~~

~~Garmin provides a list of tested and compatible devices that can be used with the Flight Stream. Connection to the Flight Stream may be possible with devices other than those on the supported device list, but Wi-Fi stability and wireless data integrity cannot be guaranteed.~~

~~For details about the Garmin supported devices and apps for use with the Flight Stream product line, please visit: http://garmin.com/connext/supported_devices~~

7.13 Built in Bluetooth

The GPS 175/GNC 355/GNX 375 have built in Bluetooth transceivers to allow PEDs to connect to the certified avionics. Data such as traffic, flight plan, datalink weather, and attitude information is sent from the GPS 175/GNC 355/GNX 375 to the PED. The PED is capable of sending flight plans to the GPS 175/GNC 355/GNX 375.

Garmin provides a list of tested and compatible devices that can be used with the GPS 175/GNC 355/GNX 375. Connection to the GPS 175/GNC 355/GNX 375 may be possible with devices other than those on the supported device list, but Bluetooth® stability and wireless data integrity cannot be guaranteed.

For details about the Garmin supported devices and apps for use with GPS 175/GNC 355/GNX 375 product line, please visit:

https://fly.garmin.com/fly-garmin/support/

7.14 Map Page

7.14.1 Configuration

The moving map and weather pages are capable of displaying 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.

7.15 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.

7.16 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.

7.17 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.

7.18 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.

7.19 European Visual Reporting Points

If the GPS 175/GNC 355/GNX 375 is interfaced with a G500/600 PFD/MFD, and a flight plan in the GPS 175/GNC 355/GNX 375 contains a VRP, the G500/600 must have a database that contains the VRP in order 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.

7.20 Advisory Visual Approaches

The GPS 175/GNC 355/GNX 375 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 GPS 175/GNC 355/GNX 375, the GPS 175/GNC 355/GNX 375 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 GPS 175/GNC 355/GNX 375 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)".

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

7.21 Composite CDIs

When the GPS 175/GNC 355/GNX 375 is interfaced to a composite CDI indicator, the TO/From Flag will not function on the indicator, and a placard must be installed adjacent to the indicator. The placard must read: "TO/FROM FLAG WILL NOT FUNCTION CORRECTLY WHEN DISPLAYING GPS DEVIATION. USE TO/FROM INDICATION ON GPS." and follow all placard guidelines in the Installation Manual.

These indicators will either show no To/From indication at all, or will only show the "TO" indication. Pilots must use the on screen TO/FROM indications when interfaced to these CDIs.



Figure 6 - To/From Indication Location

7.22 Database Sync Compatibility

The GPS 175/GNC 355/GNX 375 units are capable of utilizing database sync completely between other GPS 175/GNC 355/GNX 375 units, as well as GI275 units. The GPS 175/GNC 355/GNX 375 are capable of a limited database sync from a G500 TXi and G600 TXi. Sync from the GPS 175/GNC 355/GNX 375 to the G500 TXi and G600 TXi is not supported.

7.23 Navigation Database

Discrepancies that invalidate a procedure should be reported to Garmin International. 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.

7.24 Safetaxi

SafeTaxi functions do not comply with the requirements of AC 120-76D and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi is to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

7.25 RF Legs Types

7.25.1 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 GPS 175/GNC 355/GNX 375 as a means to provide RNP 1 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.

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 2.7.1 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 1.3.7 of this manual to determine if this capability is supported in this installation.

7.25.2 RNP 0.3 RF Leg Types

Garmin has demonstrated acceptable crew workload and Flight Technical Error for coupled procedures with RF legs when the GPS 175/GNC 355/GNX 375 installation complies with the limitations set forth in section 2.7 of this document. It is required to couple the autopilot for RNP 0.3 RF procedures. See section 1.3.7 of this manual to determine if this capability is supported in this installation.

~~7.26 Datalink Weather~~

~~Information provided by data link weather products may not accurately depict current weather conditions.~~

~~Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.~~

~~Not all TFRs and NOTAMS can be depicted on the GPS 175/GNC 355/GNX 375.~~

~~Datalink text weather is decoded for the convenience of the pilot, however it is possible that the decoding may be affected by anomalies in the data or differences in the units of measure between the decoding system and the text weather source. All text weather displayed on the GPS 175/GNC 355/GNX 375 also includes the raw weather text for pilot review.~~

7.27 Flight Planner/Calculator Functions

The Fuel Planning page uses Fuel on Board as entered by the pilot when on the Fuel Planning page. This *is not* a direct indication of actual aircraft 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.

7.28 Glove Use / Covered Fingers

No device may be used to cover fingers used to operate the GPS 175/GNC 355/GNX 375 touchscreen unless the Glove Qualification Procedure located in the Pilot's Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GPS 175/GNC 355/GNX 375 combinations.

7.29 GPS 175/GNC 355/GNX 375 Crossfill

Specific data will sync between GPS 175/GNC 355/GNX 375 units when installed in a dual navigator configuration. The following data will crossfill between the two GPS 175/GNC 355/GNX 375 units with CROSSFILL ON or OFF:

- User Waypoints
- FPL Catalog
- Traffic Alerts
- Missed Approach Popups
- Altitude Leg Popups
- Time Offset
- CDI Scale

The following unit changes will crossfill:

- Temperature
- NAV Angle
- Fuel

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

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

If data is not included in this list, it is not crossfilled. When the GPS 175/GNC 355/GNX 375 is interfaced with other non-GPS 175/GNC 355/GNX 375 Garmin navigators, there will likely be minor differences in the flight plan and course depictions based on the differences in the two navigators, even when crossfill is enabled. If the discrepancy is such that the pilot workload is affected, crossfill should be turned off, and operate using one navigator only.

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EASA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GPS 175, GNX 375, or GNC 355 GPS/SBAS Navigation System
as installed in

CESSNA AIRCRAFT COPANY C172S
Make and Model Airplane

Registration Number: **F-HAAM** Serial Number: **172S8743**

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 10071756 for the installation and operation of the Garmin GPS 175, GNX 375, or GNC 355 GPS/SBAS Navigation System. 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 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 approved Airplane Flight Manual.

Signed By: Erik Frisk

Erik Frisk
ODA STC Unit Administrator
Garmin International Inc.
ODA-240087-CE

Date: 25-NOV-2019

EASA STC No.: 10071756 Rev. -

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	Page			
Revision Number	Date	Number	Description	EASA Approval
1	11-25-19	All	Complete Supplement	EASA Approved Date: See Page 1

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Section 1. GENERAL

1.1 Garmin GPS 175/GNX375/GNC 355 Navigators

The information in this supplement is EASA-approved material and must be attached to the FAA Approved STC Airplane Flight Manual Supplement, P/N 190-02207-A3, when the airplane has been modified by installation of the Garmin GPS 175/GNX 375/GNC 355 Navigation System in accordance with STC 10071756.

This EASA approved Airplane Flight Manual Supplement is required in addition to the FAA approved Airplane Flight Manual Supplement, P/N 190-02207-A3.

Additional References:

Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance CS-ACNS Issue 2

Section 2. LIMITATIONS

2.1 Data Received by Personal Electronic Devices (PED)

The PED is not approved as the sole source of information to base tactical or strategic decision making and is not approved to replace the information provided by the GPS 175, GNX 375, or GNC 355. The built-in Bluetooth interface and data provided to a portable electronic device is not approved to replace any required or installed aircraft display equipment, including navigation or traffic/weather display equipment. The data presented on the PED may not have the required integrity to be used as the sole source of information to base tactical or strategic decision making. The Flight Stream 510 is used only for database transfers via WiFi and is powered off during flight.

2.2 Flight Plan Transfer

Use of the built-in Bluetooth for flight plan importing during critical phases of flight by the pilot flying is prohibited.

2.3 Electronic Flight Bag (EFB)

The Flight Stream interface and data provided to a portable electronic device is not approved to replace any required or installed aircraft display equipment, including navigation or traffic/weather display equipment. The data presented on the PED may not have the required integrity to be used as the sole source of information to base tactical or strategic decision making.

2.4 Speed Constraints

The GPS 175 / GNX 375 / GNC 355 does not display speed constraints that may be required on a SID, STAR or Approach. The flight crew is responsible for reviewing charts to identify any speed constraints that may be required and for managing the aircraft speed in compliance with those constraints.

2.5 Display of Distance to Waypoint

The GPS 175/GNC 355/GNX 375 must be configured to display distance to current waypoint (DIS) on the Map Page in the corner closest to the pilot. The display location of distance to current waypoint must not be altered or removed from the Map Page.

Section 3. EMERGENCY PROCEDURES

No Change.

Section 4. NORMAL PROCEDURES

No Change.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

No Change.

Section 7. SYSTEM DESCRIPTIONS

No Change.

Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 72S8001 AND ON

SUPPLEMENT 3

G3X Touch EFIS

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FAA Approved
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
GARMIN G3X TOUCH ELECTRONIC FLIGHT INSTRUMENT SYSTEM
as installed in

CESSNA AIRCRAFT COMPANY C172S

Make and Model Airplane

Registration Number: F-HAAM Serial Number: 172S8743

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 SA01899WI for the installation and operation of the Garmin G3X Touch 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

Robert Murray

ODA STC Unit Administrator

GARMIN International, Inc

ODA-240087-CE

DATE: 4-21-2023

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Garmin International, Inc.
1200 E. 151st Street
Olathe, KS 66062 USA
Telephone: 913-397-8200
www.garmin.com

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AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the

GARMIN G3X TOUCH ELECTRONIC FLIGHT INSTRUMENT SYSTEM

REV NO.	PAGE NO(S)	DESCRIPTION	DATE OF APPROVAL	FAA APPROVED
1	ALL	Original Issue	03/15/19	Robert Murray ODA STC Unit Administrator
2	2-2, 2-5	Added limitation for installations with an autopilot other than GFC500.	04/05/19	Paul Mast ODA STC Unit Administrator
3	1-5, 2-1	Added GPS 175 / GNX 375 as approved IFR navigators.	5/30/19	Paul Mast ODA STC Unit Administrator
4	ALL	Incorporate system software v8.60 and associated hardware changes.	12/20/19	Robert Murray ODA STC Unit Administrator
5	ALL	Formatting changes throughout document. Clarified requirements for IFR vs. VFR navigation, updated emergency procedures, annunciations, and autopilot configuration applicability. Added graphics for deviation indicators. Revised transponder mode description. Addition of Smart Glide.	12/29/21	Robert Murray ODA STC Unit Administrator
6	ALL	Added GI 275 integration, traffic aural alert limitation information, minor clerical and formatting corrections throughout document.	SEE COVER	SEE COVER

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1 GENERAL

The information in this supplement is FAA-approved and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual (POH/AFM) when the airplane has been modified by the installation of the Garmin G3X Touch Electronic Flight Instrument System in accordance with STC SA01899WI.

The information in this supplement supersedes or adds to the basic POH/AFM only as set forth below.

Users of the manual are advised to always refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

The G3X Touch provides one or more of the following functions:

- Primary Flight Display (PFD) – Provides attitude, air data, heading, and navigation information to the pilot.
- Multi-Function Display (MFD) – Provides pilot awareness of factors that may affect the overall conduct of the flight such as advanced moving map including terrain, obstacle and traffic alerts, georeferenced FliteCharts® or Jeppesen® ChartView™ charts and SafeTaxi® airport diagrams.
- Engine Indication System (EIS) – Provides engine and airframe operating parameters to the pilot.

The G3X Touch is scalable with a variety of configurations made up of the 7" portrait GDU 470 and the 10" landscape GDU 460. Installations may consist of one or both display types in any combination from one to three displays (or up to four displays total in tandem cockpit aircraft). A minimum installation with a single display may be a standalone MFD or a PFD which can be split screened to provide both PFD and MFD functions. EIS can optionally be displayed on any GDU except a 7" portrait PFD. Only one display per cockpit can be installed as a PFD (any second or third display is an MFD).



Single 7” Portrait GDU (PFD with MFD in split mode, No EIS)



Single 10” GDU (PFD & MFD, EIS Optional)



Dual 7” Portrait GDUs (PFD & MFD, EIS Optional)



One 10” + One 7” Portrait GDU (PFD & MFD, EIS Optional)

The PFD has an internal WAAS GPS receiver for VFR operations and a touchscreen interface. The G3X Touch system also can interface with an external, IFR approved navigator for IFR operations. Aircraft without an external, IFR approved navigator are approved for VFR operations only. Refer to equipment requirements for IFR operations in Limitations Section 2.3, *Navigation Systems for IFR Operations*, and the table in Section 2.24, *Kinds of Operations*.

PFD installations require the installation of a GSU 25 ADAHRS, GMU 11 magnetometer, and GTP 59 temperature probe. A GAD 27 voltage stabilizer or TCW IBBS back-up battery is required for 14V airframes with EIS. For all PFD installations in aircraft approved for IFR operations, standby instruments and an IFR approved navigation system are required.

If the installation includes a separate PFD and MFD, reversionary backup is available should a failure of either display occur. In reversionary mode, the remaining G3X Touch display combines critical flight instrumentation with engine readouts (if installed) and navigation information in a single-screen consolidated presentation.

If EIS functions are installed, they require the installation of a remote mounted GEA 24 Engine Airframe unit and associated engine sensors.

MFD functions are supported by an internal GPS receiver or connection to an external, IFR approved GPS navigator. G3X Touch flight displays can be integrated with a variety of systems including VHF radios, transponders, audio panels, ADS-B, SiriusXM® data links, mobile devices via Garmin Connext® and autopilot systems.

Carefully review the contents of this Airplane Flight Manual Supplement before operating the airplane. Also review Pilot's Guide 190-02472-00 Rev A, or later version applicable to the approved software version of the G3X Touch system installed on the aircraft. The Pilot's Guide provides details on the features of the G3X Touch system.

USE OF THE AFMS

The following definitions apply to WARNINGS, CAUTIONS and NOTES found throughout the AFMS:

WARNING

Operating procedures, techniques, etc., which could result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc., which could result in damage to equipment if not carefully followed.

NOTE

Operating procedures, techniques, etc., which are considered essential to emphasize.

1.1 G3X Touch GNSS (GPS/SBAS) Navigation Equipment Approvals

G3X Touch is capable of IFR operations when an external, IFR approved navigation system is installed and connected to the system and when the pilot selects the **FPL Source** to **External**. Refer to equipment requirements for IFR operations in Limitations Section 2.3, *Navigation Systems for IFR Operations*, and the table in Section 2.24, *Kinds of Operations*.

When no external, IFR approved navigator is connected, or when the pilot selects **FPL Source** to **Internal**, G3X Touch provides VFR flight planning capabilities and guidance on the HSI.

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1.2 Abbreviations and Terminology

The following glossary is applicable within the airplane flight manual supplement

AC	Advisory Circular
ADAHRS	Air Data Attitude Heading Reference System
ADC	Air Data Computer
ADS-B	Automatic Dependent Surveillance-Broadcast
AFCS	Automatic Flight Control System
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
AHRS	Attitude Heading Reference System
ALT	Altitude
AML	Approved Model List
AMMD	Airport Moving Map Display
AOA	Angle of Attack
AP	Autopilot
APV	Approach with Vertical Guidance
ATC	Air Traffic Control
ATT	Attitude
Baro	Barometric
BC	Back Course
CAN	Controller Area Network
CB	Circuit Breaker
CDI	Course Deviation Indicator
CFR	Code of Federal Regulations
COM	Communication
DA	Decision Altitude
DG	Directional Gyro
ECS	Electrical Control System
EIS	Engine Indication System
ESP	Electronic Stability and Protection
GA	Go Around
GP	Glide Path
GPSS	GPS Steering
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FD	Flight Director

FIS-B	Flight Information Service – Broadcast
FPL	Flight Plan
FPM	Feet Per Minute
GAD	Garmin Adaptor Device
GDU	Garmin Display Unit
GEA	Garmin Engine and Airframe
GFC	Garmin Flight Control
GMU	Garmin Magnetometer Unit
GNC 255	Garmin Navigation and Communication Transceiver
GNS	Garmin Navigation System
GNSS	Global Navigation Satellite System
GNX	Garmin Navigator Transponder
GP	Glide Path
GPS	Global Positioning System
GS	Glide Slope or Ground Speed
GSU	Garmin Sensor Unit (ADAHRS)
GTN	Garmin Touch Navigation
GTP	Garmin Temperature Probe
HDG	Heading
HSI	Horizontal Situation Indicator
IAF	Initial Approach Fix
IAS	Indicated Airspeed
IDENT	Identification button on Transponder
IFR	Instrument Flight Rules
ILS	Instrument Landing System
INT	Internal
K factor	Fuel flow transducer calibration factor
LNAV	Lateral Navigation
LNAV+V	Lateral Navigation with Vertical Guidance
LP	Localizer Precision
LP+V	Localizer Precision with Advisory Vertical Guidance
LPV	Localizer Precision with Vertical Guidance
LOC	Localizer
LOI	Loss of Integrity
MAX	Maximum
MDA	Minimum Descent Altitude

MFD	Multi-Function Display
MIN	Minimum
MSG	Message
N/A	Not Available
NAV	Navigation
NOTAM	Notice to Airmen
NRST	Nearest
PFD	Primary Flight Display
POH	Pilot's Operating Handbook
PTRIM	Pitch Trim
OAT	Outside Air Temperature
OBS	Omni Bearing Selector
ODA	Organizational Designation Authorization
REV	Revision or Reversion
RNAV	Area Navigation
RPM	Revolutions per Minute
SBAS	Satellite Based Augmentation System
SD Card	Secure Digital Card
SFD	Standby Flight Display
SL30	Garmin nav/com transceiver
STBY	Standby
STC	Supplemental Type Certificate
SYNC	Synchronize
TAS	True Airspeed
TAWS	Terrain Alert and Warning System
VDI	Vertical Deviation Indicator
TFR	Temporary Flight Restriction
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VOR	VHF Omni-directional Range
VSI	Vertical Speed Indicator
WAAS	Wide Area Augmentation System
XTK	Cross Track Error
YD	Yaw Damper

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2 LIMITATIONS

2.1 System Software Requirements

The G3X Touch must use the following or later FAA approved software versions for this AFMS revision to be applicable:

Component	Software Version
G3X Touch System Software	9.15

NOTE

This section is not intended to be a comprehensive list of approved software. It is intended to provide a means to determine if this AFMS revision is applicable to the software that is installed in the aircraft. Do not use this AFMS revision if the installation has a software version less than that shown in the table above.

2.2 Standby Flight Instruments

Standby Instruments are required for aircraft approved for IFR operations. Refer to the table in Section 2.24, *Kinds of Operations*.

2.3 Navigation Systems for IFR Operations

Aircraft approved for IFR operations must use one of the following navigation systems connected to the G3X Touch system, and **FPL Source** on the PFD must be selected to **External**.

- Garmin GNC 300XL / GPS 155XL
- Garmin GPS, GNC, or GNS 4XX(W) / 5XX(W)
- Garmin GNS 480
- Garmin GTN 6XX / 7XX
- Garmin GPS 175 / GNX 375
- Garmin SL30
- Garmin GNC 255
- Garmin GNC 355/355A

OR

- A separate, non-Garmin, IFR approved GPS and/or VHF navigation system along with a dedicated Course Deviation Indicator (CDI) separate from G3X Touch.

Refer to the table in Section 2.24, *Kinds of Operations*.

NOTE

Refer to the approved Airplane Flight Manual Supplement for the non-Garmin navigation system (if installed) for information on IFR operations.

IFR operations are prohibited using G3X Touch while **FPL Source** is selected to **Internal** GPS navigation as the navigation source on G3X Touch. When the internal navigation source is selected, a cyan **INT** and magenta **VFR** annunciation is displayed on the HSI. When **INT** and **VFR** are annunciated, IFR operations are prohibited based solely on guidance provided by G3X Touch.

IFR operations are prohibited using G3X Touch for navigation when the G3X system is not connected to an external, IFR approved navigator. Installations without an external, IFR approved navigator are limited to VFR operations only and have a placard located near the pilot PFD. Refer to Section 2.25, *Placards*.

2.4 Databases

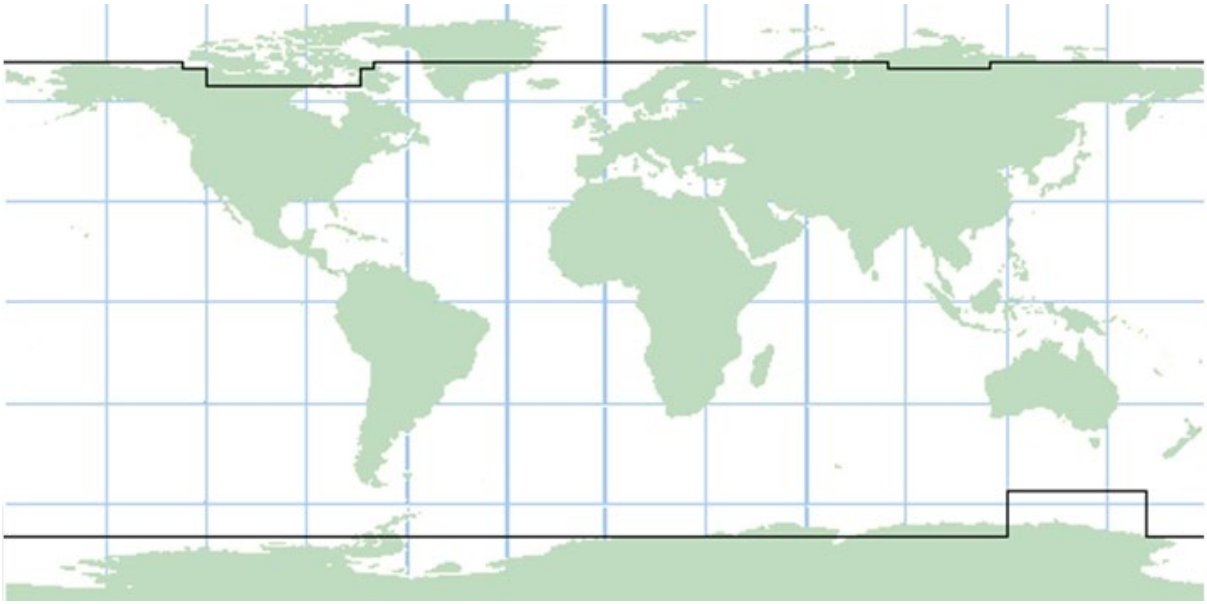
Database updates via SD card must be done while the aircraft is on the ground and stationary. Database transfers or updates are prohibited in flight.

2.5 AHRS Operational Area

IFR operations are prohibited in the following regions:

1) North of 72° North latitude, at all longitudes
2) South of 70° South latitude, at all longitudes
3) North of 65° North latitude between longitude 75° W and 120° W (Northern Canada)
4) North of 70° North latitude between longitude 70° W and 128° W (Northern Canada)
5) North of 70° North latitude between longitude 85° E and 114° E (Northern Russia)
6) South of 55° South latitude between longitude 120° E and 165° E (A region south of Australia and New Zealand)

Loss of heading may occur when operating in these regions.



2.6 Magnetic Variation Operational Area

IFR operations are prohibited in areas where the magnetic variation is greater than 99.9 degrees East or West.

2.7 Navigation Angle

The Magnetic/True Navigation Angle (as selected on the System Units page) must match the navigation angle selected on all interfaced GPS/SBAS navigators.

2.8 ADAHRS Systems Status

Valid air data, attitude, and heading must be displayed on the G3X Touch PFD and Standby Instruments for IFR operations. Refer to Section 2.24, *Kinds of Operations*, for specific equipment requirements for VFR and IFR. IFR operations are prohibited if any of the following System Status Messages are displayed:

AHRS not receiving GPS data

AHRS not receiving air data

AHRS not receiving magnetometer data

AHRS REVERT

ADC REVERT

AHRS FAIL

ADC FAIL

2.9 Aerobatic Maneuvers

Do not conduct aerobatic maneuvers if uninterrupted attitude information is required on the PFD. Refer to Section 3.2, *Attitude Failure (GSU 25)*, if the amber **AHRS ALIGN** caution is displayed on the PFD.

2.10 Other Autopilots

On aircraft with an autopilot other than a GFC 500, the pilot must select **FPL Source** to **External** on the PFD when using the autopilot in navigation (NAV or APR) modes. For those aircraft, it is prohibited to use the autopilot in navigation modes when **FPL Source** is selected to **Internal** on the PFD.

NOTE

Refer to the approved Airplane Flight Manual Supplement for the non-Garmin autopilot system (if installed) for information on modes of operation.

2.11 Synthetic Vision

The synthetic vision presentation must not be used as the sole reference for aircraft control (without reference to the primary flight instruments).

The synthetic vision presentation must not be used as the sole reference for navigation or obstacle/terrain/traffic avoidance.

2.12 Moving Maps

Moving map displays (ownship position relative to map features) must not be used as the primary or sole means of navigation or course guidance.

2.13 Terrain Display

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

2.14 Terrain Alerts

Terrain alerts must be inhibited when landing at an airport that is not in the airport database.

2.15 Traffic Display and Alerts

The display of traffic and aural traffic alerts are intended as an aid to visual acquisition and must not be used as the sole basis for aircraft maneuvering.

2.16 Surface Operations

SafeTaxi or Chartview functions shall not be used as the sole basis for ground maneuvering. 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). SafeTaxi and Chartview use is limited to airport surface orientation to improve flight crew situational awareness during ground operations.

2.17 Glide Range Ring

In the event of engine failure or engine malfunction, the Glide Range Ring must not be used to determine gliding distance. Refer to the airplanes' Pilot's Operating Manual / Airplane Flight Manual for engine failure emergency procedures and glide distance data.

2.18 Powerplant Gauge Markings

Aircraft that were previously equipped with a fuel flow gauge which measured metered fuel pressure may have this gauge replaced by a gauge which measures fuel flow directly. When these gauges are replaced in accordance with this STC, the fuel pressure and fuel flow markings on such gauges are replaced by equivalent fuel flow markings.

Fuel flow values may be in error by as much as 15% if the K factor calibration is improperly set. Do not depend solely on the fuel flow indication or the fuel totalizer to determine fuel used, fuel remaining, or fuel reserves.

The fuel computer functions must not be used as the primary means of determining the quantity of fuel in the tanks.

The Manifold Pressure gauge and the Propeller RPM gauge are the primary means for setting engine power. The Engine Power display is for information purposes only.

2.19 Weight and Balance

Weight and balance data provided by the G3X Touch is for flight planning purposes only. Consult the aircraft's Pilot's Operating Handbook for the official weight and balance data.

2.20 Data link Products (SiriusXM, FIS-B, and Connext)

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS may be depicted.

2.21 Glove Usage

No device or apparel may cover the pilot's fingertips used to operate the G3X Touch display.

2.22 Service Required

It is prohibited to initiate flight when a “Service Required” advisory is present on the PFD, MFD, or EIS display.

2.23 Portable Electronic Devices

This STC does not relieve the operator from complying with applicable requirements regarding the operation of portable electronic devices.

Data provided to a portable electronic device from the G3X Touch Bluetooth interface is not approved to replace any aircraft display equipment, including navigation or traffic/weather display equipment.

2.24 Kinds of Operations

G3X Touch is approved for Day and Night, VFR and IFR operations when the system is appropriately inspected and maintained in accordance with applicable requirements. Aircraft with a placard that reads **AIRCRAFT LIMITED TO VFR** are limited to VFR operations. Refer to Section 2.25, *Placards*.

The tables below list the minimum fully functional equipment required for flight.

This table applicable to aircraft with a G3X PFD Installed			
Equipment	**Number Installed**	**Number Required**	
		VFR	**IFR**
Primary Flight Display	1	1	1
Approved Garmin Navigator (interfaced to a PFD) **OR** Non-Garmin IFR approved navigator with standalone dedicated CDI	1	-	1
Air data and Attitude / Heading Unit (ADAHRS)	1	1a*	1
Magnetometer (GMU)	1	-	1
Standby Attitude Indicator	1	-	1
Standby Airspeed Indicator	1	1b*	1
Standby Altimeter	1	1b*	1
Non-stabilized Magnetic Compass	1	1	1

The following notes apply where indicated:

* FAA approved aircraft operating under 14 CFR Part 91 must have at least one source of altitude and airspeed information functioning for VFR operations. The altitude and airspeed information may be displayed on the PFD or on the standby instruments. The aircraft must have all “1a” items or all “1b” items from the tables above.

NOTE

Operators of aircraft approved by an airworthiness authority other than the FAA are responsible to verify equipment requirements for VFR operations and equip the aircraft accordingly.

Engine Indicating System (EIS):

The table below lists the minimum, fully functional equipment if previously installed engine instruments are replaced by G3X Touch. Refer to Section 7.6, *Engine Indication System*.

Equipment	Number Installed	Number Required
EIS Display	1	1
Engine Adaptor Unit (GEA 24)	1	1

The following engine indications must be functional on the EIS display (if these gauges are present on the EIS display as installed): Tachometer, Manifold Pressure, Oil Pressure, Oil Temperature, Fuel Quantity, and any additional engine instruments required by the aircraft Kinds Of Equipment list as listed in the Aircraft Flight Manual.

2.25 Placards

Installations Limited to VFR

☒ This installation is not limited to VFR.

☐ This installation is limited to VFR and the following placard is required near the PFD:

AIRCRAFT LIMITED TO VFR

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3 EMERGENCY PROCEDURES

3.1 ADC Failure (GSU 25)

ADC FAIL

ADC failure is indicated by:

- Red X over the airspeed and altitude tapes.
- Red X over the vertical speed tape.
- Red X over the TAS and OAT fields.

1. Use Standby Airspeed Indicator and Altimeter.

NOTE

If a Garmin G5 or GI 275 Electronic Flight Instrument is installed as the Standby Flight Instrument and the primary ADC fails, the G3X Touch will automatically revert and use air data from the G5 or GI 275. An amber **ADC REVERT** annunciation will automatically be displayed on the PFD and air data from the G5 or GI 275 will be displayed on the G3X Touch.

For G5 installations: If installed, the GFC 500 autopilot will function normally.

For GI 275 installations: If installed, the GFC 500 autopilot will be unavailable.

3.2 Attitude Failure (GSU 25)

AHRS FAIL

Attitude failure is indicated by:

- removal of the sky/ground presentation.
- Red X and **ATTITUDE FAIL** over the sky/ground presentation.

1. Use Standby Flight Instruments.

NOTE

If a Garmin G5 or GI 275 Electronic Flight Instrument is installed as the Standby Flight Instrument and the primary AHRS fails, the G3X Touch automatically reverts and uses attitude information from the G5 or GI 275. An amber **AHRS REVERT** annunciation will be displayed on the PFD and attitude information from the G5 or GI 275 will automatically be displayed on the G3X Touch.

For G5 installations: If installed, the GFC 500 autopilot will function normally.

For GI 275 installations: If installed, the GFC 500 autopilot will be unavailable.

3.3 Attitude Aligning / Keep Wings Level

If the **ALIGNING KEEP WINGS LEVEL** indication occurs during flight, the G3X Touch has detected an invalid attitude solution and will not display any attitude information.

1. Use standby instruments to maintain 1° nose up pitch and wings level flight. The system will display attitude when internal accuracy tolerances have been met.
2. Limit aircraft attitude to ±10° bank, ±5° pitch, 200 KTAS or less.
3. If attitude does not return, continue to use the standby flight instruments for aircraft attitude control.

3.4 AHRS ALIGN

The **AHRS ALIGN** annunciation indicates that the AHRS attitude information is still usable, but the internal sensors are trying to realign themselves. The attitude presentation behind the annunciation is still valid but should be crosschecked using the standby instruments.

1. Crosscheck aircraft attitude with standby attitude display.

3.5 Autopilot Abnormal Disconnect (GFC 500)

Red **AP** or **AFCS** flashing on PFD, Continuous high-low aural tone

1. Aircraft Attitude .....MAINTAIN/REGAIN AIRCRAFT CONTROL
2. AFCS Status Box on PFD .....PRESS
   (to cancel disconnect tone and extinguish annunciator)

3.6 Incorrect Barometric Synchronization (Standby to G3X Sync)

If the system is incorrectly changing the G5/GI 275 or G3X altimeter setting without the pilot manually changing either setting, disable **SFD Baro Sync** on the G3X Touch PFD using the following procedure:

1. Press MENU twice
2. Scroll down to SETUP and Select.
3. Scroll down to PFD and Select.
4. Scroll down to SFD BARO SYNC and Select.
5. Change the selection from ENABLED to DISABLED.
6. Press and hold the BACK button to return to a normal PFD display.
7. Readjust the Altimeter Barometric Settings on the G5/GI 275 and G3X Touch PFD to the desired setting.
8. If Altimeter Barometric Setting does not remain on the desired value for either the G5/GI 275 or G3X PFD, disregard the affected altimeter and use the other altimeter.

3.7 EIS Failure

EIS failure is indicated by the loss of displayed information on the EIS, including a blank, frozen, red 'X' over the display, or unresponsive display of EIS parameters.

1. Position engine controls to ensure operation within engine limitations.

3.8 Erroneous Air Data or Attitude Information on the G3X PFD

(On installations with a G5 or GI 275 Standby Flight Instrument)

1. PULL the ADAHRS Circuit Breaker
2. PULL the GAD 27 Circuit Breaker

G5 or GI 275 air data and AHRS data will automatically revert to be displayed on the PFD on G3X Touch. **ADC FAIL**, **AHRS FAIL**, **ADC REVERT**, **AHRS REVERT**, and **ECS FAIL** * messages will be displayed. This procedure will restore availability of the GFC 500 autopilot and flight director if G5 Standby Flight Instrument is installed.

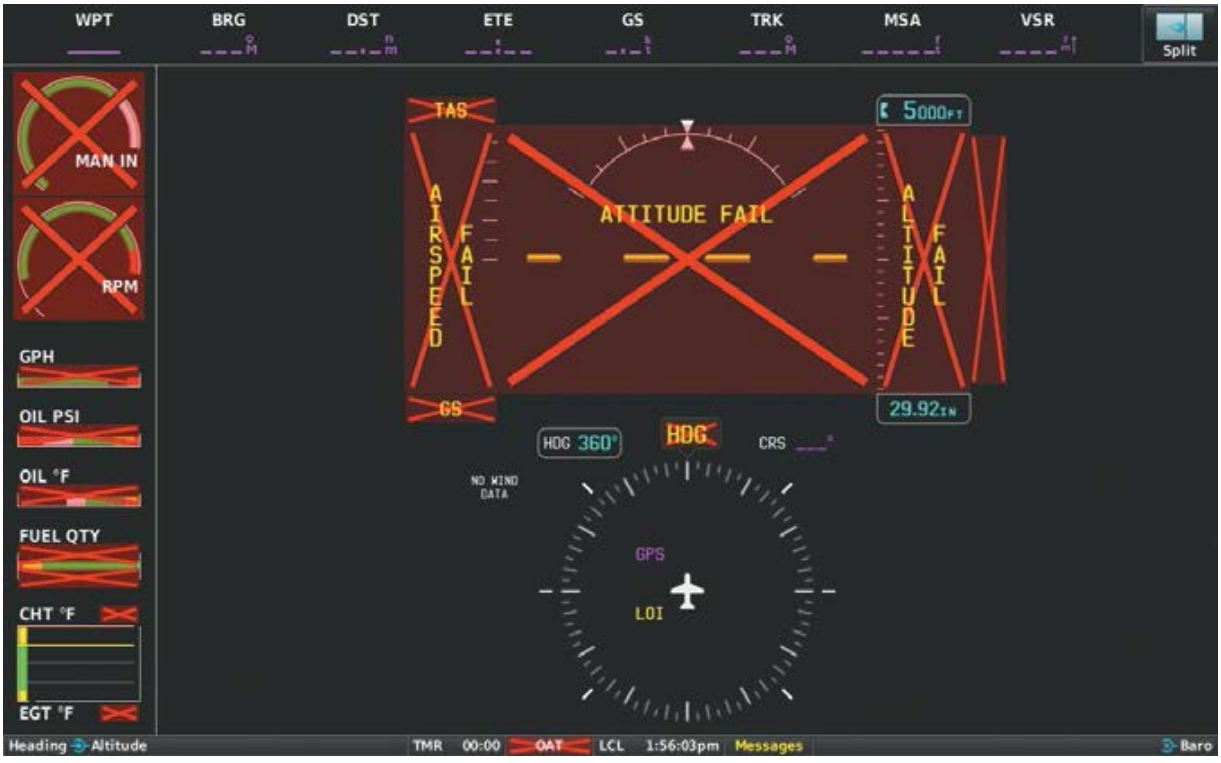
* The ECS FAIL will display when the GAD 27 circuit breaker is pulled out or the GAD 27 fails. This message is applicable only to aircraft with a 14 VDC electrical system or those with flashing (wig-wag) landing and taxi lights.

NOTE

When ECS FAIL is displayed, Landing and Taxi Lights may be inoperative if the aircraft is equipped with flashing (wig-wag) landing and taxi lights.

3.9 G3X Touch Failure Annunciations

If a G3X Touch function fails, a large red 'X' is typically displayed over the instrument(s) or data experiencing the failure. Upon G3X Touch 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 the G3X Touch should be serviced by a Garmin-authorized repair facility.



G3X Failure Annunciations

3.10 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 an amber “HDG” on the display.

1. Use standby magnetic compass.

NOTE

If the G3X Touch DG/HSI has a valid GPS signal the G3X Touch DG/HSI instrument will display the GPS track information in magenta.

3.11 PFD Failure

PFD failure is indicated by the loss of displayed information on the PFD, including a blank, frozen, or unresponsive display.

1. If IFR, use standby flight instruments for attitude, airspeed, altitude, and heading reference and land as soon as practical.
2. If VFR, use visual references and standby flight instruments (if installed) for attitude, airspeed, altitude, and heading reference and land as soon as practical.
3. Refer directly to the navigation source for navigation information (such as GPS).
4. If the autopilot is engaged, verify autopilot mode and cross check against visual references and standby flight instruments (if installed) and navigation data.

3.12 Navigation Data Failure (GPS/VOR/LOC/GS)

Navigation data failure may be indicated by any or all of the following:

- Loss of course deviation information on PFD
- Loss of glideslope/glidepath information on PFD
- Loss of bearing pointer on HSI

1. Select an alternate navigation source on the external navigator’s CDI Key.

Or

2. Use the internal GPS navigator in G3X by changing **FPL Source** from **External** to **Internal** on the PFD. When the external GPS navigation source has failed, an amber **REV** and amber **VFR** annunciation are displayed on the HSI. When **REV** and **VFR** are annunciated, IFR operations are prohibited based solely on guidance provided by G3X Touch. Refer to Limitations, Section 2.3, *Navigation Systems for IFR Operations* for VFR operations using the G3X Touch internal navigator.

If No Alternate Navigation Sources Are Available and ‘REV’ is Displayed on HSI:

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

NOTE

In the event that all configured external GPS navigators fail, the G3X Touch reverts to its internal VFR GPS for navigation and flight plan modifications.

3.13 TERRAIN ALERTS

Aural Alert	Visual Alert	Action
"Terrain Ahead! Pull Up!" "Terrain, Terrain Pull up! Pull Up!" "Obstacle Ahead! Pull Up!" "Obstacle, Obstacle Pull Up! Pull Up!" "Sink Rate, Pull Up!" "Pull Up!"	 -OR-  -OR-  NOTE: The arrow indicates the terrain is outside the Synthetic Vision field of view.	Disconnect autopilot and initiate maximum performance climb (maximum takeoff power and best angle of climb airspeed) NOTE: Only the climb maneuver is recommended, unless operating in VMC or it is determined, based on all available information, that turning in addition climbing is the safest course of action.
"CAUTION, Terrain" "Caution, Terrain Ahead" "CAUTION, Obstacle" "CAUTION, Obstacle Ahead" "CAUTION, Sink Rate"	**TERRAIN** -OR- **OBSTACLE** -OR-  NOTE: The arrow indicates the obstacle is outside the Synthetic Vision field of view.	Take corrective action until the alert ceases. Using all available information to determine the appropriate action, alter the flight path away from the threat by stopping descent, climbing, and/or turning.

3.14 WARNINGS, CAUTIONS, and ADVISORIES

The following tables show the color and significance of the warning, caution, and advisory messages which may appear on the G3X Touch display.

WARNING Annunciations – Red		
Annunciation	*Pilot Action*	*Cause*
Red X	Reference the data source or alternate equipment.	A red X through any display field indicates that display field is not receiving data or is corrupted.
Red Engine Parameter on EIS (if EIS is installed)	Take appropriate action to correct condition causing engine parameter exceedance.	The engine parameter has exceeded the warning threshold.
AP	Manually fly the airplane. Silence the autopilot disconnect tone and extinguish the annunciation by pressing the AP annunciation in the AFCS Status Box.	GFC 500 Autopilot has failed or is inoperative.
AFCS	Manually fly the airplane.	GFC 500 Flight Director and Autopilot have failed
	Manually fly the airplane.	GFC 500 Autopilot Failure
PTRIM	Manually trim the airplane using the pitch trim wheel.	Electric pitch trim is inoperative. (if installed and interfaced with the GFC 500 autopilot)
	Select full screen mode on display to view WARNING annunciations.	Display is in split screen mode and WARNING annunciations are not displayed.

CAUTION Annunciations – Amber		
Annunciation	*Pilot Action*	*Cause*
AP	Manually fly the airplane	Pilot has disconnected the GFC 500 autopilot
YD	NONE	GFC 500 Yaw Damper has disconnected
↑ TRIM UP ↑	Move the elevator trim in the nose up direction until the annunciation extinguishes.	The GFC 500 autopilot is holding excessive force due to the aircraft being out of trim due to changes in airspeed or power.
↓TRIM DOWN↓	Move the elevator trim in the nose down direction until the annunciation extinguishes.	The GFC 500 autopilot is holding excessive force due to the aircraft being out of trim due to changes in airspeed or power.
MIN SPEED	Add maximum available power. Autopilot will lower aircraft nose to increase airspeed.	Airspeed is too slow, approaching stall speed (GFC 500 autopilot).
MAX SPEED	Reduce power. Autopilot will raise aircraft nose to reduce airspeed.	Airspeed is approaching maximum airspeed limit (GFC 500 autopilot).
HDG (amber background)	Use standby compass	Displayed heading is outside of the internal accuracy limits.
	Select full screen mode on display to view CAUTION annunciations.	Display is in split screen mode and CAUTION annunciations are not displayed.
AHRS ALIGN – Keep Wings Level	Fly aircraft manually and crosscheck attitude indication with standby attitude indicator and other sources of attitude information. Limit aircraft attitude to ±10º bank and ±5º pitch as AHRS Aligns - OK to taxi.	Attitude and Heading Reference System is aligning. AHRS may not align with excessive pitch/bank angles.
AHRS ALIGN	Fly aircraft manually and crosscheck attitude indication with standby attitude indicator and other sources of attitude information (airspeed, heading, altitude, etc.)	The AHRS monitors have detected a possible AHRS malfunction or an error with the attitude presentation. The AHRS is attempting to realign itself. The GFC 500 autopilot may automatically disconnect.
ATT MISCOMP HDG MISCOMP	Cross-check the flagged information against other sources to identify erroneous information.	Difference detected between the G3X Touch attitude or heading display and the G5 attitude or heading display. NOTE G3X will not display miscompare annunciations for GI 275 miscompares. Only the GI 275 will display miscompare annunciations for attitude.

CAUTION Annunciations – Amber		
Annunciation	*Pilot Action*	*Cause*
AHRS FAIL ATTITUDE FAIL	Use standby attitude source, or, if AHRS REVERT message is also displayed, continue to use the G3X Touch. Attitude will be from the Standby Indicator.	The GSU 25 AHRS has failed.
AHRS REVERT	Continue to use the G3X Touch.	The GSU 25 AHRS has failed and attitude from the Standby Indicator is being displayed on the G3X Touch.
ALT MISCOMP IAS MISCOMP	Cross-check the flagged information against other sources to identify erroneous information.	Difference detected between the G3X Touch airspeed or altitude and the G5 airspeed or altitude. NOTE G3X will not display miscompare annunciations for GI 275 miscompares. Only the GI 275 will display the miscompare annunciations.
ADC FAIL	Use standby airspeed and altimeter indicator, or, if ADC REVERT message is also displayed, continue to use the G3X Touch.	The GSU 25 air data computer has failed.
ADC REVERT	Continue to use the G3X Touch.	The GSU 25 air data computer has failed and air data from the Standby Indicator is being displayed on the G3X Touch.
(Flashing) MESSAGE	Press the flashing message annunciation to view a new system message.	A new system message has annunciated.
Amber engine Parameter on EIS (if EIS is installed)	Take appropriate action to correct condition causing engine parameter exceedance.	The engine parameter has exceeded the caution threshold.
GPSS	De-select GPSS on the G3X Touch and select desired alternate autopilot lateral mode.	The GPS Steering command to the autopilot has been lost.
TRAFFIC	Visually acquire the traffic to see and avoid.	The interfaced traffic system has determined that nearby traffic may be a threat to the aircraft.
TAWS N/A, TAWS FAIL	Use vigilance, terrain depiction and TAWS alerting is no longer provided.	Database errors or lack of required GPS position.
ECS FAIL	Landing and Taxi lights may be inoperative if the aircraft is equipped with flashing (wig-wag) landing and taxi lights. At night, consider a well-lighted runway.	The GAD 27 has lost power or has failed.

CAUTION Annunciations – Amber		
Annunciation	*Pilot Action*	*Cause*
GLIDE	Smart Glide is active	Follow the Smart Glide procedures in the GTN Xi AFMS.

ADVISORY Annunciations – White		
Annunciation	*Pilot Action*	*Cause*
NO COMP	Cross check information between the G5 and the PFD to determine which unit is in error.	The unit will not be able to perform the miscompare monitor function. NOTE G3X will not display miscompare or NO COMP annunciations with GI 275 installed as standby indicator. Only the GI 275 will display the miscompare or no compare annunciations.

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4 NORMAL PROCEDURES

4.1 Before Starting Engine

1. Database Acknowledgement.....(PFD) Press “CONTINUE’ button

NOTE

The data link weather advisory and current database information are displayed during power-up including valid operating dates, cycle number, and database type. When this information has been reviewed for currency (to ensure that no databases have expired), the pilot is prompted to continue.

4.2 After Starting Engine

1. Avionics Master Switch.....ON
2. Database Acknowledgment (All other displays and NAV units) ..... Press “CONTINUE” button
3. Flight Plan Source (FPL) .....Select EXTERNAL or INTERNAL navigation source
4. G3X Touch CDI source .....Touch the HSI display on the PFD. PFD Options window opens.
5. In the CDI Source window.....Select GPS 1 or GPS 2 (if installed) for IFR or VFR flight, or, Select Internal GPS for VFR flight
6. Touch the HSI display on the PFD to return to normal PFD display
7. Enter a Flight Plan..... For IFR or VFR Flight, into the External GPS Navigator, or, For VFR flight only, into the PFD Internal Flight Plan

WARNING

Do not use the approach information provided by the VFR navigation database residing within the G3X Touch as a means of navigating any instrument approach. The G3X Touch VFR navigation database is limited to present only the waypoints for the final approach leg of a published procedure. These waypoints and associated course line are made available for monitoring purposes only.

8. Altimeters.....Set (PFD and Standby Altimeter)
   - Touch the Barometric Pressure Display on the PFD.
   - Enter the desired pressure using the keypad and touch ENTER.
   - Verify Barometric setting on the Standby Altimeter matches the G3X Touch.

4.3 COM Radio Tuning (Optional)

The COM Frequency Box is composed of two fields; one active frequency is on the left side and the standby frequency is on the right.

To tune the COM radio:

1. Touch STBY COM display window
2. Enter the frequency using the keypad or dual concentric knob
3. Touch ENTER to enter the frequency in the STBY window, or,
4. Touch ⟺ to transfer the entered frequency directly into the COM window.

To transfer STBY frequency to Active frequency:

1. Touch the Active COM frequency field

4.4 Lateral Navigation

Procedures below involve the Garmin GFC 500 autopilot. Information regarding a non-Garmin autopilot are provided in the G3X Touch Pilot's Guide and Airplane Flight Manual Supplement for the non-Garmin autopilot.

Changing the Navigation Source

When an external navigator that supports both GPS and VOR/ILS capabilities (i.e., GTN or GNS Series) is selected, the external navigator's **CDI** Key is used to switch the G3X Touch HSI between GPS and VOR/ILS navigation.

VOR

1. Tune a VOR station in the external navigator.
2. Navigation Source ..... Select VOR on the external navigator
3. G3X Touch CDI source ..... Touch the HSI display on the PFD. PFD Options window opens.
4. Select the external navigator from the CDI Source window (VOR 1 or 2).
5. Press and Hold **BACK** Button to return to normal PFD display.
6. Set the CDI to the desired course ..... Touch the Selected Course window on the PFD
7. Enter the desired VOR course, press ENTER
8. Establish Intercept Heading
9. Select GFC 500 autopilot modes for intercepting or tracking the selected course ..... VOR will be displayed on the AFCS Status Box.

NOTE

VOR will be annunciated in WHITE if the mode is armed or in GREEN if VOR is the active lateral mode.

GPS DIRECT TO

1. Navigation Source ..... Select GPS on the external navigator
2. Select waypoint and execute the Direct-TO on the external navigator
3. G3X Touch CDI source ..... Touch the HSI display on the PFD. PFD Options window opens.
4. Select the external navigator from the CDI Source window (GPS).
5. Press and Hold **BACK** Button to return to normal PFD display.

GPS OBS

1. Navigation Source ..... Select GPS on the external navigator
2. Select waypoint and make it the active waypoint.
3. Set external navigator to OBS mode
4. G3X Touch CDI source ..... Touch the HSI display on the PFD. PFD Options window opens.
5. Select the external navigator from the CDI Source window (GPS 1 or 2).
6. Press and Hold **BACK** Button to return to normal PFD display.
7. Set the CDI to the desired course ..... Touch the Selected Course (OBS) window on the PFD.
8. Enter the desired GPS course, press ENTER
9. Establish Intercept Heading
10. Select GFC 500 autopilot modes for intercepting or tracking the selected course ..... GPS will be displayed on the FD mode bar.

4.5 Approaches

ILS

1. Load the approach into the External navigator .....Verify external navigator tunes the proper frequency. Select it as the active frequency.
2. Navigation Source ..... Select LOC on the external navigator
3. Approach Minimums..... Set the barometric minimums alert bug
   - On the PFD, Touch the **HSI.**
   - Touch the Highlight Minimums window.
   - Enter Barometric Altitude Minimums and touch ENTER
4. G3X Touch CDI source .....Touch the HSI display on the PFD. PFD Options window opens.
5. Select the external navigator from the CDI Source window (LOC 1 or 2).
6. Press and Hold BACK Button to return to normal PFD display.

If Flying Vectors-To-Final:

7. Activate Vectors-to-Final on the external navigator, verify CDI changes to LOC and slews to the inbound course,

   OR

   - If using a VHF navigation receiver, set the CDI to the desired course .....Touch the Selected Course window on the PFD.
   - Enter the desired LOC course, press ENTER.

8. Establish Intercept Heading.
9. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.
10. Upon reaching the LOC course, turn inbound and follow the ILS course and vertical guidance.
11. Set Missed Approach Altitude ..... Touch the Reference Altitude display. Enter the missed approach altitude.
12. At Decision Altitude (DA), continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

If Flying Full Approach Including Transition:

ACTIVATE THE APPROACH on the External navigator

OR

ACTIVATE a DIRECT TO the IAF on the External navigator.

7. Navigation Source ..... Select GPS on the external navigator
8. Select IAF waypoint and execute the Direct-TO on the external navigator
9. G3X Touch CDI source ..... Touch the HSI display on the PFD.
   PFD Options window opens.
10. Select the external navigator from the CDI Source window (GPS 1 or 2).
11. Press and Hold BACK Button to return to normal PFD display.
12. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.

NOTE

The airplane will navigate in GPS mode throughout the intermediate portion of the approach procedure. When the airplane is inbound towards the final approach course, the CDI will automatically switch from GPS navigation to LOC navigation.

13. Verify ..... Course pointer slews to the front course.
14. Upon reaching the LOC course ..... Turn inbound and follow the ILS course and vertical guidance.
15. Set Missed Approach Altitude ..... Touch the Reference Altitude display.
    Enter the missed approach altitude.
16. At Decision Altitude (DA), Continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

ILS GLIDE SLOPE INOPERATIVE

1. Load the approach into the External navigator ..... Verify external navigator tunes the proper frequency.
   Select it as the active frequency.
2. Navigation Source ..... Select LOC on the external navigator
3. Approach Minimums ..... Set the barometric minimums alert bug:
   - On the PFD, Touch the HSI.
   - Touch the Highlight Minimums window.
   - Enter Barometric Altitude Minimums and touch ENTER
4. G3X Touch CDI source ..... Touch the HSI display on the PFD.
   PFD Options window opens.
5. Select the external navigator from the CDI Source window (LOC 1 or 2).
6. Press and Hold BACK Button to return to normal PFD display.

If Flying Vectors-To-Final:

7. Activate Vectors-to-Final on the external navigator, Verify CDI changes to LOC and slews to the inbound course,

   OR

   - If using a VHF navigation receiver, set the CDI to the desired course .....Touch the Selected Course window on the PFD.
   - Enter the desired LOC course, press ENTER.

8. Establish Intercept Heading.
9. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.
10. Upon reaching the LOC course, turn inbound and follow the LOC course.
11. Set Minimum Descent Altitude (MDA)..... Touch the Reference Altitude display. Enter the Minimum Descent Altitude.
12. At the Final Approach Fix (FAF), begin descent to an intermediate altitude or the Minimum Descent Altitude.
13. At the Minimum Descent Altitude, Set Missed Approach Altitude .....Touch the Reference Altitude display. Enter the Missed Approach Altitude.
14. At Missed Approach Point, Continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

If Flying Full Approach Including Transition:

ACTIVATE THE APPROACH on the External navigator,

OR

ACTIVATE a DIRECT TO the IAF on the External navigator.

7. Navigation Source .....Select GPS on the external navigator
8. Select IAF waypoint and execute the Direct-TO on the external navigator
9. G3X Touch CDI source .....Touch the HSI display on the PFD. PFD Options window opens.
10. Select the external navigator from the CDI Source window (GPS 1 or 2).
11. Press and Hold BACK Button to return to normal PFD display.
12. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.

NOTE

The airplane will navigate in GPS mode throughout the intermediate portion of the approach procedure. When the airplane is inbound towards the final approach course, the CDI will automatically switch from GPS navigation to LOC navigation.

13. Verify.....Course pointer slews to the front course.
14. Upon reaching the LOC course, turn inbound and follow the LOC course.
15. Set Minimum Descent Altitude (MDA)..... Touch the Reference Altitude display.
    Enter the Minimum Descent Altitude.
16. At the Final Approach Fix (FAF), begin descent to an intermediate altitude or the Minimum Descent Altitude.
17. At the Minimum Descent Altitude, Set Missed Approach Altitude .....Touch the Reference Altitude display.
    Enter the Missed Approach Altitude.
18. At Missed Approach Point, Continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

RNAV (GPS) OR RNAV (GNSS) – (LPV, LP+V, LNAV/VNAV, or LNAV+V)

NOTE

Some RNAV (GPS) or (GNSS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LP+V, LNAV, or LNAV+V are considered Non-precision Approaches (NPA) and are flown to an MDA even though vertical glidepath (GP) information may be provided. LP approaches may not be available outside of the United States.

1. Load the approach into the External navigator.
2. Navigation Source .....Select GPS on the external navigator
3. Approach Minimums..... Set the barometric minimums alert bug:
   - On the PFD, Touch the HSI.
   - Touch the Highlight Minimums window.
   - Enter Barometric Altitude Minimums and touch ENTER
4. G3X Touch CDI source .....Touch the HSI display on the PFD.
   PFD Options window opens.
5. Select the external navigator from the CDI Source window (GPS 1 or 2).
6. Press and Hold BACK Button to return to normal PFD display.

If Flying Vectors-To-Final:

7. Activate Vectors-to-Final on the external navigator .... Verify CDI slews to the inbound course.

8. Establish Intercept Heading.
9. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.
10. Upon reaching the GPS course, turn inbound and follow the GPS course and GP vertical guidance.
11. Verify on the HSI the Navigation mode indicates the approach being flown, (LPV, LP+V, LNAV/VNAV, or LNAV+V)
12. Set Missed Approach Altitude ..... Touch the Reference Altitude display. Enter the missed approach altitude.
13. At Decision Altitude (DA or MDA for an LNAV+V), Continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

If Flying Full Approach Including Transition:

ACTIVATE THE APPROACH on the External navigator,

OR

ACTIVATE a DIRECT TO the IAF on the External navigator.

7. Navigation Source ..... Select GPS on the external navigator
8. Select IAF waypoint and execute the Direct-TO on the external navigator
9. G3X Touch CDI source ..... Touch the HSI display on the PFD. PFD Options window opens.
10. Select the external navigator from the CDI Source window (GPS 1 or 2).
11. Press and Hold BACK Button to return to normal PFD display.
12. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.

NOTE

The airplane will navigate in GPS mode throughout the intermediate portion of the approach procedure. When the airplane is inbound towards the final approach course, the CDI will automatically slew to the inbound course.

13. Verify..... Course pointer slews to the front course
14. Upon reaching the GPS course, turn inbound and follow the GPS course and GP vertical guidance.
15. Verify on the HSI the Navigation mode indicates the approach being flown, (LPV, LP+V, LNAV/VNAV, or LNAV+V)
16. Set Missed Approach Altitude ..... Touch the Reference Altitude display. Enter the missed approach altitude.

17. At Decision Altitude (DA or MDA for a LPV+V or LNAV+V), continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

RNAV (GPS) OR RNAV (GNSS) – (LNAV, LP)

NOTE

Some RNAV (GPS) or (GNSS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LP+V, LNAV, or LNAV+V are considered Non-precision Approaches (NPA) and are flown to an MDA even though vertical glidepath (GP) information may be provided. Approaches that are annunciated on the HSI as LP will not have vertical glidepath (GP) information provided. LP approaches may not be available outside of the United States.

1. Load the approach into the External navigator.
2. Navigation Source ..... Select GPS on the external navigator
3. Approach Minimums..... Set the barometric minimums alert bug:
   - On the PFD, Touch the HSI.
   - Touch the Highlight Minimums window.
   - Enter Barometric Altitude Minimums and touch ENTER
4. G3X Touch CDI source ..... Touch the HSI display on the PFD. PFD Options window opens.
5. Select the external navigator from the CDI Source window (GPS 1 or 2).
6. Press and Hold BACK Button to return to normal PFD display.

If Flying Vectors-To-Final:

7. Activate Vectors-to-Final on the external navigator .... Verify CDI slews to the inbound course.
8. Establish Intercept Heading.
9. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.
10. Upon reaching the GPS course, turn inbound and follow the GPS course.
11. Verify on the HSI the Navigation mode indicates the approach being flown, (LNAV or LP)
12. Set Minimum Descent Altitude (MDA)..... Touch the Reference Altitude display. Enter the Minimum Descent Altitude.
13. At the Final Approach Fix (FAF), begin descent to an intermediate altitude or the Minimum Descent Altitude.
14. At the Minimum Descent Altitude, Set Missed Approach Altitude ..... Touch the Reference Altitude display. Enter the Missed Approach Altitude.
15. At Missed Approach Point, Continue visually for a normal landing,

OR

Press GO AROUND button and fly the missed approach procedure.

If Flying Full Approach Including Transition:

ACTIVATE THE APPROACH on the External navigator,

OR

ACTIVATE a DIRECT TO the IAF on the External navigator.

7. Navigation Source ..... Select GPS on the external navigator
8. Select IAF waypoint and execute the Direct-TO on the external navigator
9. G3X Touch CDI source ..... Touch the HSI display on the PFD. PFD Options window opens.
10. Select the external navigator from the CDI Source window (GPS 1 or 2).
11. Press and Hold BACK Button to return to normal PFD display.
12. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.

NOTE

The airplane will navigate in GPS mode throughout the intermediate portion of the approach procedure. When the airplane is inbound towards the final approach course, the CDI will automatically slew to the inbound course.

13. Verify..... Course pointer slews to the front course
14. Upon reaching the GPS course, turn inbound and follow the GPS course.
15. Verify on the HSI the Navigation mode indicates the approach being flown, (LNAV or LP)
16. Set Minimum Descent Altitude (MDA)..... Touch the Reference Altitude display. Enter the Minimum Descent Altitude.
17. At the Final Approach Fix (FAF), begin descent to an intermediate altitude or the Minimum Descent Altitude.
18. At the Minimum Descent Altitude, Set Missed Approach Altitude ..... Touch the Reference Altitude display. Enter the Missed Approach Altitude.
19. At Missed Approach Point, Continue visually for a normal landing,

OR

Press GO AROUND button and fly the missed approach procedure.

VOR APPROACH

1. Load the approach into the External navigator .....Verify external navigator tunes the proper frequency. Select it as the active frequency.
2. Navigation Source .....Select GPS on the external navigator
3. Approach Minimums..... Set the barometric minimums alert bug:
   - On the PFD, Touch the HSI.
   - Touch the Highlight Minimums window.
   - Enter Barometric Altitude Minimums and touch ENTER
4. G3X Touch CDI source .....Touch the HSI display on the PFD. PFD Options window opens.
5. Select the external navigator from the CDI Source window (GPS 1 or 2).
6. Press and Hold BACK Button to return to normal PFD display.

If Flying Vectors-To-Final:

7. Activate Vectors-to-Final on the external navigator, Verify CDI slews to the appropriate course.
8. Navigation Source .....Select VOR on the external navigator.
9. G3X Touch CDI source .....Touch the HSI display on the PFD. PFD Options window opens.
10. Select the external navigator from the CDI Source window (VOR 1 or 2).
11. Verify the selected course .....Touch the Selected Course window to adjust if needed.
12. Establish Intercept Heading.
13. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.
14. Upon reaching the VOR course, turn inbound and follow the VOR course.
15. Set Minimum Descent Altitude (MDA)..... Touch the Reference Altitude display. Enter the Minimum Descent Altitude.
16. At the Final Approach Fix (FAF), begin descent to an intermediate altitude or the Minimum Descent Altitude.
17. At the Minimum Descent Altitude, Set Missed Approach Altitude .....Touch the Reference Altitude display. Enter the Missed Approach Altitude.
18. At Missed Approach Point, Continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

If Flying Full Approach Including Transition:

ACTIVATE THE APPROACH on the External navigator,

OR

ACTIVATE a DIRECT TO the IAF on the External navigator.

7. Navigation Source ..... Select GPS on the external navigator
8. Select IAF waypoint and execute the Direct-TO on the external navigator
9. G3X Touch CDI source ..... Touch the HSI display on the PFD. PFD Options window opens.
10. Select the external navigator from the CDI Source window (GPS 1 or 2).
11. Press and Hold BACK Button to return to normal PFD display.
12. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.

NOTE

The airplane will navigate in GPS mode throughout the intermediate portion of the approach procedure.

13. When established inbound to the FAF ..... Navigation Source, Select VOR on the external navigator.
14. Verify..... VOR is annunciated in the HSI.
15. Verify..... Course pointer is on the FAF inbound course.
16. Set Minimum Descent Altitude (MDA)..... Touch the Reference Altitude display. Enter the Minimum Descent Altitude.
17. At the Final Approach Fix (FAF), begin descent to an intermediate altitude or the Minimum Descent Altitude.
18. Adjust VOR course if needed inside the FAF.
19. At the Minimum Descent Altitude, Set Missed Approach Altitude ..... Touch the Reference Altitude display. Enter the Missed Approach Altitude.
20. At Missed Approach Point, Continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

BACK COURSE (BC)

1. Load the approach into the External navigator ..... Verify external navigator tunes the proper frequency. Select it as the active frequency.
2. Navigation Source ..... Select GPS on the external navigator
3. Approach Minimums..... Set the barometric minimums alert bug:

- On the PFD, Touch the HSI.
- Touch the Highlight Minimums window.
- Enter Barometric Altitude Minimums and touch ENTER

4. G3X Touch CDI source .....Touch the HSI display on the PFD.
   PFD Options window opens.
5. Select the external navigator from the CDI Source window (GPS 1 or 2).
6. Press and Hold BACK Button to return to normal PFD display.

If Flying Vectors-To-Final:

7. Activate Vectors-to-Final on the external navigator, Verify CDI changes slews to the localizer front course.
8. Navigation Source .....Select LOC on the external navigator.
9. G3X Touch CDI source .....Touch the HSI display on the PFD.
   PFD Options window opens.
10. Select the external navigator from the CDI Source window (LOC 1 or 2).
11. Verify the selected front course.....Touch the Selected Course window to adjust if needed.
12. Establish Intercept Heading.
13. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.
14. Upon reaching the BC course, turn inbound and follow the BC course guidance.
15. Set Minimum Descent Altitude (MDA)..... Touch the Reference Altitude display.
    Enter the Minimum Descent Altitude.
16. At the Final Approach Fix (FAF), begin descent to an intermediate altitude or the Minimum Descent Altitude.
17. At the Minimum Descent Altitude, Set Missed Approach Altitude .....Touch the Reference Altitude display.
    Enter the Missed Approach Altitude.
18. At Missed Approach Point, Continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

If Flying Full Approach Including Transition:

ACTIVATE THE APPROACH on the External navigator,

OR

ACTIVATE a DIRECT TO the IAF on the External navigator.

7. Navigation Source .....Select GPS on the external navigator
8. Select IAF waypoint and execute the Direct-TO on the external navigator

9. G3X Touch CDI source .....Touch the HSI display on the PFD.
   PFD Options window opens.
10. Select the external navigator from the CDI Source window (GPS 1 or 2).
11. Press and Hold BACK Button to return to normal PFD display.
12. Verify ACTIVE and ARMED modes on the AFCS Status Box on the PFD, if using the GFC 500 autopilot/FD.

NOTE

The airplane will navigate in GPS mode throughout the intermediate portion of the approach procedure.

13. When established inbound to the FAF .....Navigation Source, Select LOC on the external navigator.
14. Verify..... BC is annunciated in the HSI.
15. Verify.....Course pointer is on the front course.
16. Set Minimum Descent Altitude (MDA)..... Touch the Reference Altitude display.
    Enter the Minimum Descent Altitude.
17. At the Final Approach Fix (FAF), begin descent to an intermediate altitude or the Minimum Descent Altitude.
18. At the Minimum Descent Altitude, Set Missed Approach Altitude .....Touch the Reference Altitude display.
    Enter the Missed Approach Altitude.
19. At Missed Approach Point, Continue visually for a normal landing,

    OR

    Press GO AROUND button and fly the missed approach procedure.

GO AROUND (GA)

1. Control Wheel.....GRASP FIRMLY
2. GO AROUND button .....PUSH
3. Rotate to Go Around attitude
4. Go Around .....EXECUTE

NOTE

If using a Garmin external navigator and an instrument approach is loaded, the HSI will automatically change to GPS course guidance, and the flight plan will automatically sequence onto the missed approach portion of the flight plan.

5. Verify the HSI changes to the GPS navigation.
6. Verify that leg sequencing has unsuspended. If not, unsuspend leg sequencing.
7. Fly Published Missed Approach Procedure,

OR

Fly ATC Assigned Missed Approach Heading

NOTE

The pilot is responsible for initial missed approach guidance in accordance with published procedure. The G3X Touch may not provide correct guidance until the airplane is established on a defined leg of the procedure.

8. Set Missed Approach Altitude ..... Touch the Reference Altitude display. Enter the Missed Approach Altitude.

4.6 Barometric Minimums Alert

A barometric minimums alert is provided in the G3X Touch to enhance the pilot's awareness of approaching altitude minimums while flying an instrument approach procedure.

Setting the barometric minimums alert bug:

1. On the PFD, Touch the HSI.
2. Touch the Highlight Minimums window.
3. Enter Barometric Altitude Minimums and touch ENTER

CAUTION

If a new approach is loaded into an external IFR capable navigator, the pilot will need to update the Barometric Minimums Alert in the G3X Touch with the new approach's altitude minimums.

4.7 Transponder Operation (Optional)

Entering Transponder Code

1. Touch the transponder data box.
2. Use the keypad to enter a code and touch ENTER.

IDENT

1. Touch IDENT, the green bar illuminates momentarily.

4.8 Disable Electronic Stability Protection (ESP)

(If Installed, GFC 500 Autopilot)

To disable ESP for flight training purposes or aerobatic maneuvers:

On ground or in flight:

1. Touch the AFCS Status Box at the top of the PFD. Automatic Flight Control System window opens.
2. Highlight and Select ESP. The green ESP status bar extinguishes. ESP is disabled.

3. Press and Hold the BACK button to close the Automatic Flight Control System window and return to PFD display.

In flight only:

1. Press and hold the AP DISC switch for 5 seconds.

To reenable ESP:

1. Touch the AFCS Status Box at the top of the PFD. Automatic Flight Control System window opens.
2. Highlight and Select ESP. The green ESP status bar illuminates. ESP is enabled.
3. Press and Hold the BACK button to close the Automatic Flight Control System window and return to PFD display.

5 PERFORMANCE

No change.

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6 WEIGHT AND BALANCE

See current weight and balance data.

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7 SYSTEM DESCRIPTION

The G3X Touch EFIS is scalable with a variety of configurations supported. The functions described in this section may not be available in all aircraft depending on installed equipment and interfaces. A minimum installation with a single display may be a standalone MFD or a PFD which can be split screened to provide both PFD and MFD functions. Optional functions include EIS, datalink traffic and weather, AOA, autopilot interface, remote audio panel, GPS/NAV/COM interface, transponder interface, and others.

7.1 Primary Flight Instruments

When a PFD is installed, attitude information is displayed over a virtual blue sky and synthetic ground with a white horizon line. The Attitude Indicator displays the pitch (indicated by the Amber symbolic aircraft on the pitch scale), roll, and slip/skid information.

The horizon line is part of the pitch scale. Pitch markings occur at 2.5˚ intervals through all pitch ranges.

The inverted white triangle indicates zero on the roll scale. Major tick marks at 30˚ and 60˚ and minor tick marks at 10˚, 20˚, and 45˚ are shown to the left and right of the zero. Angle of bank is indicated by the position of the pointer on the roll scale.

Slip/skid is indicated by the location of the ball.



Bezel Overview (GDU 460)



Bezel Overview (GDU 470)

NRST Key	Press to display the Nearest Page for viewing the nearest airports, intersections, NDBs, VORs, waypoints, frequencies, and airspaces
Direct-To Key	Press to activate the Direct-To function, enter a destination waypoint establish a direct-to course to the selected destination
MENU Key	Press once to view the Page Menu Press twice to view the Main Menu Press a third time to clear the Main Menu enabled.
BACK Key	Press to return to the previous screen Press and hold to return to the default MFD Page

The Standard Rate Turn Bank Angle Pointers are green pointers displayed on the roll scale that show the bank angle corresponding to a standard rate turn.



Standard Rate Turn Bank Angle Pointers

The Turn Rate Indicator is located at the top of the HSI. Tick marks to the left and right of the displayed heading denote standard turn rates (3 deg/sec). A magenta Turn Rate Trend Vector shows the current turn rate. The end of the trend vector gives the heading predicted in 6 seconds, based on the present

turn rate. A standard-rate turn is shown on the indicator by the trend vector stopping at the standard turn rate tick mark, corresponding to a predicted heading of 18˚ from the current heading. At rates greater than 4 deg/sec, an arrowhead appears at the end of the magenta trend vector and the prediction is no longer valid.

The Airspeed Indicator may be displayed as a vertical tape or a round dial. When the Airspeed Indicator is displayed as a tape, it displays a range of 70 knots on a rolling number gauge using a vertical tape. Numeric labels and major tick marks are shown at intervals of 10 knots. Minor tick marks are at intervals of 5 knots. The current airspeed is displayed in the black pointer. The True Airspeed (TAS) is displayed above the scale in white digits and the Ground Speed (GS) is displayed below the scale in magenta digits.

The Altimeter may be displayed as a vertical tape or a round dial. When the Altimeter is displayed as a tape, it displays 400 feet of barometric altitude values at a time on a rolling number gauge using a moving tape. Numeric labels and major tick marks are shown at intervals of 100 feet. Minor tick marks are at intervals of 20 feet. The current altitude is displayed in the black pointer. The barometric pressure setting is displayed below the Altimeter in inches of mercury (in Hg) or hectopascals (hPa) when metric units are selected.

The Selected Altitude is displayed above the Altimeter in the box indicated by a selection bug symbol. A bug corresponding to this altitude is shown on the altimeter; if the Selected Altitude exceeds the range shown on the tape, the bug appears at the corresponding edge of the tape.

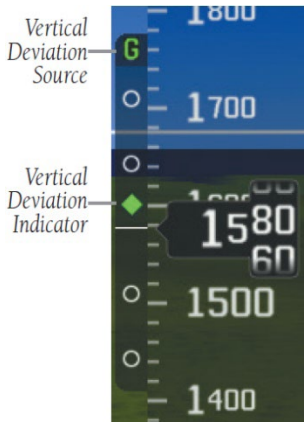
The Altitude Alerting function provides the pilot with visual and aural alerts when approaching the Selected Altitude. Whenever the Selected Altitude is changed, the Altitude Alerter is reset. The following will occur when approaching the Selected Altitude:

- Passing within 1000 feet of the Selected Altitude, the Selected Altitude (shown above the Altimeter) flashes for 5 seconds and an aural tone is generated.
- When the aircraft passes within 200 feet of the Selected Altitude, the Selected Altitude flashes for 5 seconds and an aural tone is generated to indicate that the aircraft is approaching the selected altitude.
- After reaching the Selected Altitude, if the pilot flies outside the deviation band (±200 feet of the Selected Altitude), the Selected Altitude changes to Amber text on a black background, flashes for 5 seconds, and an aural tone is generated.

The Vertical Speed Indicator (VSI) may be displayed as a tape or an arc segment. The VSI displays the aircraft vertical speed using a non-moving tape labeled at 500, 1000 and every 1000 fpm up to the maximum with minor tick marks every 100 feet up to 1000 fpm. The current vertical speed is displayed using a white arrow along the scale.

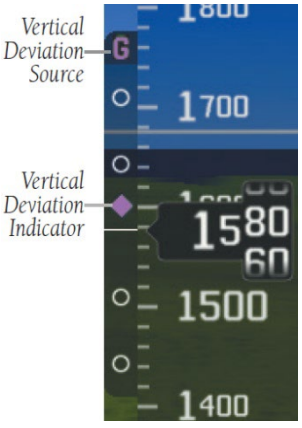
7.2 Vertical Deviation Indicators

The Vertical Deviation (Glideslope) Indicator (VDI) appears to the left of the altimeter whenever an ILS frequency is tuned in the active NAV field of an external navigator. A green diamond acts as the VDI Indicator. The green 'G' indicates an external glideslope source. If a localizer frequency is tuned and there is no glideslope signal, “NO GS” is annunciated.



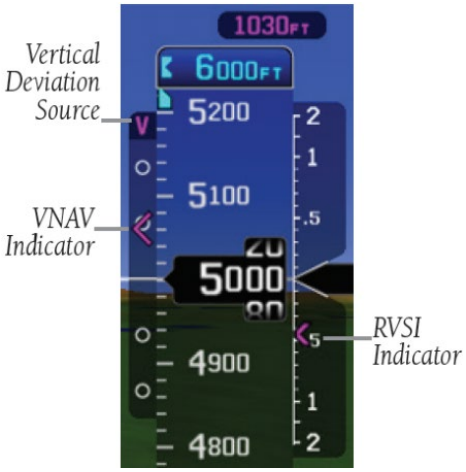
Vertical Deviation Indicator (Glideslope – ILS Source)

The Vertical Deviation (Glidepath) Indicator (VDI) also appears to the left of the altimeter during a GPS approach. The glidepath is analogous to the glideslope for GPS approaches supporting WAAS vertical guidance (LNAV+V, L/VNAV, LPV). The Glidepath Indicator appears on the G3X Touch as a magenta diamond. The magenta 'G' indicates a GPS source. If the approach type downgrades past the final approach fix (FAF), “NO GP” is annunciated.



Vertical Deviation Indicator (Glidepath – GPS Source)

An external navigation source is not required to receive VNAV indications. A magenta chevron (VNAV Indicator) to the left of the altimeter on the Vertical Deviation Scale shows the VNAV profile, and a magenta chevron (Required Vertical Speed Indicator (RVSI)) on the Vertical Speed Indicator indicates the required vertical speed to reach the target altitude. The magenta 'V' indicates a VNAV profile is active.



VNAV Indicator

7.3 HSI Annunciations

Some or all HSI annunciations may appear in the four quadrants of the G3X Touch HSI depending on the external navigator(s) configured.

Amber **LOI** – Loss of GPS integrity

Amber or Magenta **VFR** – An external GPS source is configured but there is not enough guidance data for IFR use.

Amber **REV** – External navigation source failed. Reverted to internal VFR GPS for navigation.

Amber **MSG** – External navigation source has a pending message

Cyan **INT** – The pilot has elected to use the internal GPS navigation source instead of the external GPS navigation source.

7.4 Course Deviation Indicator (CDI)

The HSI contains a Course Deviation Indicator (CDI), with a Course Pointer, To/From Indicator, and a sliding deviation bar and scale. The course pointer is a single line arrow (GPS1, VOR1, and LOC1) or a double line arrow (GPS2, VOR2, and LOC2) which points in the direction of the set course. The To/From arrow rotates with the course pointer and is displayed when the active NAVAID is received.

The Course Deviation Indicator (CDI) moves left or right from the course pointer along a lateral deviation scale to display aircraft position relative to the course. If the course deviation data is not valid, the CDI is not displayed.

Another Lateral Deviation Scale and combination Course Deviation and To/From Indicator is located below the slip/skid indicator.



CDI and Lateral Deviation Indication

The CDI can display two sources of navigation: GPS or NAV (VOR, localizer) depending on the external navigator(s) configured. Color indicates the current navigation source: magenta (for GPS) or green (for VOR and LOC). The full-scale limits for the CDI are defined by a GPS-derived distance when coupled to GPS. When coupled to a VOR or localizer (LOC), the CDI has the same angular limits as a mechanical CDI. If the CDI exceeds the maximum deviation on the scale (two dots) while coupled to GPS, the crosstrack error (XTK) is displayed below the white aircraft symbol.

In addition to the flight instruments, the PFD also displays supplemental information, including the Outside Air Temperature (OAT), wind data, User Timer, and G-Meter.

7.5 Display of PFD information on MFD

MFDs installed as part of the G3X touch system can display PFD information if manually selected by the pilot, or will automatically do so if the installed PFD display fails. The display of PFD information on an MFD is a duplication of the original PFD information and is not an independent compilation of data from other sources.

To manually display backup PFD information on an MFD:

1. On the MFD, press the MENU button twice.
2. Select Setup.
3. Select Display.
4. On a 7” GDU 470, set Full MFD/PFD Toggle to Enabled. On a 10” GDU 460, set MFD Split Screen Page to PFD.
5. Press and hold the BACK button to close the Display Setup window and return to MFD display.
6. On a 7” MFD, touch the PFD button in the upper corner to select the backup PFD display. On a 10” MFD, touch the Split button in the upper corner to select the backup PFD display.

7.6 Engine Indication System

The G3X Touch EIS (if installed) displays engine, electrical, and other system parameters. Gauges required to be displayed full time are located on the Main Engine Display which is always in view. Additional EIS information can be viewed on the Eng Page which can be selected by touching the Main Engine Display or by turning the 'Select Page' knob to the right on an MFD window.

Green bands on the instruments indicate normal ranges of operation; amber and red bands indicate caution and warning, respectively. When unsafe operating conditions occur, the corresponding caution readout will display solid amber and the warning readout will flash red. Most EIS caution and warning conditions also generate an alert message on the PFD, including gauges that may appear only on the Eng Page. An aural alert is also issued with a flashing red warning. If sensor data for an instrument becomes invalid or unavailable, a red "X" is displayed across the instrument.

7.7 Communication / Navigation / Surveillance System

The Communication/Navigation/Surveillance (CNS) system includes the audio interface, communication radios, navigation radios, and Mode S transponder. These functions can be accessed from the boxes that make up the CNS Data Bar located at the top of the PFD and/or MFD.



CNS Data Bar

7.8 Remote Transponder Interface

The G3X Touch is capable of interfacing with several remote transponders providing Mode S interrogation and reply capabilities. Transponder tuning for panel mount transponders is also supported.

Ground and Altitude Modes

Most Garmin transponders automatically transition between on-ground and in-air and operate in the appropriate mode at all times. No pilot action is required to manage modes unless there is a need to manually select STBY or ON modes.

G3X displays a green GND indication and transponder code in the Transponder Data Box while on-ground, and a green ALT indication when in-air, when not set to STBY or ON.

NOTE

Some panel mount transponders may indicate ALT on their dedicated display at all times, even while on-ground. As a result, in some installations, the transponder display and G3X display will indicate different modes while on the ground, although they are functionally equivalent.

Standby Mode (Manual)

When Standby mode is selected, the transponder does not reply to interrogations, but new codes can be entered. A white STBY indication and transponder code appear in the Transponder Data Box. The transponder will not automatically transition from STBY to ALT mode when the aircraft transitions from on-ground to in-air.

On Mode (Manual)

ON Mode can be selected at any time. ON Mode generates Mode A and Mode S replies, but Mode C altitude reporting is inhibited. In ON Mode, a green ON indication and transponder code appear in the Transponder Data Box.

Reply Status

When the transponder sends replies to interrogations, a green R indication appears momentarily in the Transponder Data Box.

IDENT Function

Touching IDENT sends a distinct identity indication to Air Traffic Control (ATC). The indication distinguishes the identing transponder from all the others on the air traffic controller's screen. After touching IDENT the bar on the button turns green momentarily.

7.9 Minimum Altitude Display and Alerting

When enabled by the pilot, an altitude minimums bug will be displayed in cyan on the barometric altitude tape.

Altitude minimums are accessed under the PFD Options Menu → Minimums sub menu and can be set by touchscreen keypad or dual-concentric knob.

Both visual and aural altitude minimums alerts are provided. During a descent to minimums, the minimums bug will change from cyan to white when the aircraft descends to within 100 ft of minimums. An aural "Minimums, Minimums" alert will be triggered when the aircraft's altitude descends through minimums and the minimums bug will change to Amber. As the aircraft altitude climbs back above minimums, the minimums bug will change to white 50 ft above minimums and cyan 150 ft above minimums. Alerting is rearmed once the aircraft is 150 ft or more above the minimum's altitude.

If a new approach is loaded into the external navigator, the Minimums Altitude display is not automatically updated with the new approach minimums. The pilot must update the Minimums Altitude Display with the MDA/DH for the approach loaded into the navigator.

~~7.10 AOA Probe~~

~~The G3X Touch PFD will display angle of attack from the GAP 26 AOA probe if installed. The GSU 25 uses the pressure from the GAP 26 probe and the pitot/static pressures it already receives from the existing aircraft pitot/static system to determine the aircraft's angle of attack (AOA).~~

~~The AOA indications and warnings presented on the G3X system are for reference only and are not intended as replacements for the aircraft's original stall warning system. The AOA stall warning margin and indications may not be the same at different flap settings and are only supported for positive G flight.~~

~~7.11 GAD 27 Wig Wag~~

~~The GAD 27 module (if installed) provides a feature that provides the ability to flash the Landing and Taxi lights of the airplane in an alternating fashion, otherwise known as "Wig Wag". Two 3-position switches control this feature, one for the landing lights and one for the taxi lights:~~

- ~~ON – Respective light is on~~
- ~~FLASH – Respective light will flash~~
- ~~OFF – Respective light is off~~

When both switches are in the FLASH position, the landing and taxi lights alternate off and on with each other to produce the 'Wig-Wag' effect.

Before landing, switch to ON for steady landing lights.

7.12 EIS Caution / Warning Lights

If the G3X EIS display is outside the pilot's primary field of view and a PFD is not installed to provide EIS annunciations, discreet Caution/Warning lights are installed. The lights are installed in the primary field of view and are labeled ENGINE. Only a G3X EIS exceedance from a gauge on the Main EIS Display triggers the EIS Caution/Warning lights. EIS gauges that are not on the Main EIS Display do not alert.

7.13 Smart Glide

When installed with a Garmin GTN Xi with Smart Glide enabled, the G3X Touch will provide Smart Glide map indications, annunciation of GLIDE, and Emergency Page data for the Smart Glide feature. For more details on the Smart Glide function, refer to the GTN Xi Pilot's Guide (190-02327-03, revision D or later) and GTN Xi AFMS (P/N 190-01007-C2 or 190-01007-C3, revision 4 or later).

7.14 SFD Baro Sync

Cyan background coloring of the altimeter barometric window on either the G5/GI 275 or G3X PFD altimeters indicates that the altimeter setting is automatically changing to synchronize with the other unit. This feature is called **SFD Baro Sync**.

SFD Baro Sync can be **Enabled** or **Disabled** in the G3X Touch PFD Menu. It defaults to Enabled when the system is powered on. When **SFD Baro Sync** is enabled, and the pilot changes the altimeter setting on one altimeter, the other altimeter setting changes automatically and indicates in inverse video (cyan background with black numbers).

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c/o GARMIN International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

EASA Approved AIRPLANE FLIGHT MANUAL SUPPLEMENT

G3X Touch Electronic Flight Instrument System

Dwg. Number: 190-01754-02 Rev. 1

This Supplement is Applicable to the Following Manuals:

190-01754-01

This Supplement must be attached to the FAA Approved STC Airplane Flight Manual Supplement when the GARMIN G3X Touch Electronic Flight Instrument System is installed in accordance with STC SA01899WI. The information contained herein supplements the information of the STC Airplane Flight Manual Supplement. For Limitations, Procedures, and Performance information not contained in this Supplement consult the basic Pilot's Operating Handbook, FAA Approved Airplane Flight Manual and the FAA Approved STC Airplane Flight Manual Supplement.

Airplane Serial Number: CESSNA- 172S8743

Airplane Registration Number: F-HAAM

Signed By: _____

Robert G. Murray
ODA STC Unit Administrator
Garmin International Inc.
ODA-240087-CE

Date: JULY 16, 2020

EASA Approval No. 10073816
Revised: --

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GARMIN International, Inc.
1200 E. 151st Street
Olathe, KS 66062 USA
Telephone: 913-397-8200
www.garmin.com

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GARMIN International, Inc

Log of Revisions

EASA Approved AIRPLANE FLIGHT MANUAL SUPPLEMENT

GARMIN G3X Touch Electronic Flight Instrument System
AML STC

REV NO.	PAGE NO(S)	DESCRIPTION	DATE OF APPROVAL	EASA APPROVED
1	ALL	Original Issue	See Cover	See Cover

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Section 1 - General

The information in this supplement is EASA-approved material and must be attached to the FAA Approved STC Airplane Flight Manual Supplement, p/n 190-01754-01 when the airplane has been modified by installation of the Garmin G3X Touch Electronic Flight System in accordance with STC SA01899WI.

This EASA approved Airplane Flight Manual Supplement is required in addition to the FAA approved Airplane Flight Manual Supplement, p/n 190-01754-01.

Section 2 – Limitations

No change except as shown below.

2.23 Portable Electronic Devices
Data Received by Personal Electronic Devices (PED)

The PED is not approved as the sole source of information to base tactical or strategic decision making and is not approved to replace the information provided by the Garmin G3X EFIS. The G3X's Bluetooth interface and data provided to a portable electronic device is not approved to replace any required or installed aircraft display equipment, including navigation or traffic/weather display equipment. The data presented on the PED may not have the required integrity to be used as the sole source of information to base tactical or strategic decision making.

2.24 Kinds of Operations
FAA operational requirements (14 Code of Federal Regulations Part 91, Part 121, and Part 135) do not apply to aircraft operated under European Operational requirements.

Flight Plan Transfer

Use of the G3X's Bluetooth connectivity for flight plan importing during critical phases of flight by the pilot flying is prohibited.

Electronic Flight Bag (EFB)

Use of the G3X's Bluetooth interface and data for the purpose of Electronic Flight Bag (EFB) applications is not approved as part of this STC. Use of any device as an EFB may require separate approvals.

Section 3 – Emergency Procedures

No Change except as shown below

3.7 EIS Failure

2. Land as soon as practical

Section 4 – Normal Procedures

References to "LP" approaches should be disregarded for aircraft operating within European airspace.

Section 5 - Performance

No Change

Section 6 – Weight and Balance

No Change

Section 7 – Systems Description

No Change

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Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 72S8001 AND ON

SUPPLEMENT 4

GFC500 Digital autopilot

GARMIN Ltd. or its subsidiaries
c/o GARMIN International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

GFC 500 Autopilot with ESP

Installed in

Textron Aviation 172E / 172F / 172G / 172H / 172I / 172K / 172L / 172M / 172N / 172P / 172Q / 172R / 172S / R172K

And

Cessna F172E / F172F / F172G / F172H / F172K / F172L / F172M / F172N / F172P / FR172K

Dwg. Number: 190-02291-02 Rev. 10

This Supplement must be attached to the FAA Approved Airplane Flight Manual when the GFC 500 Autopilot system is installed in accordance with STC SA01866WI. The information contained herein supplements the information of the basic Airplane Flight Manual. For Limitations, Procedures, and Performance information not contained in this Supplement consult the basic Pilot's Operating Handbook and 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.

Airplane Serial Number: CEESNA 172S87433

Airplane Registration Number: F-HAAM

FAA Approved By: Paul Mast

Paul Mast
ODA STC Unit Administrator
Garmin International, Inc
ODA-240087-CE

Date: 7-12-2024

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Garmin International, Inc.
1200 E. 151st Street
Olathe, KS 66062 USA
Telephone: 913-397-8200
www.garmin.com

Garmin International, Inc

Log of Revisions

FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

GFC 500 Autopilot with ESP

Installed in

Textron Aviation 172E / 172F / 172G / 172H / 172I / 172K / 172L / 172M / 172N / 172P / 172Q / 172R / 172S / R172K

And

Cessna F172E / F172F / F172G / F172H / F172K / F172L / F172M / F172N / F172P / FR172K

REV NO.	PAGE NO(S)	DESCRIPTION	DATE OF APPROVAL	FAA APPROVED
1	ALL	Original Issue	12/21/2017	Robert G. Murray Garmin ODA STC Unit Administrator
2	ALL	Add model 172E	5/11/2018	Robert G. Murray Garmin ODA STC Unit Administrator
3	ALL	Add VNAV Procedures	07/27/2018	Paul Mast Garmin ODA STC Unit Administrator
4	ALL	Correct Typographical errors	01/18/19	Robert G. Murray Garmin ODA STC Unit Administrator
5	ALL	Add G3X Information	03/15/19	Robert G. Murray Garmin ODA STC Unit Administrator
6	ALL	Added R172K/FR172K/F172E	05/30/19	Paul Mast Garmin ODA STC Unit Administrator
7	ALL	Updated various procedures	12/16/19	Robert G. Murray Garmin ODA STC Unit Administrator

REV NO.	PAGE NO(S)	DESCRIPTION	DATE OF APPROVAL	FAA APPROVED
8	ALL	Add GI 275 Information	9/10/20	Erik Frisk Garmin ODA STC Unit Administrator
9	ALL	Added ESP Disable	4/21/2023	Paul Mast Garmin ODA STC Unit Administrator
10	ALL	Updated to show airspeed in both MPH and KTS	See Cover	See Cover

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SECTION 1 – GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual (POH/AFM) when the airplane has been modified by installation of the Garmin GFC 500 Autopilot system in accordance with Garmin International, Inc. approved data.

The information in this supplement supersedes or adds to the basic POH/AFM only as set forth below. Users of the manual are advised to always refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

USE OF THE SUPPLEMENT

The following definitions apply to WARNINGS, CAUTIONS and NOTES found throughout the supplement:

WARNING

Operating procedures, techniques, etc., which may result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc., which may result in damage to equipment if not carefully followed.

NOTE

Operating procedures, techniques, etc., which is considered essential to emphasize.

ABBREVIATIONS AND TERMINOLOGY

The following glossary is applicable within the airplane flight manual supplement

AFCS	Automatic Flight Control System
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
AGL	Above Ground Level
AHRS	Attitude and Heading Reference System
ALT	Altitude
AP	Autopilot
APR	Approach
ATC	Air Traffic Control
BC	Back Course Approach
CDI	Course Deviation Indicator
DA	Decision Altitude
DISC	Disconnect
DWG	Drawing
ESP	Electronic Stability and Protection
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FD	Flight Director
GA	Go Around
GFC 500	Garmin Autopilot
GMC 507	Autopilot Mode Control Panel
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GS	Glideslope
GSA	Garmin Servo Actuator
HDG	AFCS heading mode
IAS	Indicated Airspeed
ILS	Instrument Landing System
INT	Interrupt
KIAS	Knots Indicated Airspeed
LNAV	Lateral Navigation
LNAV+V	Lateral Navigation with Advisory Vertical Guidance
LNAV/VNAV	Lateral Navigation / Vertical Navigation Approach
LOC	Localizer (no glideslope available)
LP	Localizer Performance
LP+V	Localizer Performance with Advisory Vertical Guidance
LPV	Localizer Performance with Vertical Guidance
LVL	Level
MDA	Minimum Descent Altitude
PFT	Preflight Test
POH	Pilot's Operating Handbook
STC	Supplemental Type Certificate
TO	Takeoff
TRK	Track
VHF	Very High Frequency
VOR	VHF Omni-directional Range
VS	Vertical Speed

INSTALLED EQUIPMENT INTERFACES

The following is the list of installed equipment and functions associated with the GFC 500 Autopilot installation in this airplane.

Table 1-1: Table of Installed Equipment Interfaces

DEVICE TYPE	Manufacturer / Model If not installed, note N/A	Additional Information
GPS Navigator #1	GTN650 Xi	Is Navigator #1 interfaced to GFC 500? X YES ☐ NO
VHF Nav Radio #1	GTN650 Xi	Is VHF Nav Radio #1 interfaced to GFC 500? ☒ YES ☐ NO
VHF Nav Radio #2		
Pitch Trim Servo	YES	

INSTALLED FEATURES CHECKLIST

The checked autopilot modes and features are available on this aircraft.

Basic AP Features

- ☒ Flight Director
- ☒ Electric Pitch Trim
- ☒ Overspeed Protection
- ☒ Underspeed Protection

Electronic Stability and Protection

- ☒ Pitch/Roll Attitude
- ☒ High Speed Protection
- ☒ Low Speed Protection

Vertical Autopilot Modes

- ☒ Pitch (PIT)
- ☒ Level (Zero vertical speed)
- ☒ Go Around (GA)
- ☒ Altitude Hold
- ☒ Vertical Speed
- ☒ Altitude Capture via Altitude Preselect
- ☒ Indicated Airspeed (IAS)
- ☒ Vertical Navigation (VNAV)
- ☒ GPS Approach Glidepath
- ☒ ILS Glideslope

Lateral Autopilot Modes

- ☒ Roll (ROL)
- ☒ Level (Wings Level)
- ☒ Go Around (GA)
- ☒ Heading
- ☒ Track
- ☒ GPS Navigation
- ☒ VHF Navigation
- ☒ Approach Mode
  - ☒ GPS
  - ☒ VOR/LOC

SECTION 2 – LIMITATIONS

The Garmin G5 Electronic Flight Instrument Pilot's Guide for Certified Aircraft, part number 190-01112-12 Rev A (or later approved revisions), must be immediately available to the flight crew (when G5 is installed).

The Garmin G3X Touch Pilot's Guide for Certified Aircraft, part number 190-02472-00, Rev A (or later approved revisions) must be immediately available to the flight crew (when G3X EFIS system is installed).

The Garmin GI 275 Pilot's Guide for Certified Aircraft, part number 190-02246-01, Rev B (or later approved revisions) must be immediately available to the flight crew (when GI 275 system is installed).

This AFMS is applicable to the software versions shown below:

Software Item	**Software Version (or later FAA Approved version for this STC)**
G5 Software Version	8.20
G3X Software Version	9.15
GI 275 Software Version	2.60

A pilot must be seated in the left pilot's seat, with seatbelt fastened, during all autopilot operations.

Do not use autopilot during takeoff and landing.

The GFC 500 AFCS preflight test must complete successfully prior to use of the autopilot, flight director or manual electric trim.

The maximum fuel imbalance with the autopilot engaged is 10 gallons.

All speeds shown are indicated airspeeds unless otherwise noted.

Autopilot maximum engagement speed is 150 KIAS (172 MPH).

Autopilot engagement is limited to flap positions no greater than 10 degrees.

The autopilot must be disengaged below 200 feet AGL during approach operations and below 800 feet AGL during all other operations.

The GFC 500 autopilot is approved for Category 1 precision approaches and non-precision approaches only.

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SECTION 3 – EMERGENCY PROCEDURES

Some emergency situations require immediate memorized corrective action. These steps are printed in bold in the emergency procedures and should be accomplished without the aid of the checklist.

AUTOPILOT MALFUNCTION / PITCH TRIM RUNAWAY

If the airplane deviates unexpectedly from the planned flight path:

1. **Control Wheel.....GRIP FIRMLY**
2. **AP DISC / TRIM INT Button .....PRESS AND HOLD**

CAUTION

Be prepared for high elevator control forces.

3. **Aircraft Attitude.....MAINTAIN / REGAIN AIRCRAFT CONTROL**
4. Elevator Trim.....RE-TRIM if necessary using Elevator Trim Control Wheel
5. AUTOPILOT Circuit Breaker..... PULL

NOTE

Do not release the AP DISC / TRIM INT Button until after pulling the AUTOPILOT Circuit Breaker.

Pulling the AUTOPILOT circuit breaker will render the autopilot and ESP inoperative.

6. AP DISC / TRIM INT Button..... RELEASE

WARNING

In flight, do not overpower the autopilot. The trim will operate in the direction opposing the overpower force, which will result in large out-of-trim forces.

Do not attempt to re-engage the autopilot or use manual electric pitch trim until the cause of the malfunction has been corrected.

AUTOPILOT FAILURE / ABNORMAL DISCONNECT

(Red AP in autopilot status box on display, continuous aural disconnect tone.)

1. AP DISC / TRIM INT Button or:
   - G5 Knob
   - G3X Autopilot Status Bar
   - GI 275 Knob or Autopilot Status Button ..... PRESS AND RELEASE (to cancel disconnect tone)
2. Aircraft Attitude ..... MAINTAIN / REGAIN AIRCRAFT CONTROL

NOTE

The autopilot disconnect may be accompanied by a red AFCS in the autopilot status box, indicating the automatic flight control system has failed. The flight director will not be available and the autopilot cannot be re-engaged with this annunciation present.

If the disconnect is accompanied by an amber AP with a red X, the autopilot will not be available however the flight director will still be functional.

In the event of a GMC failure, pressing the G5 knob, GI 275 knob or autopilot status button, or G3X Autopilot status bar will acknowledge the disconnect tone.

PITCH TRIM FAILURE

(Red PTRIM on G5, GI 275, or G3X display.)

This failure will only occur if the optional pitch trim servo is installed.

1. Indicates a failure of the pitch trim servo.
2. Control Wheel ..... GRIP FIRMLY
3. AP DISC / TRIM INT Button ..... PRESS and RELEASE (Be prepared for high elevator control forces)
4. Elevator Trim ..... AS REQUIRED USING ELEVATOR TRIM CONTROL WHEEL

NOTE

The autopilot may be re-engaged. Refer to the normal procedures section of this AFMS, MANUAL PITCH TRIM WITH AUTOPILOT ENGAGED.

ESP ACTIVATION

1. **Throttle ..... AS REQUIRED**
2. **Aircraft Attitude ..... MAINTAIN / REGAIN AIRCRAFT CONTROL**

NOTE

If ESP is active for approximately 10 seconds, the autopilot will automatically engage in LVL mode, an aural ‘ENGAGING AUTOPILOT’ will be played, (or a Sonalert tone will sound for installations without a supported audio panel) and the autopilot will roll the wings level and fly at zero-vertical speed. Refer to Section 7, System Description for further information.

ESP will be disabled by pressing and holding the AP DISC / TRIM INT button. Releasing the button will allow ESP to function.

OVERSPEED PROTECTION (MAXSPD)

(MAXSPD displayed on G5, GI 275, or G3X, AIRSPEED – AIRSPEED Aural sounds.)

1. **Throttle ..... REDUCE**
2. **Aircraft Attitude and Altitude ..... MONITOR**

After overspeed condition is corrected*:*

3. Autopilot .....RESELECT VERTICAL AND LATERAL MODES (if necessary)
4. Throttle .....ADJUST as necessary

NOTE

Overspeed protection mode provides a pitch up command to decelerate the airplane at or below the maximum autopilot operating speed.

UNDERSPEED PROTECTION (MINSPD)

(MINSPD displayed on G5, GI 275, or G3X, AIRSPEED – AIRSPEED Aural sounds.)

1. **Throttle ..... INCREASE POWER AS REQUIRED TO CORRECT UNDERSPEED**
2. **Aircraft Attitude and Altitude ..... MONITOR**

After underspeed condition is corrected:

3. Autopilot .....RESELECT VERTICAL AND LATERAL MODES (if necessary)
4. Throttle .....ADJUST as necessary

NOTE

Autopilot Underspeed Protection Mode provides a pitch down command to maintain 50 KIAS (58 MPH).

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SECTION 3A – NON-NORMAL PROCEDURES

AUTOPILOT PRE-FLIGHT TEST FAIL

(Amber AP with a red X in G5, GI 275, or G3X autopilot status box.)

1. Indicates the AFCS system failed the automatic Pre-Flight test.

NOTE

The autopilot, ESP, and electric elevator trim are inoperative.

LOSS OF NAVIGATION INFORMATION

This procedure applies only if the optional GPS and/or VHF navigator is installed.

(Amber GPS, VOR, LOC, or BC flashes for 10 seconds on G5, GI 275, or G3X.)

NOTE

If a navigation signal is lost while the autopilot is tracking it, the autopilot will roll the aircraft wings level and default to roll mode (ROL).

1. GMC 507 Mode Panel..... SELECT HDG mode and SET desired heading
2. NAV Source ..... SELECT a valid NAV source
3. NAV Key..... PRESS

If on an instrument approach at the time the navigation signal is lost:

4. Missed Approach Procedure..... EXECUTE (as applicable)

LOSS OF AIRSPEED DATA

(Red X through airspeed tape on the G5, GI 275, or G3X display, amber AP with a red X in autopilot status box.)

NOTE

If airspeed data is lost while the autopilot is tracking airspeed, the flight director will default to pitch mode (PIT).

1. AP DISC / TRIM INT Button ..... PRESS AND RELEASE (to cancel disconnect tone)
2. Aircraft Attitude ..... MAINTAIN / REGAIN AIRCRAFT CONTROL
3. Manual Elevator Trim ..... TRIM as required

NOTE

The autopilot cannot be re-engaged. The flight director is available however IAS mode cannot be selected. Loss of airspeed will be accompanied by a red PTRIM indication on the G5, GI 275, or G3X (if a pitch trim servo is installed).

LOSS OF ALTITUDE DATA

(Red X through altitude tape on the G5, GI 275, or G3X display.)

NOTE

If altitude data is lost while the autopilot is tracking altitude, the autopilot will default to pitch mode (PIT).

1. Autopilot ..... SELECT different vertical mode

LOSS OF GPS INFORMATION

(GPS position information is lost to the autopilot.)

NOTE

If GPS position data is lost while the autopilot is tracking a GPS, VOR, LOC or BC course, the autopilot will default to roll mode (ROL). The autopilot will default to pitch mode (PIT) if GPS information is lost while tracking an ILS. The autopilot uses GPS aiding in VOR, LOC and BC modes.

1. Autopilot ..... SELECT different lateral and vertical mode (as necessary)

If on an instrument approach:

1. AP DISC / TRIM INT button ..... PRESS, Continue the approach manually

   Or

2. Missed Approach Procedure ..... EXECUTE (as applicable)

HEADING DATA SOURCE FAILURE

1. Autopilot ..... SELECT different lateral mode (as necessary)

NOTE

Track information will be displayed on the G5, GI 275, or G3X.

Without a heading source to the navigator, GPSS will not be provided to the autopilot for heading legs. Navigator map cannot be oriented heading up.

ELEVATOR MISTRIM (AUTOTRIM)

(Amber TRIM UP or TRIM DOWN displayed on the G5, GI 275, or G3X.)

WARNING

Do not attempt to overpower the autopilot in the event of a pitch mistrim. The autopilot servo will oppose pilot input and will cause pitch trim to run opposite the direction of pilot input. This will lead to a significant out-of-trim condition, resulting in large control wheel force when disengaging the autopilot.

NOTE

Indicates a mistrim of the elevator while the autopilot is engaged.

If a pitch trim servo is not installed, refer to the normal procedures section of this AFMS, MANUAL PITCH TRIM WITH AUTOPILOT ENGAGED. If a pitch trim servo is installed, the autopilot will normally trim the airplane as required. However, during rapid acceleration, deceleration, configuration changes, or near either end of the elevator trim limits, momentary illumination of this message may occur. If the autopilot is disconnected while this message is displayed, high elevator control forces are possible.

If a pitch trim servo is not installed:

1. Refer to the normal procedures section of this AFMS, MANUAL PITCH TRIM WITH AUTOPILOT ENGAGED.

If a pitch trim servo is installed:

NOTE

Momentary display of the TRIM UP or TRIM DOWN message during configuration changes or large airspeed changes is normal.

1. Control Wheel ..... GRIP FIRMLY

WARNING

Be prepared for significant sustained control forces in the direction of the mistrim annunciation. For example, TRIM DOWN indicates nose down control wheel force will be required upon autopilot disconnect.

2. AP DISC / TRIM INT Button..... PRESS AND RELEASE
3. Manual Elevator Trim ..... RE-TRIM as required

Electric pitch trim should be considered inoperative until the cause of the mistrim has been investigated and corrected.

SECTION 4 – NORMAL PROCEDURES

GFC 500 POWER UP

During the preflight test the G5, GI 275, or G3X will display PFT in the autopilot status box. When the GFC 500 passes preflight test, PFT will be removed from the autopilot status box.

FLIGHT DIRECTOR / AUTOPILOT NORMAL OPERATING PROCEDURES

Autopilot/Flight Director mode annunciations are displayed at the top of the G5 Electronic Flight Instrument, at the top of the G3X Electronic Flight Instrument System PFD, or at the bottom of the GI 275 Electronic Flight Instrument ADI . Green text indicates active autopilot/flight director modes. Armed modes are indicated in white text. Normal mode transitions will flash inverse video for 10 seconds before becoming steady. Abnormal mode transitions will flash for 10 seconds in amber text before the default mode is annunciated as the active mode in green text. Default autopilot/flight director modes are Roll (ROL) and Pitch (PIT) modes.

The autopilot status box displays the autopilot engagement status as well as armed and active flight director modes.

Autopilot Engagement with Flight Director Off — Upon engagement, the autopilot will be set to hold the current attitude of the airplane if the flight director was not previously on. In this case, 'ROL' and 'PIT' will be annunciated.

Autopilot Engagement with Flight Director On — If the flight director is on, the autopilot will smoothly pitch and roll the airplane to capture the FD command bars. The prior flight director modes remain unchanged.

Autopilot Disengagement — The most common way to disconnect the autopilot is to press and release the AP DISC / TRIM INT button located on the control yoke. An autopilot disconnect tone will sound and an amber AP will be annunciated on the G5, GI 275, or G3X autopilot status box. Other ways to disconnect the autopilot include:

– Pressing the AP Key on the GMC 507 Mode Controller

– Operating the Electric Pitch Trim Switch (located on the control wheel)

– Pulling the AUTOPILOT circuit breaker

In the event of unexpected autopilot behavior, press and holding the AP DISC / TRIM INT button will disconnect the autopilot and remove all power to the servos.

MANUAL AUTOPILOT DISCONNECT

If necessary, the autopilot may be manually disconnected using any one of the following methods:

1. AP DISC / TRIM INT Button ..... PRESS and RELEASE (Pilot's control wheel)
2. AP Key ..... PRESS
3. Pitch Trim Switch ..... ACTIVATE
4. AUTOPILOT Circuit Breaker ..... PULL

VERTICAL MODES

VERTICAL SPEED (VS) MODE

1. Altitude Preselect ..... SET to Desired Altitude
2. VS Key .....PRESS, autopilot synchronizes to the airplane's current vertical speed
3. Vertical Speed Reference .....ADJUST using UP / DN Wheel
4. Green ALT..... VERIFY Upon Altitude Capture

INDICATED AIRSPEED (IAS) MODE

1. Altitude Preselect ..... SET to Desired Altitude
2. Press IAS Key, autopilot synchronizes to the airplane's current indicated airspeed.
3. AIRSPEED Reference .....ADJUST using UP / DN Wheel
4. Throttle ..... ADJUST, INCREASE POWER to climb
   DECREASE POWER to descend
5. Green ALT..... VERIFY Upon Altitude Capture

ALTITUDE HOLD (ALT) MODE, MANUAL CAPTURE

1. When at the desired altitude .....PRESS ALT key

NOTE

If climbing or descending at a high rate when the ALT key is pressed, the airplane will overshoot the reference altitude and then return to it. The amount of overshoot will depend on the vertical speed when the ALT key is pressed.

The altitude reference is displayed in the autopilot status box. The reference may be changed by +/- 200 FT using the UP / DN wheel.

VERTICAL NAVIGATION (VNAV)

1. Navigation Source ..... SELECT CDI to GPS
2. Vertical Navigation Profile ..... LOAD into the GPS navigator's flight plan
3. Altitude Preselect ..... SET to the vertical clearance limit
   When ATC clearance received.
4. GMC 507 Mode Panel ..... PRESS VNAV

NOTE

Vertical navigation will not function for the following conditions:

- Selected navigation source is not GPS navigation. VNAV will not function if the navigation source is VOR or Localizer.
- VNAV is not enabled on the GPS Navigator
- If the altitude preselect is not set below the current aircraft altitude.
- No waypoints with altitude constraints in the flight plan
- Glideslope or Glidepath is the active flight director pitch mode.
- OBS mode is active
- Dead Reckoning mode is active
- Parallel track is active
- Aircraft is on the ground

Vertical navigation is not available between the final approach fix (FAF) and the missed approach point (MAP)

ALTV will be the armed vertical mode during the descent if the altitude preselect is set to a lower altitude than the VNAV reference altitude. This indicates the autopilot / flight director will capture the VNAV altitude reference. ALTS will be the armed mode during the descent if the altitude preselect is set at or above the VNAV reference altitude, indicating that the autopilot / flight director will capture the altitude preselect altitude reference.

GO AROUND

1. GO AROUND button ..... PRESS – Verify GA / GA on G5, GI 275, or G3X autopilot will not disengage
2. Autopilot (if engaged) ..... VERIFY airplane pitches up following flight director command bars
3. Throttle ..... APPLY Go Around power
4. GMC 507 Mode Panel ..... PRESS NAV to couple to selected navigation source
   OR
   PRESS HDG to Fly ATC Assigned Missed Approach Heading
5. Altitude Preselect ..... VERIFY Set to appropriate altitude.

NOTE

The pilot is responsible for initial missed approach guidance in accordance with published procedure. When the GA button is pressed the Flight Director command bars will command go-around pitch attitude and wings level. The pilot must select the CDI to the appropriate navigation source and select the desired lateral and vertical flight director modes.

MANUAL PITCH TRIM WITH AUTOPILOT ENGAGED

(Amber TRIM UP or TRIM DOWN displayed on G5, GI 275, or G3X.)

NOTE

If the aircraft is not equipped with a pitch trim servo, the pilot must manually adjust the pitch trim when airspeed and aircraft configuration changes are made.

A message will be displayed on the G5, GI 275, or G3X display to indicate the pitch servo is holding sustained force, and the pilot must manually trim the aircraft.

1. If TRIM UP message is displayed ..... MANUALLY TRIM nose up
2. If TRIM DOWN message is displayed ..... MANUALLY TRIM nose down

LATERAL MODES

HEADING MODE (HDG)

1. HDG Key ..... PRESS
   The autopilot will turn the airplane in the direction of the heading bug.
2. HDG/TRK Knob ..... Rotate to set heading bug to desired heading.

TRACK MODE (TRK)

1. TRK Key ..... PRESS
   The autopilot will turn the airplane in the direction of the track bug.
2. HDG/TRK Knob ..... Rotate to set track bug to desired track.

NAVIGATION (VOR)

1. Navigation Source. ..... SELECT CDI to VHF NAV
   Tune and identify the station frequency.
2. Course Pointer ..... SET CDI to the Desired Course
3. Intercept Heading ..... ESTABLISH in HDG, TRK or ROL mode
4. NAV Key ..... PRESS

NOTE

If the Course Deviation Indicator (CDI) is greater than one dot from center, the autopilot will arm the VOR mode. The pilot must ensure that the current heading will result in a capture of the selected course. If the CDI is one dot or less from center, the autopilot will enter the capture mode when the NAV key is pressed.

NAVIGATION (GPS)

1. Navigation Source ..... SELECT CDI to GPS
2. Waypoint ..... SELECT on Navigation Source
3. Course Pointer ..... VERIFY CDI set to the Desired Course
4. Intercept Heading ..... ESTABLISH in HDG or ROL mode
5. NAV Key ..... PRESS

NOTE

If the Course Deviation Indicator (CDI) is greater than one dot from center, the autopilot will arm the GPS mode. The pilot must ensure that the current heading will result in a capture of the selected course. If the CDI is one dot or less from center, the autopilot will enter the capture mode when the NAV key is pressed.

APPROACHES

ILS APPROACH

1. Navigation Source..... SELECT CDI to VHF Nav Tune and Identify an ILS station frequency.
2. CDI ..... SET to front LOC course

NOTE

Ensure that the current heading will result in a capture of the selected course.

3. APR Key..... PRESS, verify LOC and GS ARMED
4. LOC and GS Mode.....VERIFY airplane Captures and Tracks LOC and GS
5. Missed Approach Altitude ..... SET in Altitude preselect.

At Decision Altitude (DA),

6. AP DISC / TRIM INT button ..... PRESS, Continue visually for a normal landing

   Or

7. GO AROUND (GA) button .....PRESS, Execute Missed Approach Procedure
8. Apply GA power.

NOTE

Pressing the GA button will not disconnect the autopilot. Select NAV or HDG mode to fly the missed approach procedure.

If the Course Deviation Indicator (CDI) is greater than half scale deflection, the autopilot will arm the LOC mode. The pilot must ensure that the current heading will result in a capture of the selected course. If the CDI is within half scale deflection, the autopilot will enter the capture mode when the APR key is pressed.

When the selected navigation source is an ILS, glideslope coupling is automatically armed when the APR key is pressed. The glideslope cannot be captured until the localizer is captured. The autopilot can capture the glideslope from above or below the glideslope.

LOC APPROACH (GS out)

1. Navigation Source ..... SELECT CDI to VHF Nav
   Tune and Identify an ILS station frequency.
2. Course Pointer ..... SET to front LOC course

NOTE

Ensure that the current heading will result in a capture of the selected course.

3. NAV Key ..... PRESS, verify LOC ARMED
4. LOC Mode ..... VERIFY airplane Captures and Tracks LOC Course
5. Altitude Preselect ..... SET to next required step down altitude
6. Missed Approach Altitude ..... SET when in ALT mode at the MDA

At Missed Approach Point,

7. AP DISC / TRIM INT button ..... PRESS, Continue visually for a normal landing

   Or

8. GO AROUND (GA) button ..... PRESS, Execute Missed Approach Procedure
9. Apply GA power.

NOTE

Pressing the GA button will not disconnect the autopilot. Select NAV or HDG mode to fly the missed approach procedure.

GPS APPROACH (LPV, LNAV/VNAV, LP+V, or LNAV+V)

1. Navigation Source ..... SELECT CDI to GPS
2. Course Pointer ..... VERIFY CDI set to the Desired Course

NOTE

Ensure that the current heading will result in a capture of the selected course.

3. APR Key ..... PRESS, verify GPS and GP ARMED
4. GPS and GP Mode ..... VERIFY airplane Captures and Tracks GPS and GP
5. ALT Key ..... PRESS to level off at the MDA for a LP+V or LNAV+V approach

At DA (LPV or LNAV/VNAV approach), or MDA and Missed Approach Point (LP+V or LNAV+V),

6. AP DISC / TRIM INT button ..... PRESS, Continue visually for a normal landing

Or

7. GO AROUND (GA) button ..... PRESS, Execute Missed Approach Procedure
8. Apply GA power.
9. Set missed approach altitude in the altitude preselect.

NOTE

Pressing the GA button will not disconnect the autopilot. Select NAV or HDG mode to fly the missed approach procedure.

GPS APPROACH (LP, LNAV)

1. Navigation Source ..... SELECT GPS on the CDI
2. Course Pointer ..... VERIFY CDI set on the Desired Course

NOTE

Ensure that the current heading will result in a capture of the selected course.

3. NAV Key ..... PRESS, verify GPS ARMED
4. GPS Mode ..... VERIFY airplane Captures and Tracks GPS Course
5. Altitude Preselect ..... SET to next required step down altitude
6. Missed Approach Altitude ..... SET when in ALT mode at the MDA

At Missed Approach Point,

7. AP DISC / TRIM INT button ..... PRESS, Continue visually for a normal landing

Or

8. GO AROUND (GA) button ..... PRESS, Execute Missed Approach Procedure
9. Apply GA power.

NOTE

Pressing the GA button will not disconnect the autopilot. Select NAV or HDG mode to fly the missed approach procedure.

LOC BC APPROACH

1. Navigation Source..... SELECT CDI to VHF Nav
   Tune and Identify an ILS station frequency
2. Course Pointer ..... SET CDI to LOC Front Course

NOTE

Ensure that the current heading will result in a capture of the selected course.

3. NAV Key..... PRESS, verify BC ARMED
   (when heading is within 75 degrees of BC course)
4. BC Mode .....VERIFY airplane Captures and Tracks BC Course
5. Altitude Preselect .....SET to next required step down altitude
6. Missed Approach Altitude .....SET when in ALT mode at the MDA

At Missed Approach Point:

7. AP DISC / TRIM INT button ..... PRESS, Continue visually for a normal landing

   Or

8. GO AROUND (GA) button .....PRESS, Execute Missed Approach Procedure
9. Apply GA power.

NOTE

Pressing the GA button will not disconnect the autopilot. Select NAV or HDG mode to fly the missed approach procedure.

VOR APPROACH

1. Navigation Source..... SELECT CDI to VHF Nav
   Tune and identify the station frequency
2. Course Pointer .....SET CDI to the Desired Course

NOTE

Ensure that the current heading will result in a capture of the selected course.

3. NAV Key..... PRESS, verify VOR ARMED
4. VOR Mode .....VERIFY airplane Captures and Tracks VOR Course
5. Altitude Preselect .....SET to next required step down altitude
6. Missed Approach Altitude .....SET when in ALT mode at the MDA

At Missed Approach Point,

7. AP DISC / TRIM INT button..... PRESS, Continue visually for a normal landing

   Or

8. GO AROUND (GA) button .....PRESS, Execute Missed Approach Procedure
9. Apply GA power.

NOTE

Pressing the GA button will not disconnect the autopilot. Select NAV or HDG mode to fly the missed approach procedure.

DISABLING ESP

ESP can be disabled on the G5 attitude indicator with the following procedure. ESP will default to “Enabled” on the next power cycle.

1. G5 Knob. ..... PRESS
2. ESP ..... SELECT
3. G5 Knob ..... PRESS

ESP can be disabled on the G3X with the following procedure. ESP will default to “Enabled” on the next power cycle.

1. Autopilot Status Box ..... TOUCH
2. ESP Button ..... TOUCH
3. Back Button ..... PRESS

ESP can be disabled on the GI 275 with the following procedure. ESP will default to “Enabled” on the next power cycle.

1. GI 275 Knob ..... PRESS and HOLD
2. Options ..... SELECT
3. ESP Button ..... SELECT
4. Back Button…… ..... PRESS and HOLD

ESP can be disabled, but only while in the air, with the following procedure. ESP will default to “Enabled” on the next power cycle.

1. AP DISC switch ..... PRESS and HOLD for 5 seconds

SECTION 5 – PERFORMANCE

No Change.

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SECTION 6 – WEIGHT AND BALANCE

No change to loading information. Refer to current weight and balance report and equipment list for changes to empty weight/moment and installed equipment.

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SECTION 7 – SYSTEM DESCRIPTION

AFCS OVERVIEW

The GFC 500 is a digital Automatic Flight Control System (AFCS). It is a two-axis autopilot and flight director system which provides the pilot with the following features:

G5 Outputs to Autopilot — The G5 flight instrument (when installed) provides attitude, rate, and acceleration information to the servos. Additionally, indicated airspeed, vertical speed, pressure altitude and GPS information are sent to the autopilot for mode control.

G3X Outputs to Autopilot — The G3X electronic flight instrument system provides attitude, rate, and acceleration information to the servos. Additionally, indicated airspeed, vertical speed, pressure altitude and GPS information are sent to the autopilot for mode control.

GI 275 Outputs to Autopilot — The GI 275 electronic flight instrument system provides attitude, rate, and acceleration information to the servos. Additionally, indicated airspeed, vertical speed, pressure altitude and GPS information are sent to the autopilot for mode control. **Flight Director (FD)** — The flight director processing occurs in the G5, GI 275, or G3X instrument. Selected modes for the flight director are displayed on the G5, GI 275, or G3X autopilot status box.

The flight director provides:

- Command Bars showing pitch/roll guidance
- Vertical / lateral mode selection and processing

Autopilot (AP) — Autopilot operation occurs within the pitch, roll, and optional pitch trim servo. It also provides servo monitoring, and automatic flight control in response to flight director steering commands, attitude and rate information, and airspeed.

Optional Electric Pitch Trim — The pitch trim servo provides manual electric pitch trim capability when the autopilot is not engaged. The trim servo provides automatic pitch trim when the autopilot is engaged and the airplane is in the air. Automatic trim functionality is disabled on the ground.

GMC 507 — Pilot commands to the autopilot and flight director are entered through the GMC 507 autopilot mode panel. The GMC 507 contains internal sensors which calculate the aircraft attitude, attitude rate and accelerations. These inertial sensors are completely independent from the sensors within the G5, GI 275, or G3X and the rest of the autopilot system, and are not used for the flight director, autopilot, trim or ESP functions. They are used solely to provide independent monitoring of the GFC 500.

Airspeed and Altitude Information — The GFC 500 requires airspeed and altitude information from the G5 instrument, the GI 275 system, or the G3X system.

Other components of the AFCS include the GSA 28 pitch, roll, and optional pitch trim servo that also contain autopilot processors, control wheel mounted elevator trim switch (if trim servo is installed), control wheel mounted autopilot disconnect and trim interrupt button (AP DISC / TRIM INT), and a Go-Around (GA) button.

Underspeed Protection (USP) — The GFC 500 will provide Underspeed Protection when the autopilot is engaged.

When the minimum airspeed of 60 KIAS (69 MPH) is reached, a visual MINSPD message will appear above the airspeed tape and the autopilot will lower the nose to maintain 60 KIAS (69 MPH). An aural “AIRSPEED, AIRSPEED” voice alert will sound for installations connected to an audio panel.

Underspeed Protection is exited automatically when airspeed exceeds 65 KIAS (75 MPH).

Overspeed Protection (OSP) — The GFC 500 will provide Overspeed Protection when the autopilot is engaged.

When the maximum airspeed of 150 KIAS (172 MPH) is reached, visual MAXSPD message will appear above the airspeed tape and the autopilot will raise the nose of the aircraft to avoid exceeding the maximum configured airspeed. An aural “AIRSPEED, AIRSPEED” voice alert will sound for installations connected to an audio panel.

Overspeed Protection is exited automatically when airspeed is reduced below 145 KIAS (167 MPH).

Coupled Go-Around — Pressing the GA button will not disengage the autopilot. Instead, the autopilot will attempt to capture and track the flight director command bars. If insufficient airplane performance is available to follow the commands, the autopilot will enter Underspeed Protection mode at the minimum airspeed.

Electronic Stability and Protection (ESP) — The GFC 500 will provide Electronic Stability and Protection when the autopilot is not engaged.

Electronic Stability and Protection (ESP) uses the autopilot servos to assist the pilot in maintaining the airplane in a safe flight condition within the airplane's normal pitch, roll and airspeed envelopes.

Electronic Stability and Protection is invoked when the pilot allows the airplane to exceed one or more conditions beyond normal flight defined below:

- Pitch attitude beyond normal flight (+20°, -15°)
- Roll attitude beyond normal flight (45°)
- High airspeed beyond normal flight (above 161 KIAS (185 MPH))
- Low airspeed below normal flight (below 50 KIAS (58 MPH))

The conditions that are required for ESP to be available are:

- Pitch and Roll servos available
- Autopilot not engaged
- The GPS altitude above ground is more than 200 feet (for low airspeed mode)
- Aircraft is within the autopilot engagement envelope (+/-50° in pitch and +/-75° in roll)

Protection for excessive Pitch, Roll, and Airspeed is provided when the limit thresholds are first exceeded, which engages the appropriate servo in ESP mode at a nominal torque level to bring the airplane back within the normal flight envelope. If the airplane deviates further from the normal flight envelope, the servo torque will increase until the maximum torque level is reached in an attempt to return the airplane into the normal flight envelope. Once the airplane returns to within the normal flight envelope, ESP will deactivate the autopilot servos.

When the normal flight envelope thresholds have been exceeded for more than 10 seconds, ESP Autolevel Mode is activated. Autolevel Mode engages the autopilot to bring the airplane back into straight and level flight based on 0° roll angle and 0 FPM vertical speed. An aural "ENGAGING AUTOPILOT" alert (or a Sonalert tone) sounds and the Flight Director mode annunciation will indicate LVL for the pitch and roll modes.

Anytime an ESP mode is active, the pilot can interrupt ESP by using the Autopilot Disconnect (AP DISC / TRIM INT) switch, or simply override ESP by overpowering the autopilot servos. The pilot may also disable ESP through the G5, GI 275, or G3X menu.

The engagement and disengagement attitude limits are displayed with double hash marks on the roll indicator depending on the airplane attitude and whether or not ESP is active in roll. When ESP is inactive (roll attitude within nominal limits) only the engagement limit indications are displayed in order to reduce clutter on the roll indicator.

Display symbology implemented for ESP is illustrated in the following figures.

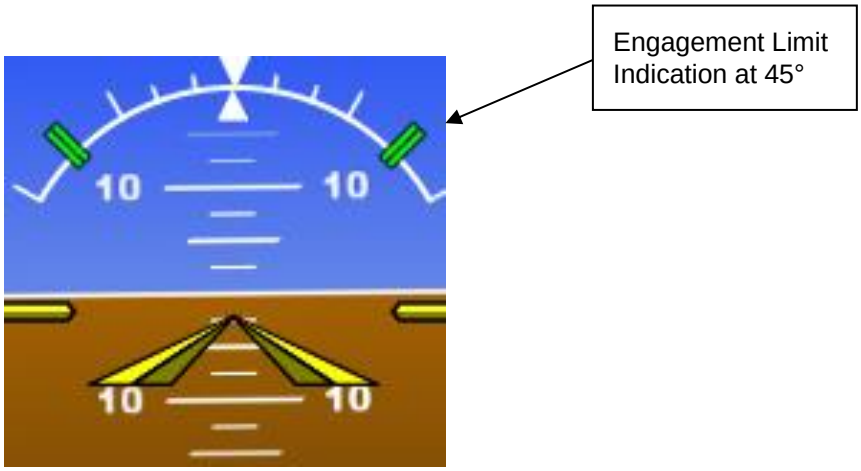


Figure 7-1: Nominal Roll Attitude ESP Engagement Limit Indications

Once ESP becomes active in roll, the engagement limit indication that was crossed (either Left or Right) will move to the lower disengagement limit indication. The opposite roll limit remains at the engagement limit.

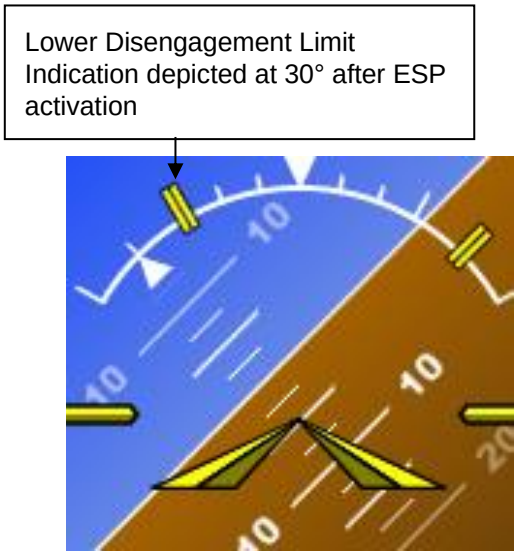


Figure 7-2: Engagement Limit Indications Upon ESP Activation

Disconnect Methods

The following conditions will cause the autopilot to automatically disconnect:

- Electrical power failure, including pulling the AUTOPILOT circuit breaker.
- Internal autopilot system failure (including internal AHRS failure).

The following pilot actions will cause the autopilot to disconnect:

- Pressing the red AP DISC / TRIM INT button on the pilot's control wheel.
- Actuating the manual electric trim switch (if installed).
- Pushing the AP Key on the GMC 507 mode controller when the autopilot is engaged.
- Pulling the AUTOPILOT circuit breaker.

The red AP DISC / TRIM INT button on the pilot's control wheel will interrupt power to the manual electric trim for as long as the switch is depressed.

AUTOPILOT CONTROL UNIT AND DISPLAY

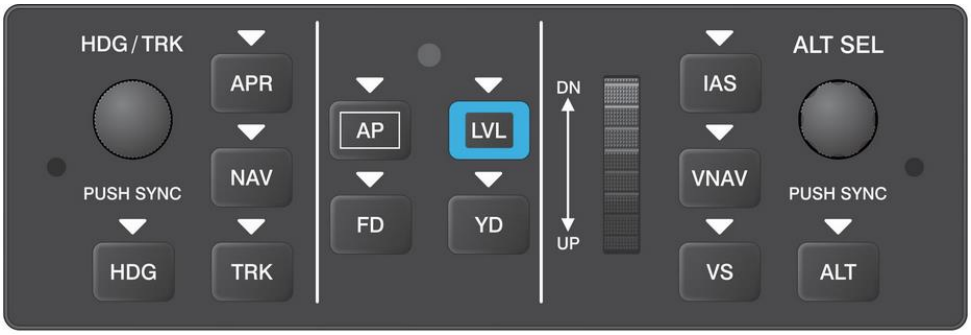


Figure 7-3: GMC 507 Control Unit (Reference Only)



Figure 7-4: G5 Display (Reference Only)

The following tables list the available AFCS vertical and lateral modes with their corresponding controls and annunciations. The UP/DN wheel can be used to change the vertical mode reference while operating in Pitch Hold, Vertical Speed, Altitude Hold, or IAS mode. Increments of change and maximum ranges of values for each of these references using the UP/DN wheel are also listed in the table.

AFCS VERTICAL MODES

Vertical Mode	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	(default)	PIT	20° Nose Up 15° Nose Down	0.5°
Selected Altitude Capture	*	ALTS		
Altitude Hold	**ALT** Key	ALT nnnnn		10 FT
Vertical Speed	**VS** Key	VS nnnn	-2000 to +2000 FPM	100 FPM
IAS Hold	**IAS** Key	IAS nnn	60 to 150 KT (69 to 172 MPH)	1 KT (1 MPH)
Vertical Path Tracking (VNAV)	**VNV** Key	VNAV		
VNAV Target Altitude Capture	**	ALTV		
Glidepath	**APR** Key	GP		
Glideslope		GS		
Takeoff or Go Around	**GA** Button	TO or GA	7°	
Level (LVL)	**LVL** Key	LVL	Zero Vertical Speed	
ESP High Pitch Engagement			ESP High Pitch Attitude engages at 20° nose up	
ESP Low Pitch Engagement			ESP Low Pitch Attitude engages at 15° nose down	
ESP High Airspeed Engagement			ESP High Airspeed engages at 161 KIAS (185 MPH)	
ESP Low Airspeed Engagement			When above 200 FT AGL, ESP Low Airspeed engages at 50 KIAS (58 MPH). (This mode only available if height above terrain is available from a compatible Garmin GPS).	

* ALTS arms automatically when PIT, VS, IAS, or GA is active.

** ALTV arms automatically if the VNAV Target Altitude is to be captured instead of the Selected Altitude.

AFCS LATERAL MODES

Lateral Mode	Control	Annunciation	Maximum Roll Command Limit
Roll Mode	(default)	ROL	30°
Heading Select	**HDG** Key	HDG	30°
Track Select	**TRK** Key	TRK	30°
Navigation, GPS Arm/Capture/Track	**NAV** Key	GPS	30°
Navigation, VOR Enroute and Approach Arm/Capture/Track		VOR	30°
Navigation, LOC Arm/Capture/Track (No Glideslope)		LOC	30°
Backcourse Arm/Capture/Track		BC	30°
Approach, GPS Arm/Capture/Track (Glidepath Mode Automatically Armed, if available)	**APR** Key	GPS	30°
Approach, ILS Arm/Capture/Track (Glideslope Mode Automatically Armed)		LOC	30°
Takeoff or Go Around	**GA** Button	TO or GA	Wings Level
LVL (Level)	**LVL** Key	LVL	Wings Level
ESP Roll Attitude Engagement	ESP Roll Attitude engages at 45°		

The autopilot may be engaged within the following ranges:

Pitch 50° nose up to 50° nose down

Roll ±75°

If the above pitch or roll limits are exceeded while the autopilot is engaged, the autopilot will disconnect. Engaging the autopilot outside of its command limits, but within its engagement limits, will cause the autopilot to return the aircraft within command limits. The autopilot is capable of commanding the aircraft in the following ranges:

Pitch 20° nose up to 15° nose down

Roll ±30°

PREFLIGHT TEST

During the preflight test the G5, GI 275, or G3X will display PFT in the autopilot status box. The PFT annunciation is removed at the completion of the preflight test. If GFC 500 fails the PFT, a yellow AP with a red X is displayed in the autopilot status box on the G5, GI 275, or G3X.

MESSAGES AND ANNUNCIATIONS

Autopilot Messages	
AFCS Controller Key Stuck	The system has sensed a key input on the GMC 507 for 30 seconds or longer.
AFCS Controller Audio Database Missing	The audio database is missing from the GMC 507. The aural voice alerts will not be heard.
Servo Clutch Fault	One or more autopilot servos has a stuck clutch. The servo needs service.
Servo Trim Input Fault	The inputs to the trim system are invalid. The trim system needs service.
Autopilot Annunciations	
AFCS	Autopilot has failed. Autopilot and trim are inoperative and flight director is not available.
AP	Autopilot normal disconnect.
AP	Autopilot abnormal disconnect.
AP	Autopilot has failed. The autopilot is inoperative. FD modes may still be available.
MAXSPD	Autopilot Overspeed Protection mode is active. Autopilot will raise the nose to limit the aircraft's speed.
MINSPD	Autopilot Underspeed Protection mode is active. Autopilot will lower the nose to prevent the aircraft's speed from decreasing.
PFT	Autopilot preflight test is in progress.
PTRIM	Pitch Trim Fail – Manual Electric Pitch Trim is inoperative.
TRIM DOWN	Elevator Trim Down – Autopilot is holding elevator nose down force. The pitch trim needs to be adjusted nose down.
TRIM UP	Elevator Trim Up – Autopilot is holding elevator nose up force. The pitch trim needs to be adjusted nose up.

LIGHTING

When the aircraft's dimming bus is selected off, or full dim, GMC 507 mode control panel lighting is controlled by integrated photocells which sense the ambient cockpit lighting.

GARMIN Ltd. or its subsidiaries
c/o GARMIN International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

EASA Approved AIRPLANE FLIGHT MANUAL SUPPLEMENT

G3X Touch Electronic Flight Instrument System

Dwg. Number: 190-01754-02 Rev. 1

This Supplement is Applicable to the Following Manuals:

190-01754-01

This Supplement must be attached to the FAA Approved STC Airplane Flight Manual Supplement when the GARMIN G3X Touch Electronic Flight Instrument System is installed in accordance with STC SA01899WI. The information contained herein supplements the information of the STC Airplane Flight Manual Supplement. For Limitations, Procedures, and Performance information not contained in this Supplement consult the basic Pilot's Operating Handbook, FAA Approved Airplane Flight Manual and the FAA Approved STC Airplane Flight Manual Supplement.

Airplane Serial Number: CEESSNA C172S8743

Airplane Registration Number: F-HAAM

Signed By: _____

Robert G. Murray
ODA STC Unit Administrator
Garmin International Inc.
ODA-240087-CE

Date: JULY 16, 2020

EASA Approval No. 10073816
Revised: --

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GARMIN International, Inc.
1200 E. 151st Street
Olathe, KS 66062 USA
Telephone: 913-397-8200
www.garmin.com

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Log of Revisions

EASA Approved AIRPLANE FLIGHT MANUAL SUPPLEMENT

GARMIN G3X Touch Electronic Flight Instrument System
AML STC

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Section 1 - General

The information in this supplement is EASA-approved material and must be attached to the FAA Approved STC Airplane Flight Manual Supplement, p/n 190-01754-01 when the airplane has been modified by installation of the Garmin G3X Touch Electronic Flight System in accordance with STC SA01899WI.

This EASA approved Airplane Flight Manual Supplement is required in addition to the FAA approved Airplane Flight Manual Supplement, p/n 190-01754-01.

Section 2 – Limitations

No change except as shown below.

2.23 Portable Electronic Devices
Data Received by Personal Electronic Devices (PED)

The PED is not approved as the sole source of information to base tactical or strategic decision making and is not approved to replace the information provided by the Garmin G3X EFIS. The G3X's Bluetooth interface and data provided to a portable electronic device is not approved to replace any required or installed aircraft display equipment, including navigation or traffic/weather display equipment. The data presented on the PED may not have the required integrity to be used as the sole source of information to base tactical or strategic decision making.

2.24 Kinds of Operations
FAA operational requirements (14 Code of Federal Regulations Part 91, Part 121, and Part 135) do not apply to aircraft operated under European Operational requirements.

Flight Plan Transfer

Use of the G3X's Bluetooth connectivity for flight plan importing during critical phases of flight by the pilot flying is prohibited.

Electronic Flight Bag (EFB)

Use of the G3X's Bluetooth interface and data for the purpose of Electronic Flight Bag (EFB) applications is not approved as part of this STC. Use of any device as an EFB may require separate approvals.

Section 3 – Emergency Procedures

No Change except as shown below

3.7 EIS Failure

2. Land as soon as practical

Section 4 – Normal Procedures

References to "LP" approaches should be disregarded for aircraft operating within European airspace.

Section 5 - Performance

No Change

Section 6 – Weight and Balance

No Change

Section 7 – Systems Description

No Change

Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 72S8001 AND ON

SUPPLEMENT 5

Garmin G5

Standby Flight instruments

SUPPLEMENTAL TYPE CERTIFICATE

10064473

This Supplemental Type Certificate is issued by EASA, acting in accordance with Regulation (EC) No. 216/2008 on behalf of the European Community, its Member States and of the European third countries that participate in the activities of EASA under Article 66 of that Regulation and in accordance with Commission Regulation (EU) No. 748/2012 to

GARMIN (EUROPE) LIMITED

LIBERTY HOUSE
HOUNSDOWN BUSINESS PARK
SOUTHAMPTON
Hampshire
SO40 9LR
UNITED KINGDOM

and certifies that the change in the type design for the product listed below with the limitations and conditions specified meets the applicable Type Certification Basis and environmental protection requirements when operated within the conditions and limitations specified below:

Original Type Certificate Number: SEE EASA APPROVED MODEL LIST
Type Certificate Holder: SEE EASA APPROVED MODEL LIST
Type: SEE EASA APPROVED MODEL LIST
Model: SEE EASA APPROVED MODEL LIST

Description of Design Change:
Installation of Garmin G5 Electronic Flight Instrument.

EASA Certification Basis:
a. The certification basis for parts not changed or not affected by this change remains unchanged from the original approval.

b. The certification basis for parts changed or affected by this change is FAR Part 23:

23.301(a), 23.303, 23.305(a)(b), 23.307(a), 23.337(a)(b), 23.561(a)(b)(3), 23.561(e), 23.601, 23.603, 23.605(a), 23.607(b), 23.613(a)(b), 23.771(a), 23.773(a)(2), 23.777(a)(b), 23.853(a), 23.1301, 23.1303(a)(b)(c)(f), 23.1307, 23.1309(a)(b)(c)(d)(e), 23.1311(a)(1)(2)(3)(6)(7)(b), 23.1321(c)(d)(e), 23.1322, 23.1323(a)(b)(c), 23.1325(a)(b),

See Continuation Sheet(s)

For the European Aviation Safety Agency

Cologne, Germany, 30 January 2018

Dominique ROLAND
Head of General Aviation and
Remotely Piloted Aircraft Systems (RPAS)

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23.1327(a)(1)(2), 23.1329(g)(h), 23.1331(a)(b)(1)(c), 23.1351(a), 23.1353(h), 23.1357(a)(b)(c)(d), 23.1359, 23.1365(a)(b)(d)(e), 23.1381(a)(b), 23.1431(a)(b), 23.1529, 23.1541, 23.1543(b), 23.1545(a)(b)(c), 23.1555(a)(b), 23.1581(a)(b)(d)(f), 23.1585(a).

The requirements for environmental protection and the associated certified noise and/ or emissions levels of the original product are unchanged and remain applicable to this certificate/ approval.

Associated Technical Documentation:
Installation in accordance with Garmin Master Drawing List (MDL) 005-01112-01, Revision 8, dated October 18, 2017.

Instructions for Continued Airworthiness (ICA) as listed in above MDL.

Operate in accordance with Garmin G5 Airplane Flight Manual Supplement as listed in above MDL.

For EASA STC 10064473 Approved Models refer to Garmin Authorized Model List, 005-01112-46, Revision 1

or later revisions of the above listed documents approved by EASA.

(1) The installation of the G5 requires the retention of existing mechanical airspeed indicator, altimeter, and vertical speed indicator.

(2) For installations in aircraft approved for IFR operations:
(a) If the G5 is installed as the primary attitude indicator, the existing rate of turn indicator must be retained.
(b) If the G5 is installed as the rate of turn indicator, the existing primary attitude indicator must be retained.

(3) For installations in aircraft approved for VFR-only operations, the G5 can be installed as the attitude indicator and rate of turn indicator without retention of either the existing attitude indicator or rate of turn indicator.

(4) Aircraft modified by this STC must be operated in accordance with the Airplane Flight Manual Supplement (AFMS) identified above.

(5) Aircraft modified by this STC must be maintained in accordance with the Instructions for Continued Airworthiness (ICA) identified above.

(6) If the holder agrees to permit another person to use this certificate to alter the product, the holder must give the other person written evidence of that permission.

Limitations/Conditions:
Prior to installation of this design change it must be determined that the interrelationship between this design change and any other previously installed design change and/ or repair will introduce no adverse effect upon the airworthiness of the product.

- End -

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1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

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

CESSNA AIRCRAFT COMPANY C172S

Make and Model Airplane

Registration Number: F-HAAM Serial Number: 172S8743

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

Paul Mast

ODA STC Unit Administrator

GARMIN International, Inc

ODA-240087-CE

DATE: 5-2-2023

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Garmin International, Inc.
1200 E. 151st Street
Olathe, KS 66062 USA
Telephone: 913-397-8200
www.garmin.com

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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	9/28/2021	Paul Mast ODA STC Unit Administrator
8	3-4 4-2 4-3	Addition of NO BATT emergency procedure. Update normal procedure: *Prior to Flight in IMC.* Update Roll Steering (GPSS) emulation normal procedure.	12/29/2021	Robert Murray ODA STC Unit Administrator
9	2-1	Update limitations regarding use of secondary instruments.	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	8.00

Use of Secondary Instruments

A G5 Electronic Flight Instrument may not be used as a primary indication of airspeed, altitude, or vertical speed.

If a G5 Electronic Flight Instrument is installed as the primary rate of turn indicator, a second G5 may not be used as a primary indication of aircraft attitude.

A G5 Electronic Flight Instrument installed in place of a directional gyro may not also be used as a primary indication of aircraft attitude. A second G5, in addition to a G5 used as a directional gyro, may be installed as primary indication of aircraft 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.

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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.

Internal Battery Failure

In the event of a failure of the G5 internal battery, “NO BATT” will be displayed with a red X. This indicates that the G5 internal battery is not functional.

1. If “NO BATT” is displayed on the G5 attitude indicator, do not fly in instrument meteorological conditions.





WARNING

If NO BATT is displayed on the G5 attitude indicator, the unit will not function in the event of a loss of aircraft electrical power to the G5 attitude indicator. Do not fly in instrument meteorological conditions if NO BATT is displayed on the G5 attitude indicator.

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.
   (The battery status indicator will change from green to amber or red when battery status has decreased below 41%).



Valid Battery Indication



No Battery Detected

WARNING

If NO BATT is displayed on the G5 attitude indicator, or green battery status is not shown after pressing the power button on the G5 attitude indicator, do not fly in instrument meteorological conditions.

Autopilot Operations with the G5

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 Selection coupling to the autopilot.
  - ☒ 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 ADI and HSI changes to a hollow outline and a crossed-out heading bug appears on the G5 ADI and 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 navigation source on the G5 ADI and 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.

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SECTION 6 – WEIGHT AND BALANCE

See current weight and balance data.

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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).

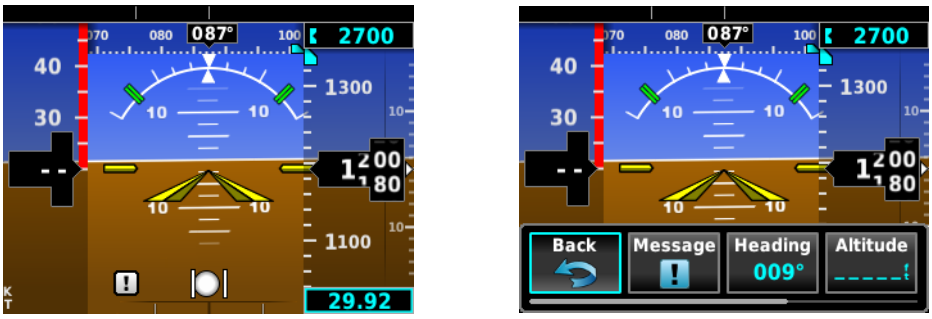
The HSI circuit breaker supplies power to the G5 instrument for normal power operation when configured as an HSI, and to charge the internal battery (if installed).

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.

EASA
European Union Aviation Safety Agency

SUPPLEMENTAL TYPE CERTIFICATE

10060846 REV. 2

This Certificate/Approval is issued by EASA, acting in accordance with Regulation (EU) 2018/1139 on behalf of the European Union, its Member States and of the European third countries that participate in the activities of EASA under Article 129 of that Regulation and in accordance with Commission Regulation (EU) No. 748/2012 to

GARMIN INTERNATIONAL, Inc.

1200 EAST 151ST STREET
OLATHE KS 66062
USA

and certifies that the change in the type design for the product listed below with the limitations and conditions specified meets the applicable Type Certification Basis and, if applicable, environmental protection requirements when operated within the conditions and limitations specified below:

Type Certificate Number: See FAA AML SA01818WI, dated 19 July 2019
Type Certificate Holder: See FAA AML SA01818WI
Type: See FAA AML SA01818WI
Model: See FAA AML SA01818WI
Original STC Number: FAA SA01818WI

Description of Design Change:
Installation of Garmin G5 Electronic Flight Instrument.

EASA Certification Basis:
The certification basis for parts not changed or not affected by this change remains unchanged from the original approval.

The certification basis for parts changed or affected by this change is FAR Part 23:

Section	Amdt
23.251(a)	23-62
23.301(a)	23-48
23.303	Orig.

See Continuation Sheet(s)

For the European Union Aviation Safety Agency

Cologne, Germany, 11 December 2019

Dominique ROLAND
Head of Department
General Aviation

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23.305(a)(b)	23-45
23.307(a)	Orig.
23.337(a)(b)	23-48
23.561(a)(b)(3)(e)	23-62
23.601	Orig.
23.603	23-23
23.605(a)	23-23
23.607(b)	23-48
23.613(a)(b)	23-45
23.771(a)	23-14
23.773(a)(2)	23-45
23.777(a)(b)	23-62
23.853(a)	23-62
23.867(a)(b)	23-49
23.1301	23-62
23.1303(a)(b)(c)(f)	23-62
23.1307	23-49
23.1309(a)(1)(2)	23-62
23.1309(a)(b)(c)(d)(e)	23-49
23.1311(a)(1)(2)(3)(6)(7)(b)	23-62
23.1321(c)(d)(e)	23-49
23.1322	23-43
23.1323(a)(b)(c)	23-62
23.1325(a)(b)	23-50
23.1327(a)(1)(2)	23-20
23.1329(g)(h)	23-49
23.1331(a)(b)(1)(c)	23-62
23.1351(a)	23-49
23.1353(h)	23-62
23.1357(a)(b)(c)(d)	23-43
23.1359	23-49
23.1365(a)(b)(d)(e)	23-49
23.1381(a)(b)	Orig.
23.1419(a)(c)	23-43
23.1431(a)(b)	23-62
23.1529	23-26
23.1541	23-21
23.1543(b)	23-50
23.1545(a)(b)(c)	23-62
23.1555(a)(b)	23-62
23.1581(a)(b)(d)(f)	23-50
23.1585(a)	23-62

See Continuation Sheet(s)

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23.2510	23-64
23.2515(a)(b)	23-64
23.2520(a)(b)	23-64
23.2335	23-64

The requirements for environmental protection and the associated certified noise and/ or emissions levels of the original product are unchanged and remain applicable to this certificate/ approval.

Associated Technical Documentation:
Garmin Master Drawing List (MDL) 005-01112-01, Revision 1, dated 22 July 2016.

Instructions for Continued Airworthiness (ICA) in accordance with Garmin G5 STC Maintenance Manual including ICA 190-01112-11, Revision 1, dated 22 July 2016.

Garmin G5 Airplane Flight Manual Supplement 190-01112-13, Revision 1, dated 22 July 2016

or later revisions of the above listed document(s) approved/accepted on behalf of EASA in accordance with the Technical Implementation Procedures of EU/ USA Bilateral Agreement.

Limitations/Conditions:
1. This STC is valid for those aircraft types and models approved by EASA and listed on the FAA Approved Model List SA01818WI, dated 19 July 2019.

2. The installation of the G5 requires the retention of the mechanical airspeed indicator, altimeter, and vertical speed indicator.

3. For installations in aircraft approved for IFR operations:
(a) If the G5 is installed as the primary attitude indicator, the existing rate of turn indicator must be retained.
(b) If the G5 is installed as the rate of turn indicator, the existing primary attitude indicator must be retained.

4. For installations in aircraft approved for VFR-only operations, the G5 can be installed as the attitude indicator and rate of turn indicator without retention of either the existing attitude indicator or rate of turn indicator.

5. Prior to installation of this design change it must be determined that the interrelationship between this design change and any other previously installed design change and/ or repair will introduce no adverse effect upon the airworthiness of the product.

- End -

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Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 72S8001 AND ON

SUPPLEMENT 6

GMA 342

Standby Flight instruments

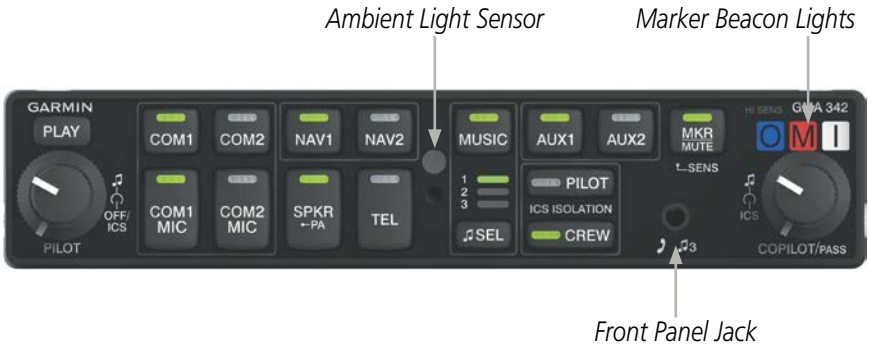
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FEATURES AND OPERATION

The GMA 342 Audio Panel provides the traditional audio selector functions of microphone and receiver audio selection. The Audio Panel includes an intercom system (ICS), a marker beacon receiver, a COM clearance recorder, and a 3.5 mm music or phone jack. Ambient noise from the aircraft radios is reduced by Avionics Squelch (ASQ). When no audio is detected, ASQ processing further reduces the amount of background noise. Intercom squelch threshold adjustments are handled automatically by the system.

Pushbutton keys control audio selection. When a key is selected, a green annunciator on the key is illuminated. Annunciator brightness is adjusted automatically by photocell dimming. Key brightness is adjusted by the radio dimming bus control. Three Aux inputs are available for additional avionics or audio devices.

Upon installation, the unit may be configured in various ways depending on aircraft type and the needs of the pilot.



GMA 342

POWER-UP

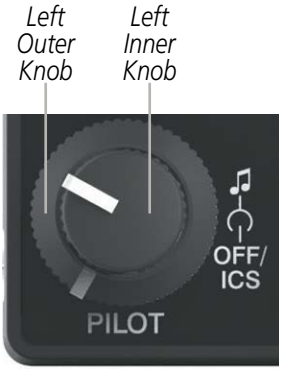
The GMA 342 performs a self-test during power-up. During the self-test all Audio Panel annunciator lights illuminate for approximately two seconds. Once the self-test is completed, most of the settings are restored to those in use before the unit was last turned off.

MONO/STEREO HEADSETS

Stereo headsets are recommended when using the GMA 342. Using a monaural headset in a stereo jack shorts the right headset channel output to ground. While this does not damage the Audio Panel, a person listening on a monaural headset hears only the left channel in both ears. If a monaural headset is used at one of the passenger positions, any other passenger using a stereo headset hears audio in the left ear only.

LEFT/RIGHT KNOBS

The **Left Inner Knob** powers-off the unit, and is used to control pilot ICS volume. The **Left Outer Knob** controls pilot music volume. The **Right Inner Knob** controls copilot and passenger ICS volume. The **Right Outer Knob** controls the copilot and passenger music volume.



Left Knob - Pilot Volume Controls



Right Knob - Copilot and Passenger Volume Controls

Function	Action	Visual/Tactile Feedback	Aural Feedback
Power OFF Audio Panel	Turn **Left Inner Knob** to full counter-clockwise position	All backlight and annunciator LEDs turn off	Left Inner Knob clicks
Pilot ICS Volume	Turn **Left Inner Knob** right/left to increase/ decrease volume	Minimum/maximum volume is reached at full counter-clockwise/ clockwise position	Pilot ICS volume increases/ decreases
Pilot Music Volume	Turn **Left Outer Knob** right/left to increase/ decrease volume	Minimum/maximum volume is reached at full counter-clockwise/ clockwise position	Pilot Music volume increases/ decreases
Copilot/ Passenger ICS Volume	Turn **Right Inner Knob** right/left to increase/ decrease volume	Minimum/maximum volume is reached at full counter-clockwise/ clockwise position	Copilot and Passenger ICS volume increases/ decreases
Copilot/ Passenger Music Volume	Turn **Right Outer Knob** right/left to increase/ decrease volume	Minimum/maximum volume is reached at full counter-clockwise/ clockwise position	Copilot and Passenger Music Volume increases/ decreases

Left/Right Knob Functions

TRANSCEIVERS

Audio from the #1 or #2 COM receiver can be selected independently by pressing the respective Key(s) (**COM1** or **COM2**). Pressing **COM1 MIC** or **COM2 MIC** selects the #1 or #2 transmitter and simultaneously selects the related COM receiver (COM1 or COM2) allowing received audio to be heard. The other COM receiver can be added by pressing the respective key.

By default, while transmitting on a COM channel (as selected with the **COM1 MIC** and **COM2 MIC** keys), both the transmitting and receiving audio are heard on the COM channel. The GMA 342 can be configured to instead mute receiving audio on a transmitting COM channel. A Garmin authorized service center can make changes to the default configuration.

SPLIT-COM MODE

NOTE: *Split COM performance is affected by the distance between the COM antennas and the separation of the tuned frequencies. If the selected COM frequencies are too close together, interference may be heard during transmission on the other radio.*

During Split-COM operation, both the pilot and the copilot can transmit simultaneously over separate radios. The pilot uses COM1 and the copilot uses COM2

Pressing both **MIC** Keys simultaneously initiates Split-COM Mode (i.e., COM1/COM2). The respective COM1/COM1 MIC and COM2/COM2 MIC annunciators are illuminated indicating Split-COM operation. Split-COM operation is cancelled by pressing one of the selected MIC Keys again.

TRANSMIT INDICATIONS

During COM transmission, the active transceiver (MIC1 or MIC2) Key Annunciator flashes approximately once per second.

During Split-COM transmission, the MIC1 annunciator flashes when the pilot's microphone PTT is pressed. The MIC2 annunciator flashes when the copilot's microphone PTT is pressed.

ENABLING/DISABLING MONITORED COM MUTING

Press and hold **COM1** or **COM2** to enable/disable monitored COM muting during reception of audio from the COM radio selected for transmission. The aural message **"Monitor Mute Enabled/Disabled"** is heard.

Function	Action	Key Annunciations	
COM Selection: Toggle between COM enabled and COM disabled (the audio from the current MIC selected COM is always enabled and cannot be disabled).	Press the corresponding **COM** Key.	 COM Enabled	 COM Disabled
MIC Selection: Selects the COM used to transmit during Push-to-Talk (PTT).	Press the corresponding **MIC** Key. The last MIC pressed remains selected and deselects all others.	 MIC Enabled	 MIC Disabled
Transmit Indication: Audio is sent from the corresponding Crew MIC to the selected COM. *	Push-to-Talk (PTT) keyed.		MIC in-key annunciator flashes.
Split-COM Mode: The pilot transmits on COM1 and the copilot transmits on COM2 independently.	Simultaneously press **COM1 MIC** and **COM2 MIC** keys.		

* The pilot has priority when transmitting in the case that both crew members attempt to transmit on the same COM.

Transceiver Key Functions

RECEIVERS

NAV RECEIVER

Pressing the **NAV1** and/or **NAV2** Key(s) selects/deselects the receiver audio for the corresponding navigation radio source. The selected audio source can be heard over the headset and the speaker (if selected). All radios can be selected individually or simultaneously.



Selecting a NAV Radio Receiver

AUXILIARY INPUTS

The GMA 342 has 3 AUX inputs. There are two keys on the unit for **AUX1** and **AUX2**. Pressing the **AUX1** key selects or deselects both the AUX1 and AUX3 receivers. Pressing the **AUX2** key selects or deselects only the AUX2 receiver.

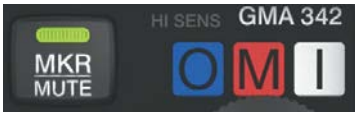


Selecting an Auxiliary Input

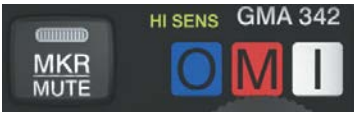
MARKER BEACON RECEIVER

The marker beacon receiver detects any marker beacon signal within the reception range of the aircraft.

When a marker beacon signal is detected, the lamps illuminate, and an associated keyed-tone is heard when MKR audio is selected. Marker beacon lamps operate independently of any audio selection and cannot be turned off.



Marker Beacon Key & Lamps



HI SENS Annunciator

The marker beacon signal sensitivity threshold can be set to either a regular or high sensitivity. To toggle between the two, press and hold the **MKR/MUTE** Key for 1 second. The HI SENS annunciator illuminates when signal sensitivity is set to high.

The receiver detects the three marker tones (outer, middle, and inner).

Audio Frequency	Audio Keying	Lamp Actuated
400 Hz (Outer)	— — — — —	Blue
1300 Hz (Middle)	▪ — ▪ — ▪ — ▪ — ▪ —	Amber
3000 Hz (Inner)	▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪	White

The GMA 342 provides three states of marker beacon operation; On, Muted, and Deselected. The **MKR/MUTE** key annunciator indicates when marker beacon audio is selected. Marker beacon audio is not heard when the annunciator is off or when the annunciator is on with the marker beacon audio muted.

TURNING MARKER BEACON AUDIO ON

With the MKR/MUTE annunciator off, press the **MKR/MUTE** Key to activate marker beacon audio and illuminate the MKR/MUTE annunciator.

MUTING MARKER BEACON AUDIO

During marker beacon audio reception, press the **MKR/MUTE** Key to mute the audio. The MKR/MUTE annunciator remains lit, but the current marker tone is silenced. Audio muting deactivates automatically and marker beacon audio is heard when the next marker beacon signal is received.

DESELECTING MARKER BEACON AUDIO

To deselect marker beacon audio, press the **MKR/MUTE** Key twice during marker beacon reception or once if a marker beacon signal is not detected.

INTERCOM SYSTEM (ICS)

The GMA 342 includes a three-position intercom system (ICS), two MUSIC inputs, and one telephone/entertainment input for the pilot, copilot and passengers. The intercom provides Pilot and Crew audio isolation.



Intercom Controls

NOTE: *The PILOT and CREW ICS ISOLATION states are exclusive. Both cannot be active at the same time. When neither Pilot or Crew are active, the unit is in All ICS mode. In this mode, the pilot, copilot, and passengers communicate with each other.*

PILOT ISOLATE MODE

Pressing the **PILOT** 'ICS ISOLATION' Key isolates the pilot from all other ICS positions (copilot and passengers). The copilot and passengers share communication between themselves but cannot communicate with the pilot. A solid annunciation of the in-key annunciator indicates PILOT ICS ISOLATION is active.

CREW ISOLATE MODE

Pressing the **CREW** 'ICS ISOLATION' Key places the pilot and copilot on a common ICS communication channel. The passengers are on their own intercom channel and can communicate with each other, but cannot communicate with the pilot and copilot. A solid annunciation of the inkey annunciator indicates CREW ICS ISOLATION is active.

INTERCOM VOLUME

The knobs on either side of the GMA 342 control intercom and music volume independently. The left inner and outer knobs are dedicated to the audio levels for the pilot headset; the right inner and outer knobs control audio levels for not only the copilot but also any passenger headsets. The inner, smaller knobs on both sides are used to control intercom volume for the receiving headsets. The outer, larger knobs are used to control music volume.

The left inner knob can be used to turn off the GMA 342 audio panel, by turning fully counter-clockwise until the knob clicks. All backlight and annunciator LEDs will turn off.

The position marks on all four knobs are not night-time visible.

RADIO MUTE MUSIC

Press and hold the **MUSIC** Key to enable or disable muting of music channel 1 and music channel 2 when radio (i.e., COM, NAV, or AUX) audio is active.

ICS MUTE MUSIC

Press and hold the **AUX2** Key to enable or disable muting of music audio when intercom audio is active.

PASSENGER MUTING

Press and hold **AUX1** to enable/disable passenger muting during COM audio reception. The aural message "Passenger Mute Enabled/Disabled" is heard.

SPEAKER

NOTE: *Speaker audio turns off in circumstances where aircraft power falls below 11 volts.*

All of the radios can be heard over the cabin speaker. Pressing the **SPKR** Key selects and deselects the cabin speaker. Speaker audio is muted when the PTT is pressed. Certain aural alerts and warnings (autopilot, traffic, altitude) are always heard on the speaker, even when the speaker is not selected.



Speaker Key

PASSENGER ADDRESS MODE (PA MODE)

Press and hold the **SPKR** Key for 1 second to initiate Passenger Address Mode. PA Mode is annunciated by a rapid blinking of the SPKR annunciator. When in PA Mode the crew can use the PTT "Push-to-Talk" button to deliver announcements over the speaker and to the passenger headsets.

SPLIT-PA MODE

During Split-PA Mode the pilot can continue to use the COM1 for transmission while the copilot delivers PA announcements. To initiate Split-PA Mode, first enter Split-COM Mode by pressing both **MIC** Keys simultaneously, then press and hold the **SPKR** Key for 1 second.

3D AUDIO

3D Audio is useful when multiple audio sources are present. By using different responses in each ear, 3D audio processing creates the illusion that each audio source is coming from a unique location or seat position.

Because this feature uses different signals for left and right channels, it requires wiring for stereo intercom and stereo headsets. If 3D audio is activated when mono headsets are in use, the listener will still hear all audio sources; however, there is no benefit from location separation.

With a single COM selected and 3D Audio enabled, the listener hears the audio source at the 12 o'clock position. If both COMs are selected, the listener hears COM1 at 11 o'clock and COM2 at the 1 o'clock position. All other intercom positions are processed to sound like their relative seat location. By default, the GMA 342 assumes the pilot sits in the left seat. A Garmin authorized service center can make changes to the default configuration.

ENABLING 3D AUDIO

Press and hold the **PILOT** Key to toggle 3D audio processing on and off for all headset positions. When 3D Audio is enabled, the aural message "3D audio left" is heard in the left ear followed by "3D audio right" in the right ear. If the aural messages are not heard in only the left and then the right ear respectively, the cause may be aircraft wiring or headset settings. Refer to the following table if a headset or aircraft wiring problem is suspected.

3D Audio Troubleshooting		
Symptom(s)	**Cause(s)**	**Solution(s)**
"3D audio left" message heard in both ears. "3D audio right" message not heard	**1)** Mono headset in use	**1)** Use a stereo headset
	2) Stereo headset in use with mono/ stereo switch set to 'mono'	**2)** Set mono/stereo switch on headset to 'stereo'
	3) Aircraft wiring has left audio wired to both left and right channels of stereo headset jack	**3)** If after checking solutions #1 and #2 see a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.
"3D audio left" message heard in both ears, followed by "3D audio right" message heard in both ears	**1)** Mono headset in use	**1)** Use a stereo headset
	2) Stereo headset in use with mono/ stereo switch set to mono	**2)** Set mono/stereo switch on headset to 'stereo'
	3) Incorrect aircraft wiring (left/right shorted together)	**3)** If after checking solutions #1 and #2 see a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.
"3D audio right" message heard in both ears. "3D audio left" not heard	**1)** Incorrect aircraft wiring (right channel used for mono instead of left or left/right swapped)	**1)** See a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.

3D Audio Troubleshooting		
"3D audio left" message heard in right ear only followed by "3D audio right" message heard in left ear only	**1)** Stereo headset is on backwards	**1)** Verify correct orientation from the left/right indication on each side of the headset or the position of the boom MIC (usually attached on left side). If the headset is backwards, the left/right position information will be swapped.
	2) Incorrect aircraft wiring (left/right channels swapped)	**2)** See a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.
"3D audio left" message heard in left ear only, no audio heard in right ear.	**1)** Aircraft wired for mono intercom	**1)** See a service center to wire the installation for stereo headsets.
"3D audio right" message heard in right ear only, no audio heard in left ear	**1)** Incorrect aircraft wiring (right channel used for mono instead of left, or left/right swapped)	**1)** See a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.

3D Audio Troubleshooting

CLEARANCE RECORDER AND PLAYER

The GMA 342 contains a digital clearance recorder that records up to 60 seconds of the selected COM radio signal. Recorded COM audio is stored in separate memory blocks. Once 60 seconds of recording time have been reached, the recorder begins recording over the stored memory blocks, starting from the oldest block.

Pressing the **PLAY** Key once plays the latest recorded memory block.

Pressing the **MKR/MUTE** Key during play of a memory block stops play. If a COM signal is detected during play of a recorded memory block, play is halted.

Pressing the **PLAY** Key while audio is playing begins playing the previously recorded memory block. Each subsequent press of the **PLAY** Key selects the previously recorded memory block.

Powering off the unit automatically clears all recorded blocks.



Left Knob - Pilot Volume Controls



Marker Mute Key

ENTERTAINMENT INPUTS

The GMA 342 provides three stereo entertainment inputs and two telephone inputs.

- Press the **MUSIC** Key to turn music on/off for all positions. The ♫ **SEL** Key selects the music source for all positions. The pilot can choose not to hear music by either turning down the Pilot music volume or enabling **PILOT** 'ICS ISOLATION'. The copilot and passengers can choose not to hear music by turning down the Copilot/Passenger music volume. Refer to the following table on **MUSIC** and ♫ **SEL** Key Functions for more information.
- The **TEL** Key controls a telephone or entertainment device connected to the rear of the audio panel or to the Front Panel Jack. Distribution is controlled by ICS isolation state. When the **TEL** Key is selected, the pilot is always connected to the telephone interface. Other ICS positions are connected to the telephone interface if they hear the Pilot in that ICS state.

Function	Action	Key Annunciations	Notes
Turn MUSIC ON	Press the **MUSIC** Key (when not selected).		**MUSIC** in-key annunciator turns green.
Turn MUSIC OFF	Press the **MUSIC** Key (when selected).		**MUSIC** in-key annunciator turns OFF (source selection annunciators are unaffected).
Change MUSIC Source	Press the ♫ **SEL** Key.		Music source selection is cyclic, moving from **1** to **2** to **3** and then back to **1**.

MUSIC and ♫ SEL Key Functions

FRONT PANEL JACK

The Front Panel Jack is a 3.5 mm stereo jack that can be used as an entertainment input or a telephone input. When a telephone is connected to the Front Panel Jack, the telephone connected to the rear of the audio panel is disabled.

To use the Front Panel Jack as a music input, press the **MUSIC** Key and use the ♫ **SEL** Key to select music source **3**. To use as a telephone input, press the **TEL** Key. The telephone function overrides the music function. **TEL** must be enabled for intercom audio to be sent to the telephone device

MUSIC EFFECTS

The following music effects are available:

- **Music Equalizer:** Press the ♫ **SEL** Key and the **PILOT** Key simultaneously to change the selected Music Equalizer setting. Available settings include: Disabled, Classical, Pop, or Rock.
- **Music Bass Boost:** Press the ♫ **SEL** Key and the **CREW** Key simultaneously to change the selected Music Bass Boost setting. Available settings include: Disabled, Medium, or High.

ENTERTAINMENT MUTING

Entertainment muting can be enabled or disabled by the user, however it is always muted during alerts.

ENABLING/DISABLING MUTING

Press and hold the **MUSIC** Key for 1 second to toggle radio muting of music on and off. The aural message **"Radio Mute Music Enabled/ Disabled"** is heard.

Press and hold the **AUX2** button for one second to toggle intercom muting of music on and off. The aural message **"Intercom Mute Music Enabled/Disabled"** is heard.

FAIL-SAFE OPERATION

If there is a failure of the GMA 342 or when power is not applied, a fail-safe circuit connects the pilot's headset and microphone directly to the COM1 transceiver. Audio is not available on the speaker during Fail-safe operation.

Function	Key(s)	Action
Monitor Mute	COM1 or COM2	Press and hold for 1 second
Radio Mute Intercom	MUSIC	Press and hold for 1 second
Passenger Mute	AUX1	Press and hold for 1 second
Intercom Mute Music	AUX2	Press and hold for 1 second
3D Audio	PILOT	Press and hold for 1 second
Passenger Address	SPKR ←PA	Press and hold for 1 second
Marker Beacon High Sens	MKR MUTE	Press and hold for 1 second
Split COM	COM1 MIC and COM2 MIC	Press keys simultaneously
Music Equalizer	♫SEL and PILOT	Press keys simultaneously
Music Bass Boost	♫SEL and CREW	Press keys simultaneously

Alternate Key Function Quick Reference

Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 72S8001 AND ON

SUPPLEMENT 7

TRIG TT31

Standby Flight instruments

SUPPLEMENTAL TYPE CERTIFICATE

10065722

This Certificate/Approval is issued by EASA, acting in accordance with Regulation (EC) No. 216/2008 on behalf of the European Community, its Member States and of the European third countries that participate in the activities of EASA under Article 66 of that Regulation and in accordance with Commission Regulation (EU) No. 748/2012 to

PEREGRINE LLC

13000 E. CONTROL TOWER RD
SUITE 220 BOX K-4
ENGLEWOOD CO 80112
USA

and certifies that the change in the type design for the product listed below with the limitations and conditions specified meets the applicable Type Certification Basis and, if applicable, environmental protection requirements when operated within the conditions and limitations specified below:

Type Certificate Number: SEE FAA APPROVED MODEL LIST (AML) SA00744DE, dated 28 February 2018.
Type Certificate Holder: SEE FAA APPROVED MODEL LIST
Type: SEE FAA APPROVED MODEL LIST
Model: SEE FAA APPROVED MODEL LIST
Original STC Number: FAA STC SA00744DE

Description of Design Change:
Installation of the Automatic Dependent Surveillance – Broadcast (ADS-B) Out Equipment using a Trig Avionics TT31 Transponder and an approved position sensor.

EASA Certification Basis:
The Certification Basis for the original product remains applicable to this certificate/ approval, except where amended by additional or later amendments if indicated on FAA STC.
The requirements for environmental protection and the associated certified noise and/ or emissions levels of the original product are unchanged and remain applicable to this certificate/ approval.

See Continuation Sheet(s)

For the European Aviation Safety Agency

Cologne, Germany, 04 June 2018

p.p. **Dominique ROLAND**
Head of General Aviation and
Remotely Piloted Aircraft Systems (RPAS)

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Associated Technical Documentation:

1. Peregrine Master Drawing List, referenced on the attached AML No. SA00744DE.

2. Instructions for Continued Airworthiness document, as listed on the attached AML No. SA00744DE.

3. Airplane Flight Manual Supplement, as listed on the attached AML No. SA00744DE.

Limitations/Conditions:

Prior to installation of this design change it must be determined that the interrelationship between this design change and any other previously installed design change and/ or repair will introduce no adverse effect upon the airworthiness of the product.

The STC is valid for those aircraft types and models approved by EASA and listed on the FAA Approved Model List SA00744DE, dated 28 February 2018.

- End -

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TT31 Mode S Transponder
Operating Manual



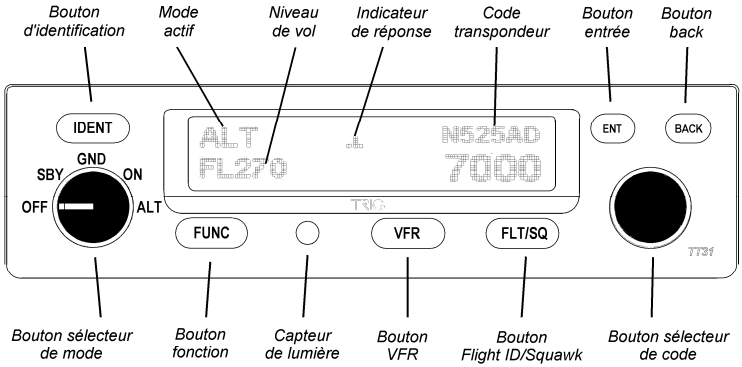
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2 Nov 2009

Trig Avionics Limited
Heriot Watt Research Park
Riccarton, Currie
EH14 4AP
Scotland, UK

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EN / DE / FR

Panneau



Affichage

L'écran affiche le mode de fonctionnement du transpondeur, l'altitude-pression mesurée, ainsi que le code transpondeur et le code d'identification de vol en cours. L'indicateur de réponse est actif lorsque le transpondeur répond aux interrogations.

L'altitude-pression s'affiche en niveau de vol, c'est à dire l'altitude-pression en centaines de pieds. Lorsque les conditions atmosphériques ne sont pas standards, cette valeur peut être différente de l'altitude indiquée par l'altimètre, mais son affichage sera correct sur les écrans radar du contrôle de la circulation aérienne.

Bouton Sélecteur de Mode

Le bouton de gauche commande la mise sous tension du transpondeur ainsi que le mode de fonctionnement.

OFF Le transpondeur est hors tension.

SBY Le transpondeur est sous tension mais ne répondra à aucune interrogation.

GND Le transpondeur répondra aux interrogations du sol en Mode S des radars de mouvement à la surface.

ON Le transpondeur répondra à toutes les interrogations, mais sans information d'altitude.

ALT Le transpondeur répondra à toutes les interrogations.

En vol, le transpondeur doit toujours être sur ALT sauf avis contraire du contrôle de la circulation aérienne. Lorsque l'appareil roule au sol, le transpondeur doit être sur GND sauf si l'installation comprend un

contact de train validant la position sol de l'avion; dans ce cas, la sélection de GND est automatique à l'atterrissage.

Boutons Poussoirs

IDENT Appuyer sur IDT lorsque le contrôle de la circulation aérienne demande « Ident » ou « Squawk Ident ». Ceci active l'impulsion spéciale d'identification de position (SPI) dans les réponses du transpondeur pendant 18 secondes. IDENT apparaîtra à l'écran.

FUNC Appuyer sur le bouton FUNC permet d'accéder au temporisateur de vol, au chronomètre, au moniteur d'ADS-B (selon l'installation) et à la fonction de moniteur d'altitude.

VFR Une pression sur le bouton VFR permet d'afficher directement le code pré-programmé. Une seconde pression sur ce bouton restaure le code transpondeur précédent.

FLT/SQ La pression de FLT/SQ alterne l'affichage primaire entre le squawk code et l'identification de vol.

ENT Le bouton ENT permet de valider chaque chiffre dans le sélecteur de code.

BACK Le bouton BACK saute de nouveau au chiffre précédent dans le sélecteur de code.

Bouton Sélecteur

Le bouton de droite permet d'afficher le code transpondeur et le code d'identification de vol. Le bouton FLT/SQ choisit qui sera mis à jour. La rotation du bouton accentuera le premier chiffre sur l'affichage, et le chiffre peut être changé comme exigé. Appuyer sur ENT pour avancer au chiffre suivant. Lorsque le bouton ENT est enfoncé après le dernier chiffre, le nouveau code transpondeur ou le nouveau code d'identification de vol s'affiche en remplacement du précédent. Si le code n'est pas saisi en moins de 7 secondes, les modifications sont ignorées et le code précédent est restauré.

1200	Code VFR aux Etats-Unis
7000	Code VFR couramment utilisé en Europe
7500	Intervention illicite
7600	Panne radio
7700	Code de détresse

Le code d'identification de vol doit correspondre à numéro de vol déclaré dans le plan de vol. S'il n'y a pas de plan de vol, l'immatriculation de l'avion doit être utilisée comme code d'identification de vol. Utiliser uniquement des lettres et des chiffres. Si le code d'identification de vol comporte moins de 8 caractères, saisir un caractère espace pour le terminer.

Temporisateur de Vol

Le temporisateur de vol enregistre le temps l'où le transpondeur a été mis sous tension et actionnant en vol le mode ON ou ALT. Appuyez sur le bouton FUNC pour montrer le temporisateur de vol.

Chronomètre

Le chronomètre peut être employé comme temporisateur commode. Appuyez sur le bouton FUNC pour montrer le chronomètre. En serrant la volonté ENT remettez à zéro et commencez le temporisateur. La pression ENT encore arrêtera le temporisateur.

Moniteur D'Altitude

Le moniteur d'altitude active un annonciateur ou une lumière audio d'annonciateur (selon l'installation) quand l'altitude pression d'avion diffère de l'altitude choisie par plus de 200 pieds. Appuyez sur le bouton FUNC pour montrer le moniteur d'altitude permettent l'écran. Serrant les cabillots ENT l'altitude surveillent à l'altitude courante.

Quand la surveillance d'altitude est en service, un petit indicateur de déviation apparaît à côté de l'affichage d'altitude sur le transpondeur.

Moniteur ADS-B

Le moniteur d'ADS-B est seulement disponible sur les installations qui incluent une source de position d'ADS-B. Le moniteur d'ADS-B fournit un affichage d'information de position qui est transmise dans des rapports de position d'ADS-B. Ceci peut fournir la confirmation que l'information correcte est transmise, en particulier où la source de GPS est éloignée du transpondeur.

Au cas où l'information valide de position ne serait pas fournie par le GPS, l'affichage de latitude et de longitude sera remplacé par des tirets; si aucune latitude et longitude valides n'est montrée alors l'information de position d'ADS-B n'est pas transmise.

Annonce de Panne

Si le transpondeur détecte une panne interne grave, un message FAULT apparaît à l'écran avec un bref état de la situation. Le

transpondeur ne répond plus aux interrogations lorsqu'une panne est détectée.

Certaines indications de pannes (FAULT) peuvent être rétablies en mettant le transpondeur hors tension puis à nouveau sous tension, bien que dans tous les cas, un message FAULT indique un problème avec le transpondeur ou avec l'installation. Noter le message FAULT en bas de l'écran et transmettre l'information au service de maintenance du fournisseur d'électronique aéronautique**.**

Mode Configuration

Le système est configuré lors de sa première installation par le fournisseur d'avionique. Les éléments de configuration comprennent l'adresse Mode S de l'avion, l'interface avec les autres systèmes de l'avion, la catégorie de l'avion, et les valeurs pré-programmées du code transpondeur VFR. Pour visualiser ou modifier ces réglages, le mode configuration doit être utilisé.

> **Ne pas utiliser le mode configuration en vol. Consulter votre installateur d'avionique avant toute modification de la configuration.**

Pour passer en mode configuration, maintenir le bouton FN enfoncé tout en mettant sous tension du transpondeur. Les éléments de configuration peuvent être modifiés à l'aide du bouton sélecteur de code et les boutons ENT et BACK. Une pression sur FN permet d'avancer jusqu'à l'élément de configuration suivant.

Lorsque la configuration est terminée, mettre le transpondeur hors tension. Lorsqu'il sera de nouveau mis sous tension, le transpondeur utilisera la nouvelle configuration.

Opération à Basses Températures

Le transpondeur est certifié pour fonctionner correctement jusqu'à -20°C, mais à ces températures, l'affichage peut s'en trouver affecté. S'il fait froid, un temps d'attente jusqu'à ce que le cockpit soit réchauffé peut être nécessaire pour garantir un fonctionnement normal.

Cessna
A Textron Company

Pilot's Operating Handbook and FAA Approved Airplane Flight Manual

CESSNA MODEL 172S

AIRPLANES 172S8001 AND ON

SUPPLEMENT 8

DAVTRON MODEL 803 CLOCK/O.A.T.

SERIAL NO._____

REGISTRATION NO._____

This supplement must be inserted into Section 9 of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Davtron Clock/O.A.T. is installed.

FAA APPROVAL
FAA APPROVED UNDER FAR 21 SUBPART J
The Cessna Aircraft Co
Delegation Option Manufacturer CE-1
Executive Engineer
Date: July 10, 1998

Member of GAMA

8 July 1998

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CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS, USA

SUPPLEMENT

DIGITAL CLOCK/O.A.T.

SECTION 1
GENERAL

The Davtron Model 803 digital clock combines the features of a clock, outside air temperature gauge (O.A.T.) and voltmeter in a single unit. The unit is designed for ease of operation with the use of three buttons. The upper button is used to control sequencing between temperature and voltage. The lower two buttons control reading and timing functions related to the digital clock. Temperature and voltage functions are displayed in the upper portion of the unit's LCD window, and clock/timing functions are displayed in the lower portion of the unit's LCD window.

The digital display features an internal light (back light) to ensure good visibility under low cabin lighting conditions and at night. The intensity of the back light is controlled by the PANEL LT rheostat. In addition, the display incorporates a test function which allows checking that all elements of the display are operating.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when the digital clock/O.A.T. is installed.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the digital clock/O.A.T. is installed.

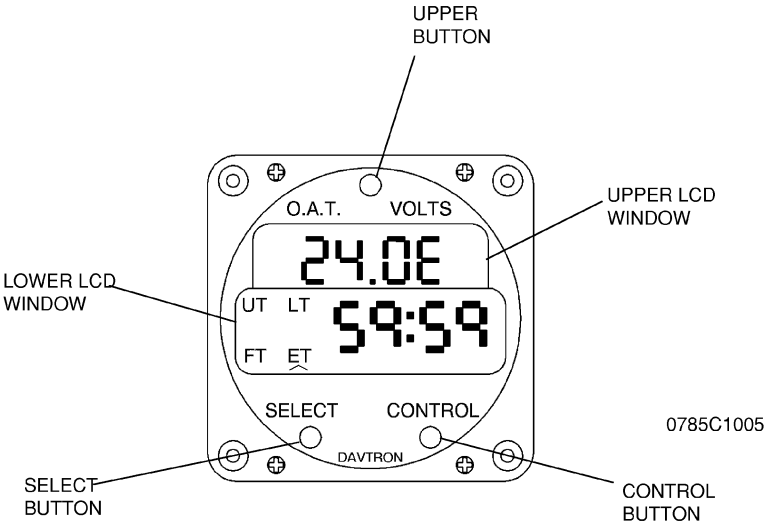


Figure 1. Clock/OAT Gauge

SECTION 4
NORMAL PROCEDURES

TEST MODE

The unit may be tested by holding the SELECT button down for three seconds. Proper operation is indicated by the display 88:88 and activation of all four annunciators.

O.A.T. / VOLTMETER OPERATION

The upper portion of the LCD window is dedicated to O.A.T. and voltmeter operations. The voltmeter reading is preselected upon startup and is indicated by an “E” following the display reading. Pushing the upper control button will sequence the window from voltage to fahrenheit (“F”) to centigrade (“C”), and back again to voltage.

CLOCK OPERATIONS

The lower portion of the LCD window is dedicated to clock and timing operations. Pushing the SELECT button will sequence the window from universal time (UT) to local time (LT) to flight time (FT) to elapsed time (ET), and back again to universal time. Pushing the CONTROL button allows for timing functions within the four SELECT menus. Setting procedures are as follows:

SETTING UNIVERSAL TIME

Use the SELECT button to select universal time (UT). Simultaneously press both the SELECT and the CONTROL buttons to enter the set mode. The tens of hours digit will start flashing. The CONTROL button has full control of the flashing digit, and each button push increments the digit. Once the tens of hours is set the SELECT button selects the next digit to be set. After the last digit has been selected and set with the CONTROL button, a final push of the SELECT button exits the set mode. The lighted annunciator will resume its normal flashing, indicating the clock is running in universal time mode.

SETTING LOCAL TIME

Use the SELECT button to select local time (LT). Simultaneously press both the SELECT and the CONTROL buttons to enter the set mode. The tens of hours digit will start flashing. The set operation is the same as for UT, except that minutes are already synchronized with the UT clock and cannot be set in local time.

FLIGHT TIME RESET

Use the SELECT button to select flight time (FT). Hold the CONTROL button down for 3 seconds, or until 99:59 appears on the display. Flight time will be zeroed upon release of the CONTROL button.

SETTING FLIGHT TIME FLASHING ALARM

Use the SELECT button to select flight time (FT). Simultaneously press both the SELECT and the CONTROL buttons to enter the set mode. The tens of hours digit will start flashing. The set operation is the same as for UT. When actual flight time equals the alarm time, the display will flash. Pressing either the SELECT or CONTROL button will turn the flashing off and zero the alarm time. Flight time is unchanged and continues counting.

SETTING ELAPSED TIME COUNT UP

Use the SELECT button to select elapsed time (ET). Press the CONTROL button and elapsed time will start counting. Elapsed time counts up to 59 minutes, 59 seconds, and then switches to hours and minutes. It continues counting up to 99 hours and 59 minutes. Pressing the CONTROL button again resets elapsed time to zero.

SETTING ELAPSED TIME COUNT DOWN

Use the SELECT button to select Elapsed Time (ET). Simultaneously press both the SELECT and the CONTROL buttons to enter the set mode. The tens of hours digit will start flashing. The set operation is the same as for UT, and a count down time can be set from a maximum of 59 minutes and 59 seconds. Once the last digit is set, pressing the SELECT button exits the set mode and the clock is ready to start the countdown. Pressing the CONTROL button now will start the countdown. When countdown reaches zero, the display will flash. Pressing either the SELECT or CONTROL button will reset the alarm. After reaching zero, the elapsed time counter will count up.

Button Select Disable

When there is no airplane power applied to the unit, the CONTROL and SELECT buttons are disabled.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this equipment is installed. However, installation of this O.A.T. probe may result in a minor reduction in cruise performance.



Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 72S8001 AND ON

SUPPLEMENT 9

GPS/XM antenna STC

GPS/XM® Antenna STC

Instructions for Continued Airworthiness

as installed in

CESSNA AIRCRAFT COMPANY 172S

(Make and Model Airplane)

Reg. No. F-HAAM **S/N** 172S8743

Antenna location(s) on aircraft

upper rear

Document Number 005-00638-09 Rev. 4

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 USA

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Record of Revision

Rev.	Date	Description of Change
1	11/23/10	Initial STC Issuance
2	08/30/11	Added GA 55 and GA 55A XM-only antennas
3	03/16/12	Added Cessna 337 pressurized instructions, updated XM to Sirius XM.
4	04/04/24	Added GA 35S antenna.

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1. INTRODUCTION

1.1 Purpose

This document is designed for use by the installing agency of the antenna models listed in Table 1 below as Instructions for Continued Airworthiness in response to 14 CFR § 23.1529, and Part 23 Appendix G. This ICA includes information required by the operator to adequately maintain the antenna models listed in Table 1 installed under Approved Model List (AML) STC SA02018SE-D.

1.2 Scope

This document identifies the Instructions for Continued Airworthiness for the modification of the aircraft for installation of the antenna models listed in Table 1.

Table 1 - List of Antenna Models

Manufacturer	Antenna Model	Description
Garmin	GA 35	GPS/WAAS Antenna
Garmin	GA 35S	GPS/WAAS Antenna
Garmin	GA 36	GPS/WAAS Antenna
Garmin	GA 37	GPS/WAAS with XM Antenna
Garmin	GA 55	XM Antenna
Garmin	GA 55A	XM Antenna

1.3 Document Control

This document shall be released, archived, and controlled in accordance with Garmin document control system. When this document is revised, refer to Section 2.15 for information on how to gain FAA acceptance or approval and how to notify customers of changes.

1.4 Permission to Use Certain Documents

Permission is granted to any corporation or person applying for approval of the antenna models listed in Table 1 to use and reference appropriate STC documents to accomplish the Instructions for Continued Airworthiness and show compliance with STC engineering data. This permission does not construe suitability of the documents. It is the responsibility of the applicant to determine the suitability of the documents for the ICA.

1.5 Definitions

The following terminology is used within this document:

1) **AC:** Advisory Circular
2) **ACO:** Aircraft Certification Office
3) **AEG:** Aircraft Evaluation Group
4) **CFR:** Code of Federal Regulations
5) **FAA:** Federal Aviation Administration
6) **ICA:** Instructions for Continued Airworthiness
7) **PMI:** Primary Manufacturing Inspector
8) **STC:** Supplemental Type Certificate

2. INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

2.1 Introduction

Content, Scope, Purpose and Arrangement:	This document identifies the Instructions for Continued Airworthiness for the modification of the aircraft by installation of the antenna models listed in Table 1.
Applicability:	Applies to aircraft altered by installation of the antenna models listed in Table 1.
Definition of Abbreviations:	See Section 1.5
Precautions:	None
Units of measurement:	None
Referenced publications:	190-01284-00 Rev. E *Garmin GPS/XM® Antenna STC Installation Manual*
(or later revisions)	005-00638-01 Rev. 5 *Master Drawing List, GPS/ XM® Antenna STC*
Distribution:	This document, or the information contained within, will be included in the aircraft's permanent records.

2.2 Description of Alteration

Installation of the antenna models listed in Table 1.

2.3 Control, Operating Information

There are no pilot controls or operating information. All pilot controls and operating information is through the interfaced GPS/WAAS and XM receiver unit.

2.4 Servicing Information

The antenna models listed in Table 1 are non-repairable. The antenna must be replaced in the event of failure.

2.5 Periodic Maintenance Instructions

This STC is for physical installation and mounting of the antenna models listed in Table 1 and does not include functional operation. The antenna models listed in Table 1, when interfaced to other receiving equipment, are functionally tested by the interfaced GPS/WAAS and XM receiver.

Operation of the system connected to antenna(s) installed under this STC is not permitted unless the inspections described in this section have been completed within time intervals prescribed in Appendix A.

2.6 Troubleshooting Information

Troubleshooting is performed with the interfaced GPS/WAAS and XM receiver unit.

2.7 Removal and Replacement Information

If the antenna is removed and replaced, verify proper operation by successful completion of the self test or checkout procedure of the interfaced GPS/WAAS and XM receiver equipment, if any.

Note: There are no special handling requirements for the antennas.

2.7.1 Removal

1. Verify that the power to the interfaced GPS/WAAS and XM receiver unit is off.
2. Disconnect the coaxial antenna connector(s) on the antenna.
3. Remove the sealant from the antenna and fuselage.
4. Remove the mounting screws on the antenna.
5. Retain the screws for reinstallation.
6. Remove the antenna.

2.7.2 Installation

1. Clean the area of debris or excess sealant.
2. Install the antenna according to Section 3.1.1.2 (non-pressurized aircraft) or 3.2.1.2 (pressurized aircraft) of the STC Antenna Installation Manual (listed in Section 2.1 of this document). This includes verifying the electrical bond of the antenna in accordance with the requirements of Section 2.6 in that installation manual.
3. Connect the antenna connector(s) to the antenna ensuring each connecter is secured.

2.8 Diagrams

Refer to the STC Antenna Installation Manual (listed under reference documentation in section 2.1 of this document) for drawings applicable to this installation. There are no wiring diagrams since this STC does not provide wiring interconnections. Location of the antenna varies with aircraft and installation. Refer to the cover page of this document for the mounting location of the antenna(s) specific to the aircraft tail number.

2.9 Special Inspection Requirements

2.9.1 Antenna Visual Inspection - Suspected lightning strike

In the event of a suspected or actual lightning strike to the aircraft, the antenna(s) and its associated installation shall be inspected.

If the antenna was struck by lightning then the antenna and the surrounding installation shall be inspected to ensure that there is no structural damage around the areas where lightning may have attached. See Table 2 for inspection criteria.

Execute the system checkout procedure for the GPS/WAAS and/or XM system using the antenna, to ensure the system is operating correctly.

2.10 Application of Protective Treatments

None, N/A.

2.11 Data Relative to Structural Fasteners

For fastener torque information and other fastener information, refer to Section 3.1.1.2 (non-pressurized aircraft) or 3.2.1.2 (pressurized aircraft) of the STC Antenna Installation Manual (listed in Section 2.1 of this document).

2.12 Special Tools

For electrical bonding testing, a milli-ohm meter is required.

2.13 Additional Instructions

There are no additional ICA instructions for this STC.

2.14 Overhaul Period

This STC is for physical installation and mounting of the antenna(s) and does not include functional operation. The antenna(s) do not require overhaul at a specific time period. Antenna health is monitored and self-test conducted by the interfaced GPS/WAAS and XM receivers.

2.15 ICA Revision and Distribution

To revise this ICA, Garmin will follow the Garmin ODA procedures manual SOP-055/ACP-016 for Instructions for Continued Airworthiness.

The latest revision of this document will be available on the Garmin website (www.garmin.com). A Garmin Service Bulletin, describing the ICA revision, will be sent to dealers if revision is determined to be significant.

2.16 Assistance

Flight Standards Inspectors or the certificate holder's PMI have the required resources to respond to questions regarding this ICA. In addition, the customer may refer questions regarding this equipment and its installation to the manufacturer, Garmin. Garmin customer assistance may be contacted during normal business hours via telephone 913-397-8200 or email from the Garmin website at garmin.com.

2.17 Implementation and Record Keeping

Modification of an aircraft by this Supplemental Type Certificate obligates the aircraft operator to include the maintenance information provided by this document in the operator's aircraft maintenance manual and/or operator's aircraft scheduled maintenance program.

3. AIRWORTHINESS LIMITATIONS

There are no new (or additional) airworthiness limitations associated with this equipment and/or installation.

> The Airworthiness Limitations section is FAA approved and specifies maintenance required under §§43.16 and 91.403 of Title 14 of the Code of Federal Regulations unless an alternative program has been FAA approved.

FAA APPROVED

Erik Frisk
ODA STC Unit Administrator
ODA-240087-CE

4/4/2024
Date

Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 172S8001 AND ON

SUPPLEMENT 10

KANNAG INTEGRA EASY AF-ELT

DOC14002D

Emergency Locator Transmitters
Orolia S.A.S.

OPERATION MANUAL



AF INTEGRA (ER-N) / AF-H INTEGRA (ER-N) ELT
With built-in GPS & built-in back-up Antenna and ARINC

Revision 03

First issue: JUN 05/2014

TP PAGE : 1

Date of rev.: MAY 15/2019

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RECORD OF REVISIONS

REV. Nb	REVISION DATE	INSERTION DATE	BY
A	JUN 05/2014	JUN 05/2014	J.S.
B	SEP 05/2014	SEP 05/2014	J.S.
C	FEB 12/2015	FEB 12/2015	J.S.
03	MAY 15/2019	MAY 15/2019	C.L.G.

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RECORD OF REVISIONS

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INTRODUCTION

INTEGRA ELTs are an extension of the range of KANNAD ELTs. The development of this type of ELTs is based on the improvement of safety of flights either for light aircraft, business aircraft or commercial aviation.

The safety of flights is strengthened thanks to a **built-in GPS** giving a more accurate position transmitted within minutes following the distress and an **built-in back-up Antenna** which may replace the external antenna in case on unavailability of this last one.

AF(1) INTEGRA (ER-N) is designed for fixed wing aircraft or helicopters, AF-H INTEGRA (ER-N) is designed for flat installation on board helicopters only.

The AF INTEGRA (ER-N) and AF-H INTEGRA (ER-N) ELTs are evolutions of AF INTEGRA (ER) and AF-H INTEGRA (ER) ELTs Cospas Sarsat Class I ELTs (Operating temperatures -40°C to +55°C). **The main evolution consists in the capability to be connected to an External Navigation Device used to store GPS data coming from an on-board GPS ARINC429 or 743 output.**

IMPORTANT: INTEGRA (ER-N) ELTs shall always be connected to an INTEGRA ARINC e-NAV External Navigation Device. Installing an INTEGRA (ER-N) ELT without INTEGRA ARINC e-NAV is not authorized.

The instructions in this manual provide the information necessary for the installation and the operation of AF INTEGRA (ER-N) and AF-H INTEGRA (ER-N) ELTs.

Servicing instructions of ELT are normally performed by shop personnel. For detailed instructions , refer to Service & Support section of Orolia Website.

For the initial installation, please refer to Initial Installation Manual supplied with AF INTEGRA (ER-N) and AF-H INTEGRA (ER-N) ELTs.

FOR REGULATORY REQUIREMENTS, PLEASE CONSULT YOUR NATIONAL AVIATION AUTHORITY.

NOTE: (1) AF for Automatic Fixed

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WARRANTY

1. Scope

The equipment is warranted against all material or manufacturing defect for a period of two years from the date of installation on the aircraft or thirty months from the date of shipment from Orolia S.A.S. facilities whichever occur first.

Work carried out under the warranty shall not have the effect of extending the warranty period.

In respect of this warranty, after a defect has been noted by our services, the sole obligation incumbent upon us shall be the repair of the equipment or the element identified as being defective by our services or possibly its replacement free of charge, to the exclusion of all compensation or damages.

This warranty covers the cost of parts and labour in our factories.

The cost of transportation of the equipment replaced or repaired are the purchaser's exclusive responsibility.

The risks shall be borne by the purchaser.

2. Exclusion

Defects and deterioration caused by natural wear of the product or by external accident (poor maintenance, abnormal conditions of use, etc.) or by modification of the equipment and tools not recommended nor specified by our company, are excluded from the warranty.

Also the warranty shall not cover visible defects which the purchaser wouldn't have formally notified Orolia S.A.S within 48 hours of receipt of the equipment.

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SYSTEM OVERVIEW

1. COSPAS-SARSAT System

A. Description

Launched in the early eighties by the four founder countries (Canada, France, Russia, USA), the COSPAS-SARSAT system provides satellite aid to search and rescue (SAR) operations for maritime, aeronautical and terrestrial vehicles anywhere in the world.

It uses distress beacons fitted on mobiles and a constellation of LEO, MEO and GEO satellites which relay and process the 406 MHz signal to ground stations (LUT) where the beacon positions are determined.

Several types of beacons are designed to match the various user needs of the COSPAS-SARSAT system:

- EPIRB (Emergency Position Indicating Radio Beacon) for maritime applications.
- ELT (Emergency Locator Transmitter) for aeronautical applications.
- PLB (Personal Locator Beacon) for land expeditions.

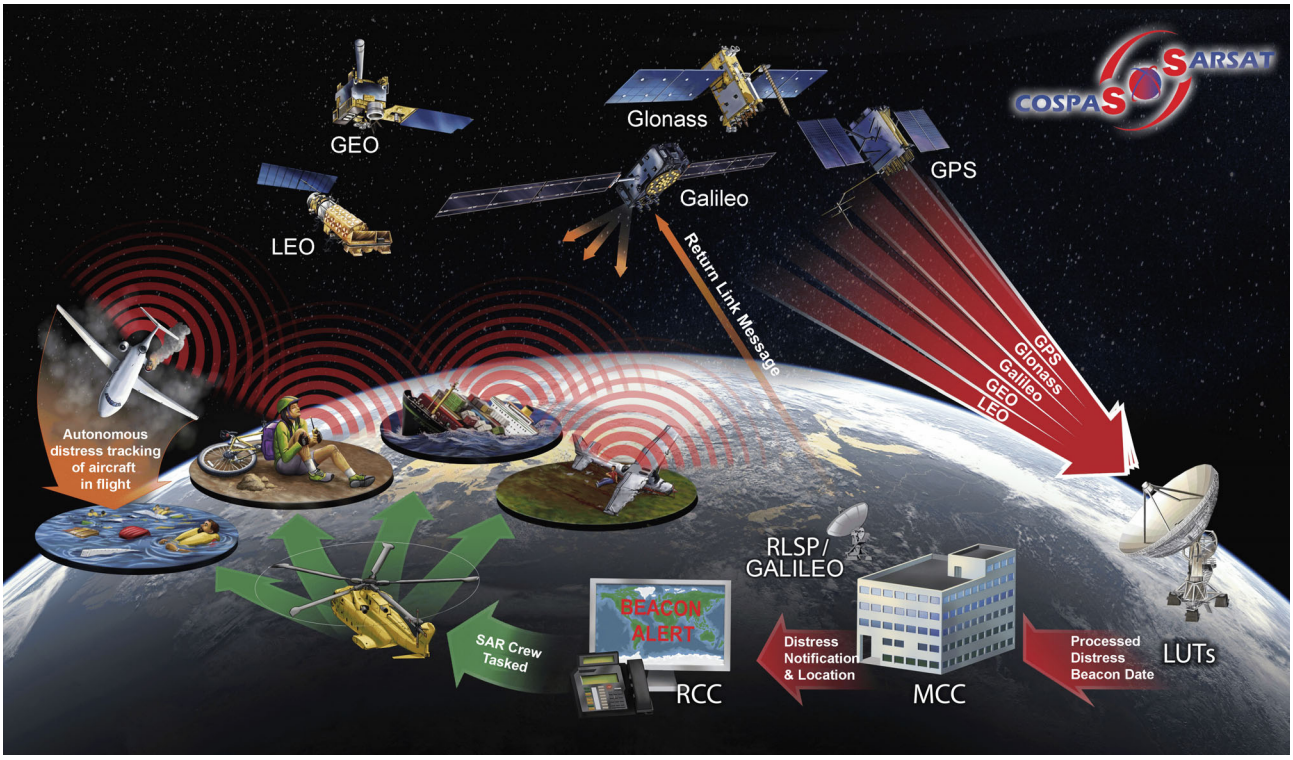


Figure 1: COSPAS-SARSAT System

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B. Worldwide coverage with the COSPAS-SARSAT system

The major improvement is the use of the COSPAS-SARSAT system for processing aeronautical emergencies.

The 406 MHz transmission carries digital data which enable the identification of the aircraft in distress and facilitate SAR operation (type of the aircraft, number of passengers, type of emergency).

The 406 MHz message is transmitted to the COSPAS-SARSAT satellites. This message is downloaded to one of the 64 ground stations (44 LEOLUTs and 20 GEOLUTS).

The aircraft is located by an independent location capability from the LEO and MEO system.

Thanks to the built-in GPS receiver or the INTEGRA e-NAV ARINC External Navigation Device, the encoded position will be transmitted in the distress message by the ELT within minutes following the distress.

The 121.5 MHz frequency is used by SAR services for homing in the final stage of rescue operations.

C. Operation

In the event of a crash, the ELT activates automatically and transmits a sweep tone on 121.5 MHz and the 406 MHz signal in space.

In a crash, a G-Switch (shock detector) activates the ELT "ON" when the ELT is subjected to an important change of velocity (or deceleration).

Activation may also be accomplished by manual means of a Remote Control Panel (RCP) from the cockpit or directly from a switch of the ELT's front panel.

In the event the external antenna is unavailable due to the crash, the built-in back-up antenna will replace it to transmit the 406 MHz signal to the Cospas-Sarsat satellites.

D. Environmental improvements of ELTs

The certification of an ELT includes a range of severe mechanical tests:

- resistance to flame;
- impact and crush tests;
- resistance up to 500 G shocks;
- watertightness;
- anti-deflagration;
- extreme temperatures .

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2. INTEGRA ELT System Presentation

AF INTEGRA (ER-N) and AF-H INTEGRA (ER-N) belong to the AF type of ELTs which are permanently attached to an aircraft. AF INTEGRA (ER-N) is designed to be installed on fixed wing aircraft or helicopters. AF-H INTEGRA (ER-N) is designed for flat installation on board helicopters only.

CAUTION: INTEGRA (ER-N) ELTs shall always be connected to an INTEGRA ARINC e-NAV External Navigation Device. Installing an INTEGRA (ER-N) ELT without INTEGRA ARINC e-NAV is not authorized.

The INTEGRA ELT system (Refer to Section Figure 2: ELT system description page 4) is composed of:

1. the ELT transmitter:
   - P/N S1851501-03 for AF INTEGRA (ER-N) or,
   - P/N S1852501-03 for AF-H INTEGRA (ER-N);
2. a mounting bracket;
3. an INTEGRA ARINC e-NAV interface(see note 1)
4. a remote control panel (RCP)(see note 2);
5. an approved external whip, rod or blade antenna;
6. an outside buzzer (optional);
7. an optional attachable dongle.

Note: (1) GPS/NAV Interface with an on board ARINC 429 or 743 GPS.

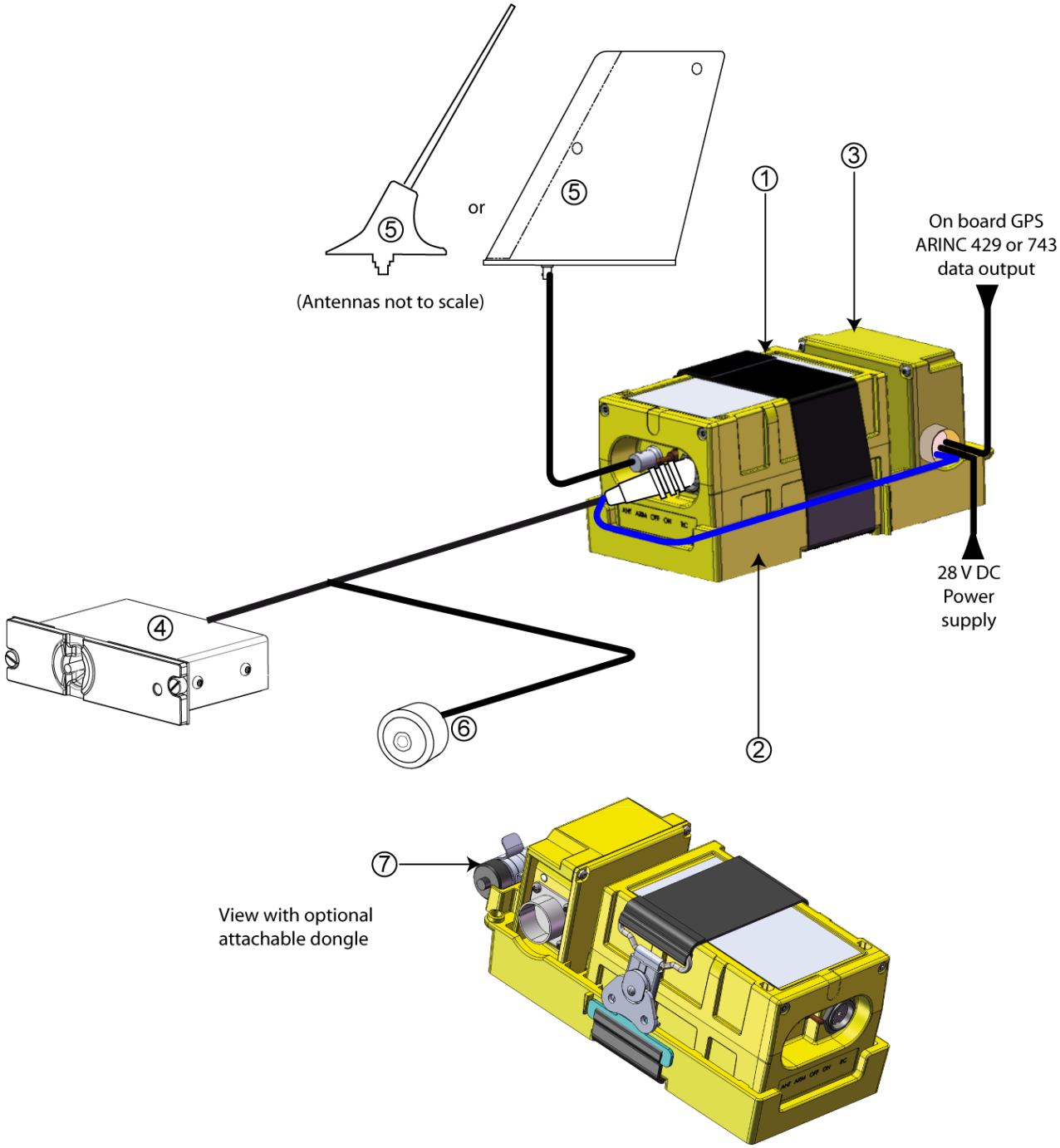
Note: (2) **The RCP is optional only if the commands and controls of the ELT are reachable and visible from the pilot seated position.** *(RTCA DO-204A)*: "*Equipment control and indicator installed for in-flight use **shall** be readily accessible from the cockpit crew position. The cockpit crew **shall** have an unobstructed view of visual indicator when in the normal seated position*."

For details of approved part number of INTEGRA ELT system, Refer to Section 6. Compatibility list page 111.

The transmitter and bracket are installed in the aircraft near the tail. The external antenna is mounted on the fuselage near the tail. The remote control panel is installed in the cockpit and connected to the ELT with a DIN-12 connector or a programming dongle and a 3 or 4-wire bundle (not supplied).

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Figure 2: ELT system description



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3. LINE REPLACEABLE UNITS

A. Transmitter

The AF INTEGRA (ER-N) and AF-H INTEGRA (ER-N) are ELTs designed to be installed onboard aircraft to transmit a distress signal on frequencies:

- 406 MHz (COSPAS-SARSAT frequency) for precise pinpointing and identification of the aircraft in distress.
- 121.5 MHz used for homing in the final stages of the rescue operations.

The AF INTEGRA (ER-N) and AF-H INTEGRA (ER-N) are certified as Automatic Fixed (AF) ELTs with the approved external antennas.

The housing of AF INTEGRA (ER-N) and AF-H INTEGRA (ER-N) transmitters are made of molded plastic with excellent mechanical resistance.

The ELT housing is designed with no sharp edges.



Figure 3: ELT Transmitter

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B. Bracket

The bracket installed near the tail is designed to fix the ELT with an attaching strap and a latch to lock the strap. This enables quick removal of the ELT for maintenance or exchange.

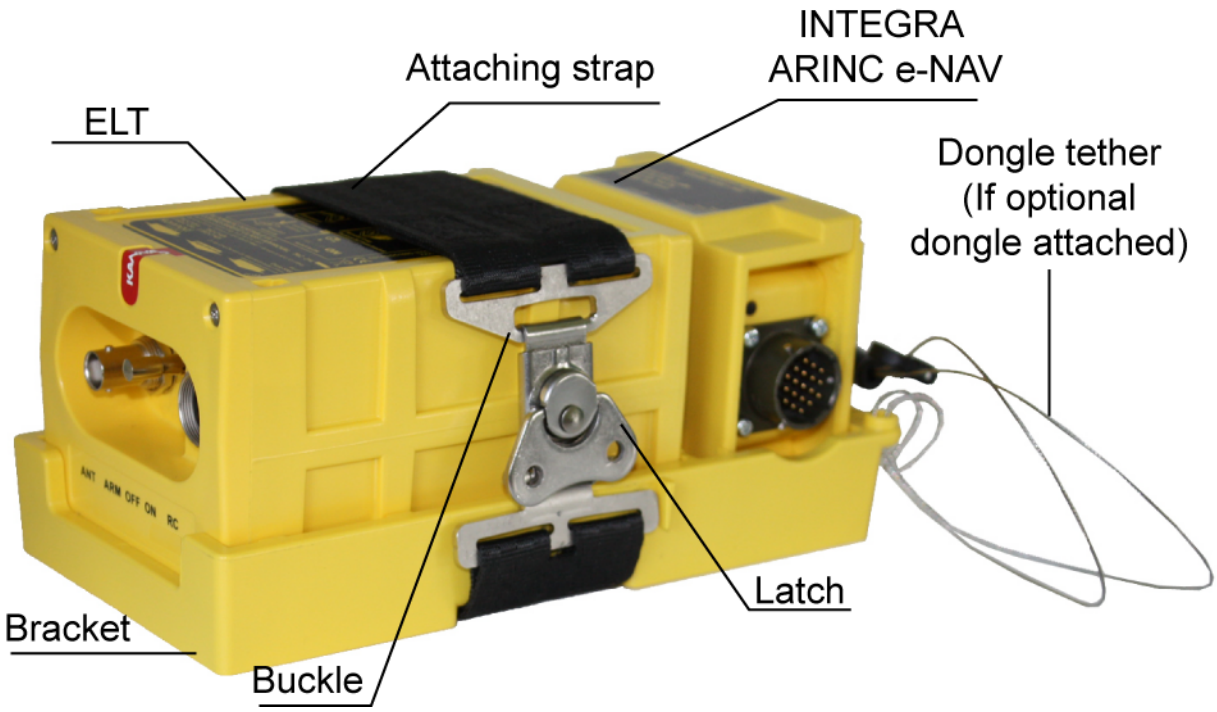


Figure 4: ELT Transmitter with Mounting Bracket

The transmitter is to be installed on a Universal Mounting Bracket for INTEGRA ARINC e-NAV for ELT (AF): P/N S1850551-02 to re-use existing drilling for retrofit (Refer to DOC14001, Initial Installation Manual for drilling masks and outline dimensions of this bracket).

NOTE: The dongle is not mandatory and may be installed as an option for on-board programming; Refer to Section 2. Programming page 203

C. External antenna

Only approved antennas may be installed (Refer to Section 6. Compatibility list page 111).

Connection to the ELT will be carried out with a 50 Ohm coaxial cable (RG58 for example) ended with a male BNC connector.

IMPORTANT NOTICE: Orolia S.A.S. recommends a cable with radio electric properties similar or better to those of a RG58 cable.

NOTE: the 50 Ohm coaxial cable and the male BNC connector are not supplied.

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SYSTEM FUNCTIONAL DESCRIPTION AND OPERATION

1. Transmitter Functional Description

A. Transmission

The transmitter can be activated either automatically when the crash occurs (thanks to a shock sensor) or manually (thanks to a switch on the transmitter itself or on a RCP).

The transmitter is designed to transmit on two frequencies (121.5 and 406 MHz). The 121.5 Mhz is mainly used for homing in the final stages of the rescue operations. The 406 MHz frequency is used by the COSPAS-SARSAT satellites for precise pinpointing and identification of the aircraft in distress.

Once activated, the transmitter operates continuously on 121.5 MHz.

During operations, a digital message is transmitted on 406.037 MHz every 50 seconds.

B. Controls & Connectors

The following controls are to be found on the ELT front panel:

1. 3-position switch ARM/OFF/ON;
2. Visual indicator (red);
3. DIN 12 socket for connection to the INTEGRA ARINC e-NAV, an optional Remote Control Panel,optional attachable programming dongle, or a programming equipment;
4. BNC connector for the external antenna.

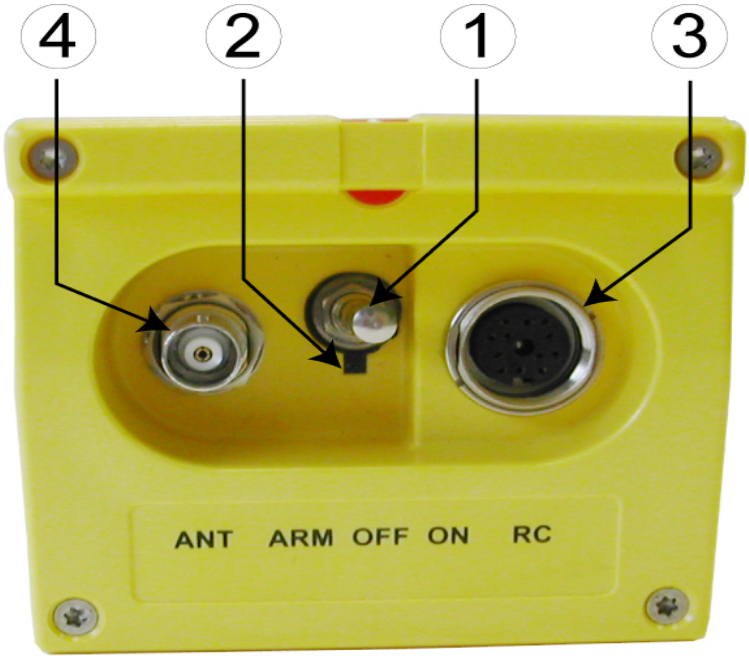


Figure 101: Front Panel

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The red light gives an indication on the working mode of the beacon:

- after the self test:
  - a series of short flashes indicates the self test failed;
  - one long flash indicates a correct self test;
- in operating mode:
  - periodic flashes during 121.5 transmission;
  - long flash during 406 transmission.

A buzzer gives audio information on the beacon working:

- continuous tone during self test;
- 1 beep every 0.7 second during 121.5 transmission;
- silence during 406 transmission.

C. Working mode information

The ELT has 4 different modes:

- Off.
- Self-test (temporary mode).
- Armed (standby mode to enable automatic activation by the shock sensor or by an optional remote control panel).
- On (transmission).

Transmission is effective if the beacon is activated (either manually on the ELT control panel, automatically by the shock sensor, or remotely by the "ON" switch of an optional remote control panel when connected).

(1)Off

The ELT is off when the switch is in position "OFF", no part of the ELT is energized.

This mode must **only** be selected when the ELT is removed from the aircraft or when the aircraft is parked for a long period or for maintenance.

(2) Self-Test

The self-test mode is a temporary mode (max duration 15 sec) in which the ELT checks the main characteristics of the transmitter (Battery voltage, Programming...) and enables digital communication with programming and test equipment.

This mode is selected:

- when switching from "OFF" to "ARM";
- when switching to "RESET / TEST" on an optional Remote Control Panel (provided that the switch of the ELT is in position "ARM");
- when switching to "ON" prior to transmission.

The buzzer operates during the self-test procedure.

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After about 10 seconds, the test result is displayed on the visual indicator as follows:

- One long flash indicates valid test.
- A series of short flashes indicates false test result.

The number of flashes indicates the type of failure:

- 3 + 1 = LOW BATTERY VOLTAGE.
- 3 + 2 = LOW TRANSMISSION POWER.
- 3 + 3 = FAULTY VCO LOCKING (FAULTY FREQUENCY).
- 3 + 4 = NO IDENTIFICATION PROGRAMMED.
- 3 + 5 = FAULTY VSWR (LINK TO EXTERNAL ANTENNA).
- 3 + 6 = INTERNAL GPS SERIAL LINK.
- 3 + 7 = INTEGRA ARINC e-NAV FAULTY CONNECTION.

It is recommended to test the ELT regularly in order to detect any possible failure (Refer to Section A. Periodicity page 301).

The number of self-tests carried out is recorded. This information is available when the ELT is connected to a programming and test equipment (PR600).

(3) Armed

In order to enable activation by the G-Switch or with an optional Remote Control Panel, the ELT must be in standby mode with the switch in the "ARM" position.

This mode is mandatory during flight. The ELT should remain in the "ARM" position except when the aircraft is parked for a long period or for maintenance.

(4) On

This mode is selected:

- manually by switching the ELT to "ON";
- by switching an optional Remote Control Panel switch to "ON" (provided that the ELT switch is in the "ARM" position);
- automatically when a crash occurs (provided that the ELT switch is in the "ARM" position).

When this mode is selected, the ELT starts transmitting:

- after 50 seconds on 406 MHz (one 406 MHz burst every 50 seconds) to the external antenna;
- after the GPS lock on 121.5 MHz (continous transmission between

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each 406 MHz burst). If GPS lock does not occur within 5 minutes, the 121.5 MHz will be activated.

The red visual indicator on the ELT (and on an optional remote control panel when connected) flashes and the buzzer operates.

- Red visual indicator:
  - 1 short flash during ELT transmission on 121.5 MHz (every 0.7 seconds);
  - 1 long flash during ELT transmission on 406 MHz (every 50 seconds).
- Buzzer:
  - 1.5 Hz pulse signal (recurrence 0.7 s) during ELT transmission on 121.5 MHz [except if the ELT has switched to built-in back-up antenna: Refer to D. VSWR Switch function (External / built-in back-up antenna)].

In case of accidental activation, the ELT can be reset either by switching it to "OFF" or by switching to "RESET" on an optional Remote Control Panel when connected.

The number of 406 MHz bursts transmitted is recorded. This information is available when the ELT is connected to a programming and test equipment (PR600).

D. VSWR Switch function (External / built-in back-up *antenna)*

During the 406 MHz burst, the Voltage Standing Wave Ratio (VSWR) is measured. After 5 bursts with wrong VSWR measurements, the ELT switches from the external to the built-in back-up antenna in order to optimize transmitted signal.

In ON mode, after 36 bursts, the ELT decides to re-switch or not according to the result of 2 new VSWR measurements.

NOTE: when shifting from the external to the built-in back-up antenna the pulse signal of the buzzer shifts from one beep every 0.7 second to 2 beeps every 0.7 second.

E. GPS Strategy

When valid, the position of the internal GPS will always take priority, even if the INTEGRA ARINC e-NAV is connected to the GPS equipment of the aircraft (external GPS):

- If only the internal GPS acquires a valid position, then the message will contain the true position of the internal GPS in the 406 MHz burst;
- If only the external GPS acquires a valid position, then the message will

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contain the true position of the external GPS in the 406 MHz burst;
- If both internal and external GPS acquire a valid position, then the message will contain the true position of the internal GPS;
- If neither the internal GPS, nor the external GPS acquire a valid position, then the message will contain the default value (GPS position not valid).

According to § 4.5.5.2 of Cospas Sarsat C/S T001, if, after providing valid data, the navigation input fails or is not available, the ELT message retains the last valid position for 4 hours (± 5 min) after the last valid position data input. After 4 hours the encoded position is set to the default values.

F. Autonomy

The energy is provided by a battery pack composed of a $LiMnO_2$ two-element battery (See pages page 107 & page 602 for Kit battery reference).

Lithium cells, lithium batteries and equipment containing such batteries are subjected to regulations and classified under class 9 as from 1st of January 2003.

Battery shall be replaced according to the expiry date indicated on the ELT.

IMPORTANT: If the ELT has been activated for more than 1 hour, the battery shall be replaced (See page 602 section 2, Battery replacement requirements)

With new batteries, the duration of the 121.5 transmission is over 48 hours at -40°C..

As it is therefore preferable to keep the battery power for 121.5 MHz homing frequency transmission for the rescue operations, in compliance with COSPAS-SARSAT specifications, the 406 MHz transmission is deliberately stopped after 24 hours to extend the 121.5 MHz transmission for as long as possible.

G. Electrical interfaces

J1

DIN 12 socket J1 is dedicated for connection to the Remote Control Panel and to the INTEGRA ARINC e-NAV. When the ELT is disconnected from theses devices, a Programming or Maintenance Dongles or a programming equipment (PR600) can be connected to the ELT.

IMPORTANT: Shielded cables are recommended. The required wires are AWG24.

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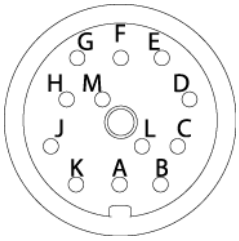
J1	PIN	Signal Name	From / To	I/O
Viewed from Front Face 	J1-A	RCP RESET	RCP	I
	J1-B	DONGLE RX	TX ARINC e-NAV	O
	J1-C	DONGLE CS	CS ARINC e-NAV	O
	J1-D	DONGLE SK	SK ARINC e-NAV	O
	J1-E	DONGLE TX	RX ARINC e-NAV	I
	J1-F	DONGLE ALE2P	ALEP2 ARINC e-NAV	O
	J1-G	RCP COMMON	RCP	O
	J1-H	RCP BUZZER	RCP	O
	J1-J	RCP LED	RCP	O
	J1-K	RCP ON	Not connected	
	J1-L	DONGLE GND	GND ARINC e-NAV	O
	J1-M	RCP 2W COM.	Not connected	

Table 1: J1 connector pin-out

J2

BNC female connector J2 is used to connect the external antenna through a 50 Ω coaxial cable.

IMPORTANT NOTICE:

The use of a low attenuation coaxial cable is recommended. The maximum permitted attenuation in the coaxial is 2dB@406 MHz excepted for Chelton Antenna 2624-82 (0.75 dB). The minimum permitted attenuation is 0dB, excepted for RAMI AV-100 antenna (0.3 db).

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H. Transmitter Technical Specifications

TYPE

- Two-frequency ELT (121.5 / 406.037 MHz)
- Automatic Fixed
- COSPAS-SARSAT Class Class I, -40°C to +55°C.

406 MHz TRANSMISSION

- Frequency: 406.037 MHz+/-1 kHz
- Output power: 5W (37 dBm +/- 2 dB)
- Modulation type: 16K0G1D (Biphase L encoding)
- Transmission duration: 520ms (long message) every 50 s.
- Autonomy 24 Hours @-40°C

121.5 MHz TRANSMISSION

- Frequency: 121.5 MHz +/- 6 kHz
- Output power: 50 to 400 mW (17dBm to 26 dBm), typical 100 mW
- Modulation type: 3K20A3X
- Modulation rate: > 85 %
- Frequency of modulation signal: 1600 Hz to 300 Hz with decreasing sweep
- Autonomy over 48 hours@-40°C

G-SWITCH SENSOR

Mechanical G-switch sensor compliant with EUROCAE ED62 specifications.

RF Fied strenght limits

0.471 V/m

Hardware - DAL E

- AF (ER-N) P/N S1850611-03
- AF-H (ER-N) P/N S1850621-03

Software - DAL D

P/N YLS1819

CONTROLS

- ARM / OFF / ON switch
- DIN12 socket for RCP and pin programming option.
- Bright red visual indicator
- Buzzer
- BNC antenna connector

BATTERY

KIT BAT200, P/N: S1840510-01
$LiMnO_2$ two-element battery for transmitter power supply
Battery expiry date: 7 years from date of cell manufacturing

HOUSING

Material: Polycarbonate
Color: Yellow (color compounded)
Transmitter dimensions:
131 x 86 x 75.4 mm
(5.157 x 3.385 x 2.968 inches)
Weight:

- AF: typical 755 g. (1.66 lb).
- AF-H: typical 760 g. (1.67 lb).

Tightness: O-ring

ENVIRONMENTAL CONDITIONS

See Table 2: ENVIRONMENTAL QUALIFICATION FORM

QUALIFICATIONS

ETSO-C126a / TSO-C126b

TSO C-126b deviations

- Use of RTCA DO-160G instead of RTCA DO-160F
- Use of RTCA DO-178C instead of RTCA DO-178B

FOR USE OUTSIDE OF THE USA OR EASA RULES, CONTACT YOUR LOCAL CIVIL AVIATION AUTHORITY.

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Table 2: ENVIRONMENTAL QUALIFICATION FORM

Conditions	Section	Description of tests conducted
Temperature and Altitude	4.0	As per ED-62A
Low Temperature	4.5.1	As per ED-62A -40°C
High Temperature	4.5.2 & 4.5.3	As per ED-62A +55°C
In-Flight Loss Cooling	4.5.4	Cat. X, no test performed
Altitude	4.6.1	As per ED-62A 50,000 ft
Decompression	4.6.2	As per ED-62A
Overpressure	4.6.3	As per ED-62A
Temperature Variation	5.0	As per ED-62A
Humidity	6.0	Cat. A
Operational Shock and Crash Safety	7.0	As per ED-62A
Vibration	8.0	AF type Cat. R(C,C1) AF-H Type Cat. U(G)
Explosive Atmosphere	9.0	Cat. X, no test performed
Waterproofness	10.0	Cat. W
Fluids Susceptibility	11.0	Cat. X, no test performed
Sand and Dust	12.0	Cat. X, no test performed
Fungus	13.0	Cat. X, no test performed
Salt Fog	14.0	Cat. S
Magnetic Effect	15.0	Cat. Z
Power Input	16.0	Cat. X, no test performed
Voltage Spike	17.0	Cat. X, no test performed
Audio Frequency Susceptibility	18.0	Cat. X, no test performed
Induced SignalSusceptibility	19.0	Cat. Z
Radio Frequency Susceptibility	20.0	As per ED-62A
Radio Frequency Emission	21.0	Cat. B
Lightning Induced Transient Susceptibility	22.0	XXG33
Lightning Direct Effects	23.0	Cat. X, no test performed
Icing	24.0	Cat. X, no test performed
Electrostatic Discharge	25.0	Cat. Z
Fire, Flammabilty	26.0	As per ED-62A

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2. Equipment limitations

Antenna - ELT cable with maximum permitted attenuation: 2dB@406 MHz.

WARNING: ELTs are radio transmitters which emit radio frequency radiation when activated. When transmitting, the user's minimum distance of exposure is 0.20 meter.

For RF Fied strenght limits, please Refer to Section H. Transmitter Technical Specifications page 107. RF Fied strenght limits have been calculated according to Canadian RSS-102 Standard "Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)".

For Canadian user, any information and/or contact on Radiofrequency (RF) Energy and Health may be found on: http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08792.html.

3. Activation

A. Standby mode for automatic activation

In order to be automatically activated by the crash sensor, the ELT must be in standby mode. This mode is mandatory during the flight. We recommend to switch off the ELT only when removed from the aircraft or when the aircraft is parked for a long period or for a maintenance operation.

- Check that the antenna is correctly connected.
- Switch to " ARM".

To operate the ELT with an optional Remote Control Panel, ensure that:

- The ELT switch is the "ARM" position .

B. Manual activation

- Check that the antenna is correctly connected.
- Switch to " ON " (either on the ELT or on an optional Remote Control Panel when connected):
  - The ELT starts with the self-test sequence then, after 50 sec., transmits on:
    - 406 MHz (one 406 MHz burst every 50 seconds);
    - 121.5 MHz (continous transmission between each 406 MHz burst after the GPS lock, or after 5 minutes if GPS lock does not occur.
  - During transmission, the buzzer operates and the red visual indicator flashes.

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4. Off

It is possible to stop the ELT in case of unintentional activation:

- Switch to " OFF ".

Regulations state that no transmission must be interrupted unless every means are used to contact and inform the Air Traffic Controller of this action.

Important notice: As 406 MHz transmission is effective 50 seconds after the ELT activation, if it is switched off within this delay, no further radio contact will be necessary.

5. Self-Test

Refer to Section 1. Self-test page 301

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INSTALLATION / REMOVAL

1. Registration

A. General

The ELT must be registered prior to installation onboard.

When a 406 MHz ELT is installed in an aircraft, it is imperative that the aircraft owner register the ELT. Each 406 MHz ELT contains a unique identification code that is transmitted to the satellite. This helps the “Rescue Coordination Center” (RCC) to determine whether an emergency has actually occurred. The unique identification permits accessing a data base.

The registration card available from the local registration authority must be completed and returned to this authority.

Any change of ownership shall also be declared and registered with the local registration authority.

B. Registration in USA

Mail or Fax your registration form to:

SARSAT BEACON REGISTRATION

NOAA

NSOF, E/SPO53

1315 East West Hwy

Silver Spring, MD 20910

or Save Time! Register your beacon online at:

www.beaconregistration.noaa.gov

All online registrations will be entered into the National 406 MHz Beacon Registration Database on the same day of entry. Registration forms received via postal mail will be entered within 2 business days of receipt. For online registrations, a confirmation letter with your completed registration information form will be sent immediately via e-mail or fax (if provided). Confirmation letters sent via postal mail should arrive within two weeks. Once your registration confirmation is received, please review all information. Any changes or updates to your registration information can be done via the internet, fax, e-mail or postal mail. If you do not receive your registration confirmation from NOAA on the same day you submit it over the internet or within two weeks if you submit it by postal mail, please call NOAA toll-free at: 1-888-212-SAVE (7283) or 301-817-4515 for assistance.

After initial registration (or re-registration) you will receive a NOAA Proof of Registration Decal by postal mail. This decal is to be affixed to the beacon and

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should be placed in such a way that it is clearly visible. If for some reason you do not receive the registration decal within two weeks, please call NOAA toll-free at: 1-888-212-SAVE (7283) or 301-817-4515.

Failure to register, re-register (as required every two years), or to notify NOAA of any changes to the status of your 406 MHz beacon could result in penalties and/or fines being issued under Federal Law. The owner or user of the beacon is required to notify NOAA of any changes to the registration information at any time. By submitting this registration the owner, operator, or legally authorized agent declares under penalty of law that all information in the registration information is true, accurate, and complete. Providing information that is knowingly false or inaccurate may be punishable under Federal Statutes. Solicitation of this information is authorized by Title 47 - Parts 80, 87, and 95 of the U.S. Code of Federal Regulations (CFR). Additional registration forms can be found on the NOAA-SARSAT website at:

www.sarsat.noaa.gov or at: www.beaconregistration.noaa.gov

C. Registration in Canada

Beacon information is held in the Canadian Beacon Registry maintained by the National Search and Rescue Secretariat for use in search and rescue operations. Online access to the Registry is available for all beacon owners to register new beacons or to update their beacon information. You can add or update your beacon information by accessing the registry directly, sending in a completed registration form or by talking to one of our beacon registry representatives.

You can access the registry:

- online: www.canadianbeaconregistry.com
- by email: CBR@Sarnet.dnd.ca
- by fax: 1-613-996-3746
- by telephone: 1-800-727-9414 or 1-613-996-1616

The registration information must be updated when the aircraft ownership changes as per the Canadian Airworthiness Notice AN B029 (refer to following link):

http://www.nss.gc.ca/site/Emergency_Beacons/canadian_beacon_registry_e.asp

Additional information and registration forms can be found on the Canadian NSS website at:

http://www.nss.gc.ca/site/cospas-sarsat/INTRO_e.asp

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3. INTEGRA ARINC e-NAV and ELT Installation Procedure

(1) ELT Installation

Refer to Figure 202: Installing ELT transmitter and INTEGRA ARINC e-NAV

1. On the Mounting Bracket, place INTEGRA ARINC e-NAV housing onto its supports either with its connector on the left side or on the right side.
2. Fix the INTEGRA ARINC e-NAV onto the mounting bracket with the 2 captive screws and tighten to a torque of 1.4 Newton per meter using a torque driver with a 2.5 mm Allen bit.
3. Place the INTEGRA (ER-N) ELT onto the Bracket with "Flight Direction Arrow" of the ELT pointed towards the front of the aircraft
   - For AF INTEGRA (ER-N), refer to Section 3. AF INTEGRA / AF INTEGRA (ER), axis of installation page 503.
   - For AF-H INTEGRA (ER-N), efer to Section 4. AF-H INTEGRA / AF-H INTEGRA (ER), axis of installation page 504.
4. Pass the attaching strap with the buckle above the ELT**.**

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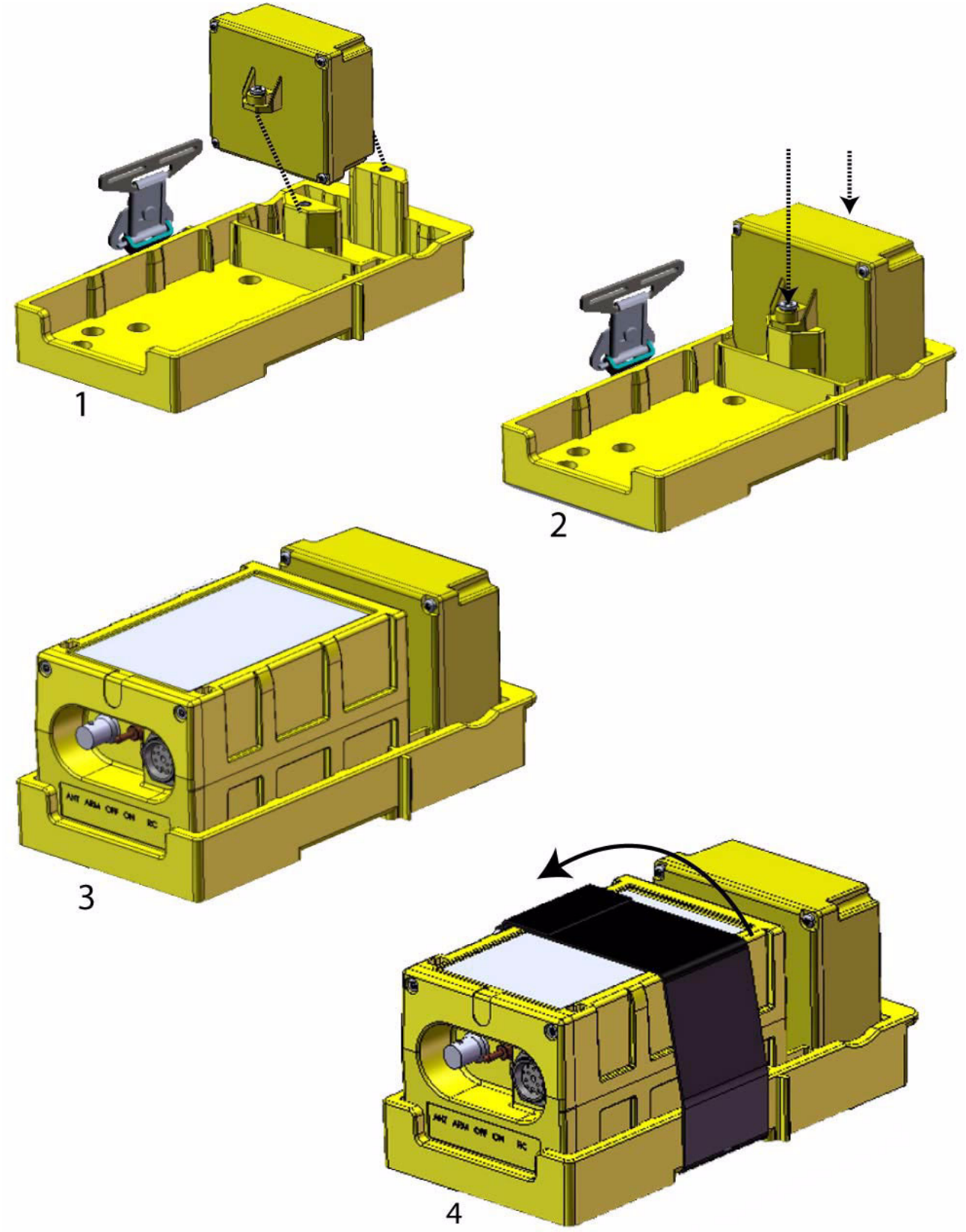


Figure 202: Installing ELT transmitter and INTEGRA ARINC e-NAV

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(2) ELT Fixing

Refer to Figure 203: Fixing the ELT on Mounting Bracket

5. Fix the strap of the mounting bracket by locking the latch on the buckle of the strap**.**
6. Do a quarter turn counterclockwise to the latch then bring the hook of the latch onto the buckle of the attaching strap.
7. Do a quarter turn clockwise to the latch to fix the attaching strap by sliding the hook down .
8. Pull down the latch to lock the attaching strap.
   CAUTION: When locked, the center of the latch shall be aligned with the center of the buckle.
9. Check that the ELT is firmly attached:

   IMPORTANT:

   Once installed in the mounting bracket, the installer must be sure that the transmitter is firmly attached in its bracket by trying to extract it manually, thereby verifying there is no play and that it remains attached when extraction from the bracket is attempted.

   CAUTION:

   AN INCORRECT LOCKING OF THE LATCH COULD LEAD TO AN UNSAFE SITUATION BY THE ELT PREVENTING THE TRANSMISSION OF THE DISTRESS MESSAGE .

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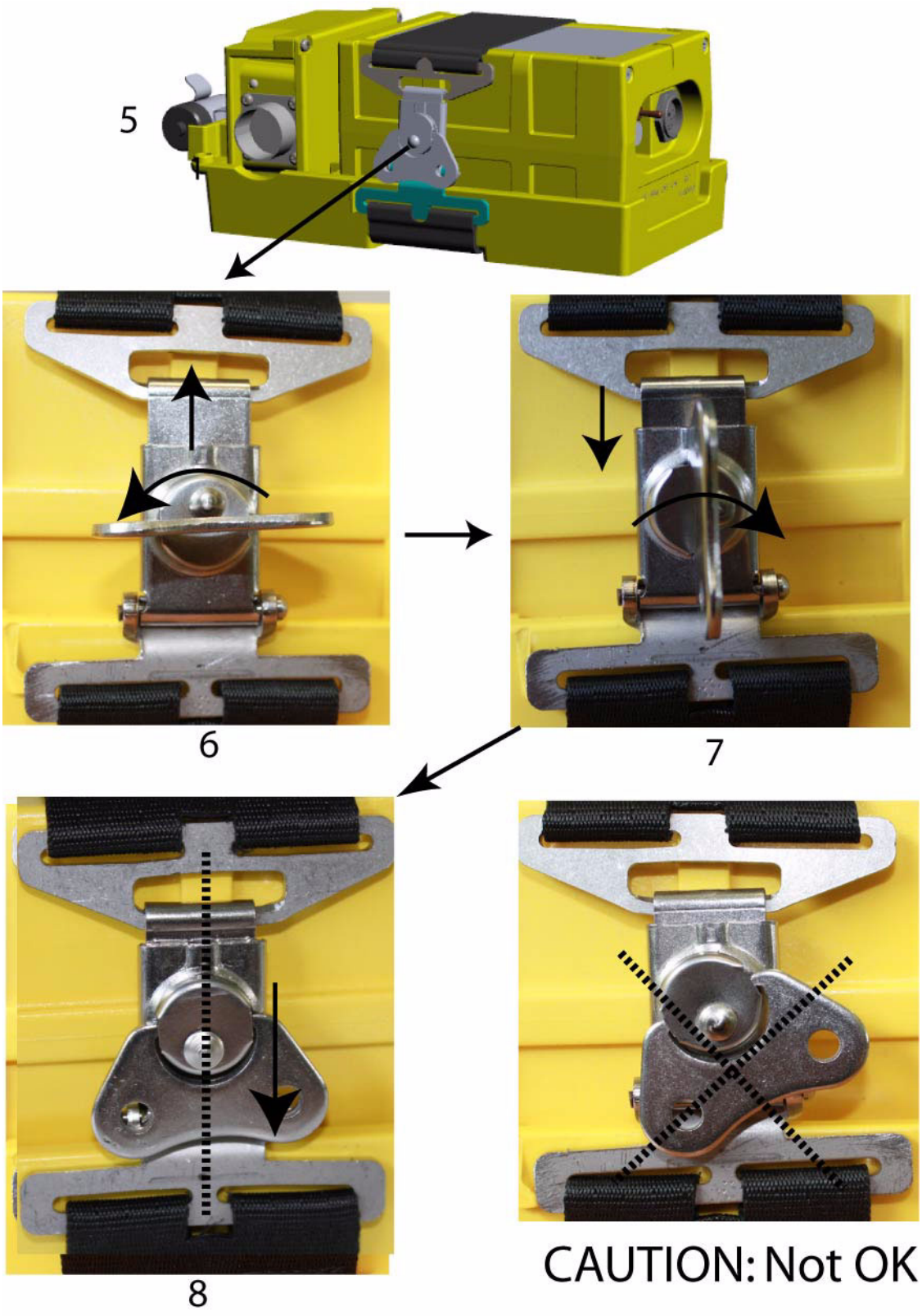


Figure 203: Fixing the ELT on Mounting Bracket

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4. ELT transmitter Connection

1. Connect the cable of the outside antenna to the BNC connector of the front panel.
2. Connect the DIN12 connector of the ARINC e-NAV and Remote Control Panel cable to the DIN 12 socket of the front panel.
3. Connect +28VDC of ARINC e-NAV.
4. Connect and switch ON the on board GPS equipment.
   NOTE: any failure on ARINC e-NAV will result in a 3+7 failure on the ELT self-test.
5. Set the 3-position switch of the front panel to ARM.

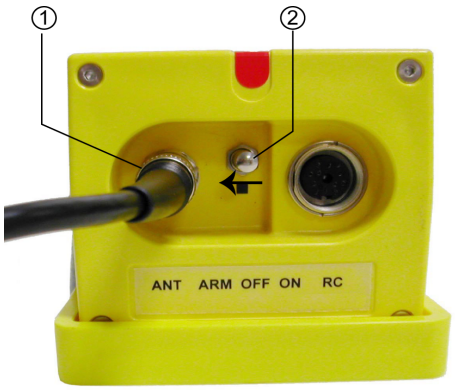


Figure 204: Installation, controls and connectors

- Perform the first power up procedure (see below).

5. First power up

Perform the following tests:

1. ELT operational tests:
   - connect the external antenna to J2;
   - switch the ELT from OFF to ARM;
   - check that the Self-Test result is OK (one long flash).
2. 406 & 121.5 MHz transmission tests (optional):
   Refer to Section B. Test of transmitted signals page 302.

At the end of the first power up procedure, switch the ELT to ARM.

The ELT is now in stand by mode and ready to be activated:

- either automatically by G-Switch sensor if a crash occurs;
- or manually by an optional Remote Control Panel (when connected).
  Note : switching to ON directly on the ELT front panel will also activate the ELT.

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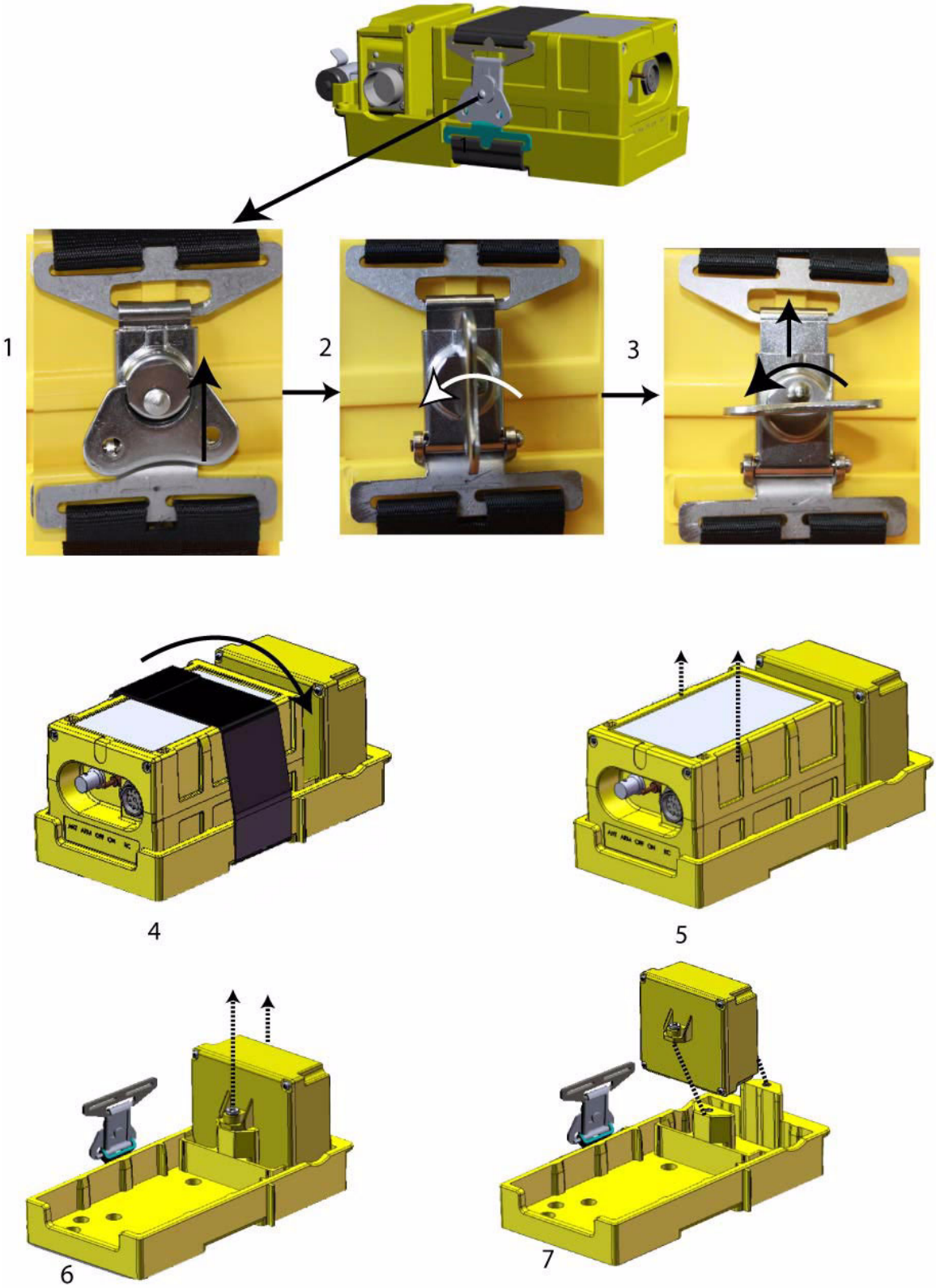
6. Removal

Refer to Figure 205: Removing ELT transmitter and INTEGRA ARINC e-NAV

1. Pull up the latch to unlock..
2. Do a quarter turn counterclockwise to the latch to slide up the lock.
3. Lift the latch to disengage the hook of the latch from the buckle.
4. Remove the attaching strap from the ELT.
5. Extract the ELT from the mounting bracket.
6. Unscrew the 2 fixing screws of the INTEGRA ARINC e-NAV.
7. Remove the INTEGRA ARINC e-NAV from the mounting bracket.

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Figure 205: Removing ELT transmitter and INTEGRA ARINC e-NAV



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CHECK

1. Self-test

A. Periodicity

EUROCAE ED-62A Recommendations

§ 2.8.9 : *"The battery source shall provide sufficient capacity for a self-test to be conducted according to the period specified by the manufacturer or at least once a month according to Cospas-Sarsat requirement."*

§ 7.5 : *"Check the self-test function according to manufacturer's recommendation and that such a test shall occur at least once every six months."*

Manufacturer Recommendations

It is recommended by the manufacturer to test the ELT to detect any possible failure.

Operational check must be performed regularly by a pilot or maintenance personnel from the cockpit (Remote Control Panel). It is recommended to perform a self-test at least once every six months but it **should not be done more than once a month.**

Each self-test consumes energy from the battery. Should self-tests be carried out more often than the maximum allowed, the battery life-time might be shorter than specified.

B. Self-test procedure

- Check that the antenna is correctly connected
  Do not perform self-test without antenna connected.
- Tune aircraft radio to 121.5 MHz and ensure you can hear it.
- Switch from position "OFF" to position "ARM" or press RESET & TEST on the Remote Control Panel (ensure that the ELT switch is in position "ARM").
- Listen for the buzzer or watch the LED - it operates during the whole Self-test procedure. Close to the end of self-test a short (3 sweeps) 121.5 transmission is made - confirm this on the aircraft radio.
- 10 seconds after the beginning of the self test, the test result is displayed with the red visual indicator and the buzzer will sound:
  - One long flash (duration 1 seconds) indicates that the system is operational and that no error conditions were found.
  - A series of short flashes (200 ms) indicates the test has failed.

Remark: The number of flashes gives an indication of the faulty parameter detected during the self-test.

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3+1	LOW BATTERY VOLTAGE
3+2	LOW RF POWER
3+3	FAULTY VCO LOCKING (FAULTY FREQUENCY)
3+4	NO IDENTIFICATION PROGRAMMED
3+5	FAULTY VSWR (EXT. ANTENNA)
3+6	INTERNAL GPS SERIAL LINK (ELT internal check)
3+7	FAULTY INTEGRA ARINC e-NAV **Possible faults:** ARINC frame not valid; +28V D.C. not correct; Faulty connection.

If self-test fails, contact the distributor as soon as possible. Unless a waver is granted, flight should be cancelled (refer to National Aviation Authorities).

2. Operational tests

These tests must be performed by maintenance personnel when performing the first power up procedure or to check the transmitter (Refer to B. Test of transmitted signals).

A. ELT operational tests

NOTE: ELT operational tests only provide the aircraft operator with an indication that the ELT is transmitting; however, a positive result cannot be interpreted as meaning that the ELT meets all operational parameters.

- connect the outside antenna to J2;
- switch the ELT from OFF to ARM;
- check that the Self-Test result is OK (one long flash).

B. Test of transmitted signals

(1) 406 MHz Transmission tests

This test should be carried out with a COSPAS-SARSAT decoder.

Note: If a COSPAS-SARSAT decoder is not available, the coding sheet supplied by the programmer for the beacon (or dongle) with the corresponding CSN proves that the beacon (or dongle) is correctly programmed. Skip to § (2) 121.5 MHz

- Perform self-test (switch ELT from OFF to ARM).
- Check with the COSPAS-SARSAT decoder that, except for the 5th and the 6th digits, the decoded message is identical to the programmed message.

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NOTE:The message transmitted during self-test sequence always begins with FF FE D0 whereas a programmed message begins with FF FE 2F.

Example of message programmed in ELT:

*FF FE **2F** 96 E3 AF 0F 0F 7F DF FF 62 60 B7 83 E0 F6 6C*

Example of same message decoded by Cospas-Sarsat Decoder:

*FF FE **D0** 96 E3 AF 0F 0F 7F DF FF 62 60 B7 83 E0 F6 6C*

NOTE: for location protocol beacons, the content of the encoded position data field of the self-test message shall be the default values (extract from C/S T001 Cospas Sarsat.

(2) 121.5 MHz Transmission tests

This check shall only be conducted during the first five minutes of any UTC, (co-ordinated universal time) hour, and restricted in duration to not more than five seconds. Be sure to notify any nearby control tower of your intentions.

This test must be carried out with a VHF receiver either with the aircraft VHF receiver or with a not on-board VHF receiver.

IMPORTANT: Aircraft VHF receiver may be used only if 406 MHz test was carried out with a Cospas-Sarsat decoder, otherwise check 121.5 MHz using a VHF receiver (not the on-board VHF receiver) several dozens meters away from the antenna. This ensures to validate the antenna.

- Tune VHF receiver to 121.5 MHz;
- Start transmission:
  - Switch ELT to ON.
- Only 2 "sweep tones" are heard after 5 seconds, then the 121.5 MHz stops.
- Stop transmission:
  - Switch to OFF;
  - continue to listen to 121.5 MHz for a few seconds to ensure that the ELT does not continue to transmit after the test is terminated.

IMPORTANT: If the ELT operates for approximately 50 seconds, a 406 MHz signal is transmitted and is considered valid by the satellite system.

Switch ELT to ARM.

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TROUBLESHOOTING

1. General

Procedure for fault isolation onboard uses the indicator light (red visual indicator) of the ELT's front panel. This indicator light is activated by a self-test capability within the ELT.

2. Faults on Self-test

When the self-test is carried out, the number of flashes on ELT or RCP's visual indicator gives an indication of the faulty parameter detected during the self-test.

(1)3+1 flashes

- Low battery voltage:
  Replace battery: refer to relevant CMM for tests and repair.

(2) 3+2 flashes

- Low RF power:
  Check 406 MHz power: refer to relevant CMM for tests and repair.

(3) 3+3 flashes

- Faulty VCO locking (faulty frequency):
  Check frequencies: refer to relevant CMM for tests and repair.

(4) 3+4 flashes

- No identification programmed
  Check programming:refer to relevant CMM for tests and repair.

(5) 3+5 flashes

- VSWR Fault
  Check correct connection of antenna
  Perform a VSWR measurement

(6) 3+6 flashes

- Internal GPS serial link fault
  Check GPS receiver: refer to relevant CMM for tests and repair.

(7) 3+7 flashes

- INTEGRA ARINC e-NAV not connected
  Check connection of INTEGRA ARINC e-NAV with ELT
  Check +28VDC INTEGRA ARINC e-NAV power supply
  Check ARINC429 frame

Note: for CMM download and other servicing instructions, refer to Service & Support section of Orolia website.

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SERVICING

1. Maintenance Schedule

Battery replacement:

carried out by an accredited PART 145 or FAR 145 (or equivalent) maintenance station.

Periodic inspection:

depending if the ELT is opened or not, PART 145 or FAR 145 (or equivalent) may be required. Refer to local regulations

A. Periodic inspection

Note: (if required by the relevant Civil Aviation Authority).

Some Civil Aviation Authorities may require the ELT be tested periodically.

In this case, refer to Service Letter SL S1840501-25-05 "Guidelines for periodic inspection" available on the Service & Support section of Orolia Website.

B. Battery replacement

Testing of various elements and parameters of the ELT is mandatory when the battery is replaced.

- For battery replacement interval, Refer to § 2. Battery replacement requirements, page 602.
- The testing procedure associated with the battery replacement is described in the relevant CMM

For CMM download and other servicing instructions, refer to Service & Support section of Orolia Website.

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2. Battery replacement requirements

Battery replacement is mandatory:

- after more than 1 hour of real transmission (cumulated duration);
- before or on the battery expiration date;
- after use in an emergency;
- after an inadvertant activation of unknown duration.

Only original and approved battery pack included in battery KIT BAT200 supplied by Orolia S.A.S. can be installed.

The battery replacement can only be carried out by a Kannad Approved Service Center.
For more information, refer to Kannad ELT Maintenance Policy available on Orolia website.

Orolia S.A.S. refuses all responsibility and invalidates all warranty should unapproved maintenance be carried out.

List of service stations available on our Web site: https://www.orolia.com

Orolia S.A.S.
Z.I. des Cinq Chemins CS10028
56520 GUIDEL - FRANCE
Telephone: +33 (0)2 97 02 49 49 Fax: +33 (0)2 97 65 00 20
Web: https://www.orolia.com
Support: support@orolia.com Tel.: +33 (0)2 97 02 49 00

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D. Acceptance test procedure

Perform an RCP test (Refer to D. RCP operational tests, page 15).

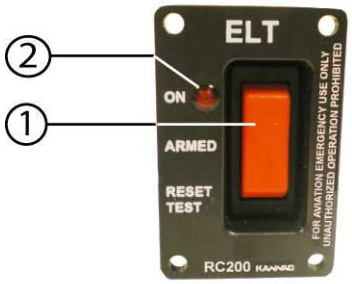
5. Working mode

A. Controls

The following elements are to be found on the RC200 remote control panels:

1. a 3-position switch (ON, ARMED, RESET & TEST);
2. a red visual indicator.

Figure 8: RCP controls



The visual indicator gives an indication on the working mode of the beacon:

- After the self-test:
  - one long flash indicates that the system is operational and that no error were found;
  - a series of short flash indicates the test has failed.
- In operation mode:
  - periodic flashes during homer transmissions;
  - long flash during 406 transmission.

B. Working mode information

The RC200 remote control panels enable remote control and remote monitoring of the KANNAD ELTs **provided that the ELT switch is in armed position.**

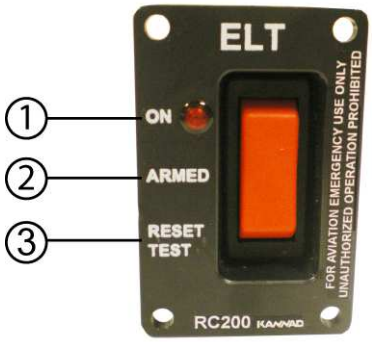
(1) Remote control

Remote control is done through a 3-position switch:

1. ON (transmission) enables manual activation of the ELT;
2. ARMED (stand by mode to enable automatic activation by the shock sensor of ELT) is an idle position. Unless there is an emergency, the switch must stay in this position.

3. RESET & TEST is used either to stop the ELT transmission if activated or to perform a self-test.

Figure 9: 3-position switch



As required by regulations, the OFF mode is not available on the remote control panel (RTCA DO 204 § 2.2.6.c, EUROCAE ED 62 § 2.5.1.1) but directly on the ELT itself by switching it in OFF position.

Important notice: TEST/RESET (downwards) is a momentary position.

Refer to operation manuals of the ELTs for precise information on these modes.

(2) Monitoring

Monitoring is done through a visual indicator (Refer to Figure 8: RCP controls, page 11) operating in the same way than those of the ELT:

Transmission:

- 1 short flash every 0.5 or 0.7 seconds during homer transmission;
- 1 long flash during ELT transmission on 406 MHz.

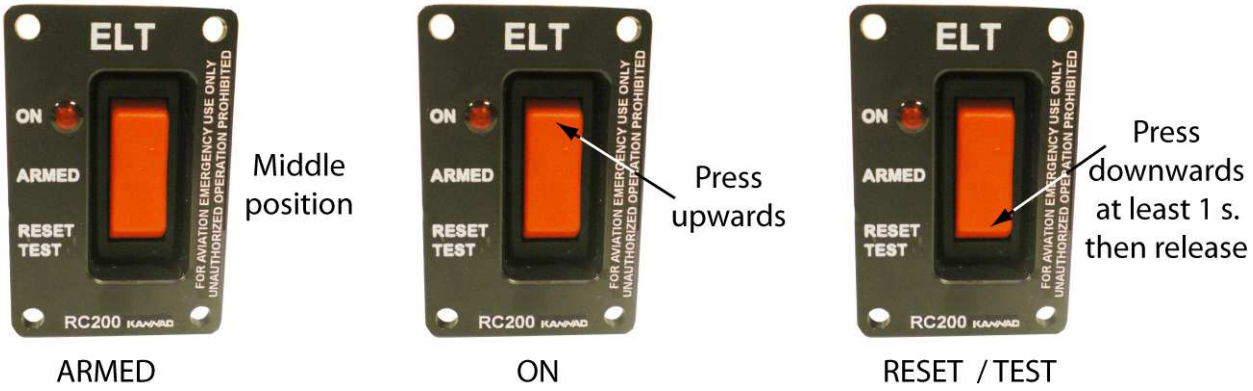
Self-test:

(Refer to C. RESET & TEST, page 13).

Refer to operation manuals of the ELTs for precise information on these modes.

6. Operation

Figure 10: Operating modes



A. Stand by mode

The stand by mode is the ARMED position (idle position). The switch is in the middle position.

This mode is used to enable automatic activation by the shock sensor of the ELT **provided that the ELT switch is in armed position.** Unless there is an emergency, the switch must stay in this position.

B. ON mode

This mode is used to activate manually the ELT. When this mode is selected, the ELT transmission is activated.

- Press the switch upwards.
  A self test is first performed (Refer to C. RESET & TEST, page 13).
- After the self-test (max. duration 15 seconds), the ELT starts to transmit:
  - The visual indicator is flashing in the same way than those of the ELT;
  - The buzzer of the ELT (and outside buzzer if connected) is activated.

C. RESET & TEST

This mode is used either to perform a self-test or to stop the ELT transmission if activated.

(1) Self test

IMPORTANT: Do not perform self-test without the antenna connected.

Self-test must be performed regularly by a pilot or maintenance personnel from the Remote Control Panel but should not be done more often than specified in ELT user manual.

However, each self-test consumes energy from the battery. Should self-tests be carried out more often than the maximum allowed, the battery life-time of the ELT might be shorter than specified.

Press the switch downwards for at least 1 second then release it (the switch comes back in ARMED position):

The visual indicator is flashing as follows:

- one short flash at the beginning of the self-test sequence

After a few seconds, the test result is displayed with the visual indicator as follows:

- one long flash indicates the system is operational and that no error conditions were found;
- a series of short flashes indicates the test has failed:
  Refer to the ELT manual.

(2) RESET

This mode is used to stop the ELT when activated.

If the ELT is activated, the visual indicator of RCP is flashing in the same way than the one of the ELT:

- Press the switch downwards for at least 1 second then release it (the switch comes back in ARMED position):
- The visual indicator is OFF.

Important notice: On ELTs P/N S182X502-XX, if a RESET is performed from RCP with the ELT manually activated (ON position on the front panel of the ELT), the ELT transmission will stop for max. 50 seconds then start again.

In this case, on the RCP:

- **The led is off for max. 50 seconds then flash again.**

Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

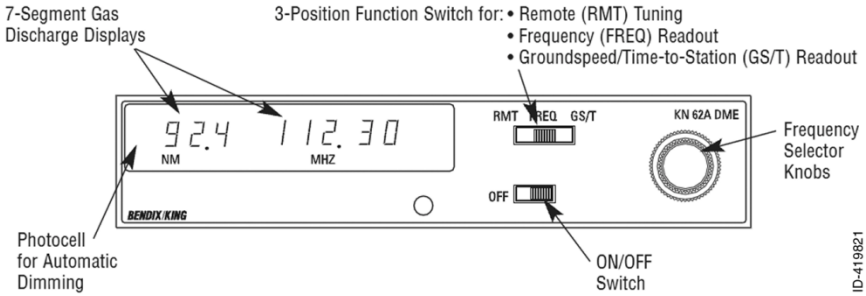
AIRPLANES 172S8001 AND ON

SUPPLEMENT 11

KN62- DME

KN 62A and KN 64
TSO'd Silver Crown Digital DMEs

Operating the KN 62A and KN 64 DMEs



Operation

Turn on the unit only after engine start-up. Also, turn avionics off prior to engine shut-down. These simple precautions should be practiced with all avionics. It will protect the solid-state circuitry from short duration high voltage spikes and extend the operational life of your avionics.

The 3-position function switch determines both the information displayed and the channeling source.

Place the function switch on Frequency (FREQ). The unit is channeled internally with its own two concentric frequency selection knobs. The smaller of the two knobs has an "in" and an "out" position. When in the "in" position, this smaller knob changes the 0.1 MHz digit (0.0, 0.1, 0.2, etc.). When pulled "out", it adds 0.05 MHz to the frequency and tunes in 0.1 MHz steps (0.05, 0.15, 0.25, etc.). Pushing the smaller knob "in" subtracts 0.05 MHz from the displayed frequency. The outer, larger knob changes the larger digits (1 MHz, 10 MHz). In FREQ mode, the unit will display distance and the selected frequency. (See Figure 19.)

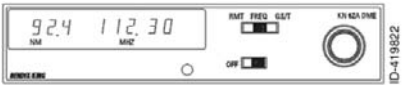


FIGURE 19.
Distance/Frequency FREQ Mode.

Now move the function switch to the Groundspeed/Time-to-Station (GS/T) position. The unit will hold the internally selected frequency and will display distance, groundspeed and time-to-station. (See Figure 20.)

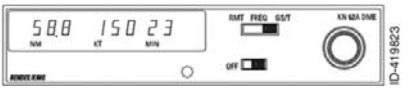


FIGURE 20.
Distance/Groundspeed/TTS GS/T Mode.

Rotating the frequency selector will have no effect on the display, because the DME is in "Frequency Hold". This frequency hold feature in the GS/T mode prevents accidental

rechanneling of the DME when the frequency is not displayed.

Place the function switch in the Remote* (RMT) position, and your DME will be channeled when you select your NAV frequency on the NAV receiver. Search time is usually about one second. When the unit locks on a ground station, it will display distance, groundspeed and time-to-station. (See Figure 21.)

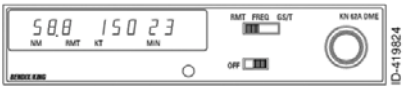


FIGURE 21.
Distance/Groundspeed/TTS RMT Mode.

Prior to lock on, "dashes" will be displayed. (See Figure 22.)

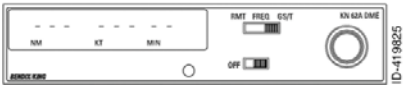


FIGURE 22.
Prior to Lock On.

Note that you may have two frequencies available at all times (one remotely selected on the NAV receiver and one internally selected with the unit's controls).

*Remote channeling requires wiring to the NAV receiver.

Operational Notes

The KN 62A and KN 64 have an audio output for use in identifying the DME ground station being received. The audio level is preset at the factory, but may be easily adjusted through the top cover.

The unit electronically converts to distance the elapsed time required for signals to travel to and from the ground station. This distance is then indicated in nautical miles on the Distance/ Speed/Time-to-Station display. This distance, commonly referred to as slant range distance, should not be confused with actual along-the-ground distance. The difference between actual ground distance and slant range is least at low altitude and/or long range. If the range is three times the altitude or greater, error is negligible.

The effective range of DME depends on many factors, most important being the altitude of the aircraft. Other contributing factors are the location and elevation of the station, DME transmitter power output, and receiver sensitivity.

The groundspeed feature incorporated in the unit measures the rate of change in DME slant range distance with time. This speed is then read from 0 to 999 knots in 1 knot increments. To obtain accurate groundspeed, the aircraft must be tracking directly to or from the station. To obtain accurate time to station, the aircraft must be tracking directly to the station.

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Cessna
A Textron Company

Pilot's Operating Handbook

CESSNA MODEL 172S

AIRPLANES 72S8001 AND ON

SUPPLEMENT 12

AIR TRAFFIC-AT1

Système de visualisation de trafic

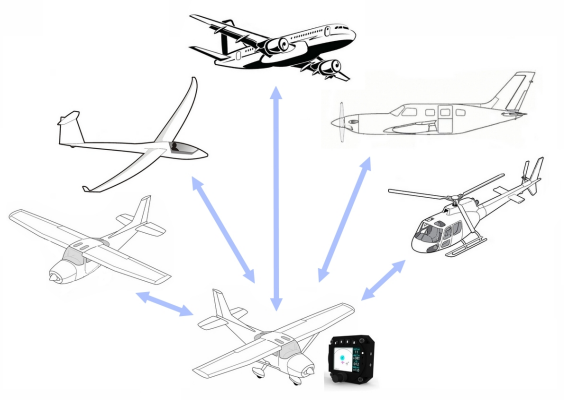
Description et utilisation pratique



AIR Traffic AT-1

Avant-propos

Le système de visualisation de trafic (Air Traffic AT-1), intégré au tableau de bord de nos avions (sauf D112), est un équipement optionnel, non requis par la réglementation. **Son installation n'a pour finalité que d'accroitre la sécurité de nos vols.**



Il ne remplace pas le principe du « Voir et éviter » que chacun doit s'efforcer de pratiquer en permanence. Le regard du pilote doit surveiller le ciel pour assurer la prévention des abordages.

Cet équipement ne génère que des indications générales sur les aéronefs qu'il détecte à proximité de votre avion pour faciliter leur localisation dans l'espace et permettre leur évitement à vue. Ce n'est pas un TCAS (Système d'alerte de Trafic et d'évitement de collision). **Il ne vous donnera aucune instruction pour vous écarter d'un trafic conflictuel**.

Architecture du système

- Un **écran d'affichage** circulaire intégré dans le tableau de bord.



- **Une unité centrale**, fixée derrière l'afficheur



Depuis cette unité centrale,

- **Une liaison au circuit statique de l'avion**, pour le fonctionnement de l'altimètre intégré

- **Une sortie audio** vers la boîte de mélange pour les annonces et messages vocaux qui sont entendus dans le casque du pilote

Architecture du système (suite)

- **Quatre antennes :**

- Une pour le GPS inclus dans le système, sur le tableau de bord



- Deux pour émettre et recevoir les signaux des équipements de détection de trafic (de type FLARM), une sur le haut, l'autre sous le fuselage.





- Une, à l'intérieur, côté pilote en bout de casquette pour recevoir les signaux des transpondeurs (de type Mode S et ADS-B).



Architecture du système (suite)



Le système est alimenté par le réseau électrique de bord par l'interrupteur **AVIONIC BUS**



- Il peut être coupé par un appui long (4s) sur le bouton poussoir en haut de l'afficheur.

- Il est protégé par un fusible (désigné AT 1)

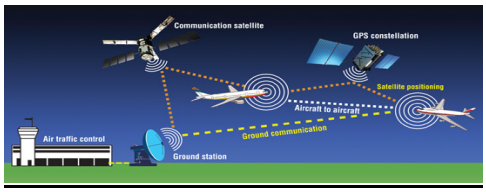
Principes de fonctionnement

L'Air Traffic AT-1 utilise 3 types de signaux pour générer une «image » des trafics proches, calculer les rapprochements potentiellement dangereux et générer des alertes si nécessaire

- **Les émissions des transpondeurs Mode S** des aéronefs qui l'environnent.



- **Les messages ADS-B-out** produits par le transpondeur de certains aéronefs.



- **Les émissions des équipements FLARM** embarqués ou installés à bord d'aéronefs à proximité.

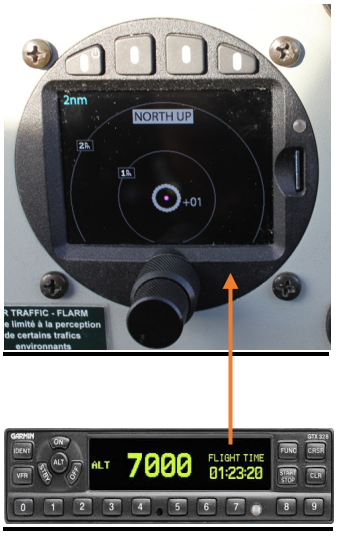


Attention, un aéronef sans transpondeur Mode S ou sans FLARM ne peut pas être vu par l'Air Traffic AT-1

Les émissions des transpondeurs Mode S des aéronefs environnants ne contiennent que deux éléments utilisables par l'Air Traffic AT-1 :

- **Le signal numérique du transpondeur** qui permet de déterminer la proximité relative d'un aéronef et qui l'identifie de manière unique (via un code numérique hexadécimal propre à chaque aéronef équipé).

- **Le Mode C** qui donne l'altitude de l'aéronef (calage non modifiable à 1013 Hpa).



Note : Les aéronefs équipés d'un transpondeur Mode A/C ne sont pas détectés par l'Air Traffic AT-1 car leur signal n'est pas numérique et ne comporte pas de code unique d'identification permettant le traitement de leur émission

Principes de fonctionnement (suite)

- **Les messages ADS-B out,** qui sont des messages enrichis de certains transpondeurs Mode S, contiennent plusieurs éléments qui facilitent la localisation d'un aéronef par l'Air Traffic AT-1 :

  - **Son identification,**
  - **Sa position géographique précise,**
  - **La direction et la vitesse de son déplacement,**
  - **Son altitude** ((calage non modifiable à 1013 Hpa)**.**



Actuellement, l'aviation légère est peu équipée de ce type d'équipement, le système ADS-B n'étant pas encore déployé par les services de la circulation aérienne européens.

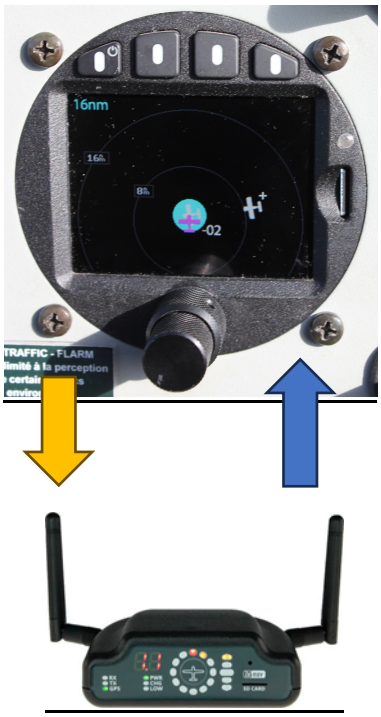
- **Les messages FLARM : les équipements sont des émetteurs-récepteurs, qui rayonnent et exploitent un signal radio numérique de faible portée (environ 5 NM).**

L'Air Traffic AT-1 contient cet équipement. Notre avion reçoit et émet donc des messages FLARM.

Des FLARM équipent la quasi-totalité des planeurs européens (qui ne sont que rarement équipés de transpondeur) car ils ont démontré leur efficacité pour prévenir les abordages dans le monde du vol à voile. On les trouve aussi sur de nombreux hélicoptères et des ULM

Principes de fonctionnement (suite)

Les messages FLARM contiennent plusieurs éléments caractérisant un aéronef :



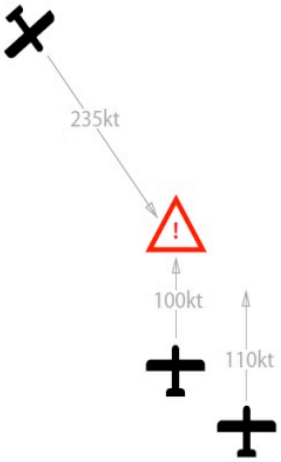
- **Son identification** (par son code hexadécimal ou les deux dernières lettres de son indicatif), et éventuellement son type et son propriétaire.
- **Sa position géographique précise**.
- **Une prédiction de sa trajectoire** (vitesse sol et direction).
- **Son altitude** ((calage non modifiable à 1013 Hpa)**.**

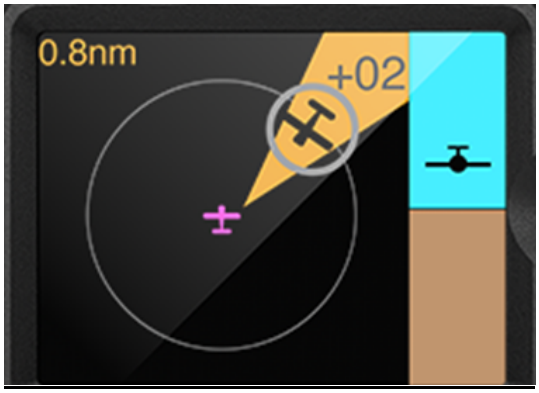
Alarmes et alertes

- **Les alertes de rapprochement sont générées en fonction de la probabilité de rapprochement** et du temps restant avant une proximité jugée dangereuse.
- **Ces alertes ne sont pas directement liées à la distance géométrique entre aéronefs**. Elles sont basées sur des calculs complexes pour estimer la probabilité d'une collision. Elles tiennent compte, lorsque ces données sont disponibles, des trajectoires et des altitudes respectives des aéronefs.
- **Les alertes sont calculées et différenciées en fonction de leur sévérité et du temps restant avant la collision potentielle :**
  - ✓ Le premier niveau d'alerte est en général actif 19 à 25 secondes à l'avance.
  - ✓ Le second niveau, qui correspond à une alerte "urgente", n'est déclenché qu'entre 6 et 18 secondes à l'avance.

Principes de fonctionnement (suite)

Dans l'exemple ci-contre, une alerte sera générée entre les avions 1 et 2, mais pas entre 1 et 3 ou 2 et 3 car leurs trajectoires ne sont pas conflictuelles. De plus, si une importante différence d'altitude existe entre 1 et 2, l'alerte ne sera pas déclenchée.





Interface d'affichage du système

A la mise sous tension de l'Air Traffic AT-1,

- ✓ L'interface d'affichage s'illumine
- ✓ effectue un autotest
- ✓ recherche un signal GPS



- affiche successivement plusieurs images.



- Un message audio **« Air Traffic Thirty Five »** (35 est le numéro du logiciel) est émis à la fin du processus.



A la fin de cette séquence, l'Air Traffic AT-1 est opérationnel. Notre propre avion est positionné au tiers bas de l'écran. L'échelle est par défaut à 8 NM. Il est recommandé de la réduire à 4 NM pour les vols dans des espaces où le trafic est dense et en local d'un aérodrome.



Interface d'affichage du système (Suite)

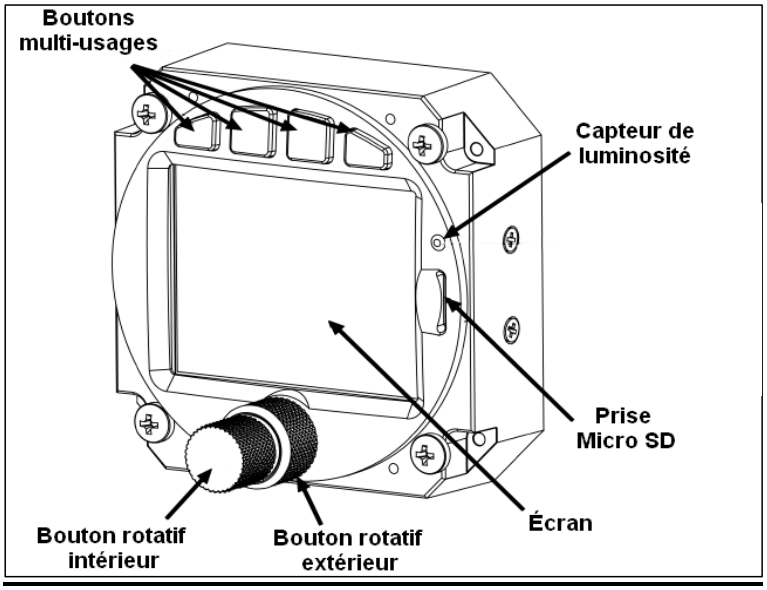
L'interface d'affichage est composée :

- **Au centre**, d'un écran, style «radar», présentant des aéronefs détectés à proximité.



- Dans le **bandeau du haut**, des touches multifonctions.

- **En bas**, de deux boutons rotatifs pour accéder à des fonctions spécifiques.



Note : Le fond d'écran peut être blanc ou noir (ce dernier choix a été retenu)

Interface d'affichage du système (Suite)

Les aéronefs détectés sont présentés :

- **En configuration standard**, sur la totalité de l'écran,



  - ✓ *Un affichage, enrichi sur son côté droit d'informations relatives à l'une des «cibles» détectées, peut être sélectionné via le menu Configuration de l'Air Traffic AT1. Cet affichage offre plus de détails pour le suivi d'une cible mais au prix de réglages relativement complexes. En conséquence, son usage n'est pas recommandé.*

  - ✓ Elle est «North-up» (Nord en haut) si l'avion est au sol, immobile ou au centre, un symbole représente notre propre avion (silhouette d'avion de couleur magenta en vol, point magenta si l'avion est au sol).



L'image radar est orientée en vol selon la route suivie par l'avion

Interface d'affichage du système (Suite)

*** Pour les aéronefs générant des signaux FLARM ou ADS B,**

- Les aéronefs détectés sont répartie sur l'écran selon leur positionnement spatial (distance horizontale et azimut). Le rayon du cercle affiché correspond à l'échelle affichée en bas à gauche de l'écran, permettant ainsi d'évaluer la distance d'une «cible».



- Le symbole caractérisant l'aéronef (avion, planeur, hélicoptère, deltaplane, avion de transport, drone) est orienté selon le sens de déplacement de l'aéronef.



- La représentation d'un aéronef effectuant un virage prononcé ou cerclant est entourée d'une flèche.



Interface d'affichage du système (Suite)

*** Pour les aéronefs générant des signaux FLARM ou ADS B (suite),**

- Un signe «+» ou «-», suivi d'un chiffre indique la différence d'altitude (au dessus ou au dessous) en centaine de pieds entre notre avion et une «cible». Dans les deux exemples ci-contre, les «cibles» sont respectivement 300 pieds plus haut et 1200 pieds plus bas.



- De plus, la taille des symboles de la représentation de l'aéronef varie en fonction de cette différence d'altitude. Ainsi, on peut apprécier la distance verticale qui nous sépare d'un autre aéronef. Le symbole de l'avion 300 pieds plus haut a une taille supérieure (car plus proche) que celui de l'avion 1200 pieds plus bas.



- Si un aéronef est juste au dessus ou en dessous de notre avion, sa représentation respecte sa position.



Avion au-dessus du nôtre



Avion en-dessous du nôtre

Interface d'affichage du système (Suite)

* Pour les aéronefs uniquement équipés d'un transpondeur mode S,

- Seules les distances horizontale et verticale sont disponibles. En conséquence, le système ne peut pas trouver la position relative des aéronefs détectés autour de notre avion.



- La proximité d'un aéronef est signalée par un cercle gris pointillé, centré sur le centre de l'écran, dont le rayon correspond approximativement à la distance de l'aéronef détecté.

- Un signe «+» ou «-», suivi d'un chiffre indique la différence d'altitude (au dessus ou au dessous) en centaine de pieds entre notre avion et l'aéronef détecté.



Attention, le système ne visualise qu'un seul aéronef équipé d'un transpondeur Mode S à la fois. Il choisit systématiquement l'aéronef le plus proche.

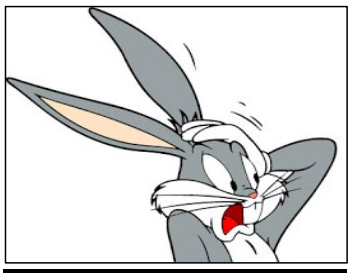


*** L'Air Traffic AT-1 peut cependant combiner la visualisation d'aéronefs détectés grâce à leur FLARM, ADS B ou Mode S sur le même écran.**

Alertes visuelles et sonores

Lorsque le système détecte un rapprochement conflictuel entre notre avion et un autre aéronef, il génère une alerte visuelle doublée de messages sonores.

- **Les alertes sont basées sur les éléments dont dispose l'Air Traffic AT-1 et sur ses propres algorithmes**. Elles ne sont donc pas strictement représentatives d'un rapprochement dangereux comme peut l'estimer un pilote. Elles ne doivent pas être utilisées seules pour initier l'évitement d'un aéronef, cette manœuvre devant être effectuée visuellement.



- **Une alerte n'est liée qu'à un seul aéronef conflictuel**. En cas, de conflits potentiels multiples, l'Air Traffic AT-1 traite l'alerte qui est générée par l'aéronef considéré comme le plus critique; tout autre conflit est occulté sauf s'il devient à son tour le plus critique.



- **Une alerte demeure active pendant toute la période où le rapprochement qui l'a initiée est considéré comme critique**. Elle évolue (visuel et message) en fonction du déplacement relatif de l'aéronef détecté et du risque de collision (alerte simple ou alerte urgente).
- **Les alertes visuelles s'affichent sur l'écran du l'afficheur**. L'aéronef critique est mis en évidence avec un affichage dédié.



- **Les messages sonores sont des messages vocaux** (voix masculine, en anglais) diffusés via l'interphone, ou le haut-parleur de cabine. Des beeps sont aussi émis par l'afficheur lui-même (peu audibles si casques utilisés).
- Les alertes visuelles et les messages sonores varient selon les données fournies par l'aéronef conflictuel et exploitées par l'Air Traffic AT-1.

Alertes visuelles et sonores (Suite)

Alertes visuelles, lors d'un rapprochementd'un aéronef générant des signaux FLARM ou ADS B

❑ **Alerte simple**

- L'aéronef conflictuel est entouré en gris,
- Un secteur en surbrillance orange apparaît pour indiquer son relèvement par rapport à notre avion,
- La distance de l'aéronef conflictuel s'affiche en orange en haut à gauche de l'écran
- La différence d'altitude est également affichée en gris et centaines de pieds.
- Un indicateur apparaît sur le côté de l'écran pour apprécier la position verticale relative du trafic conflictuel.



❑ **Si l'aéronef conflictuel est localisé dans le secteur avant de notre avion** et que l'alerte soit « urgente »

- L'image style «radar» est remplacée par un écran style «horizon artificiel» *(Attention, cet horizon n'indique en rien l'attitude de l'avion).*
- L'aéronef conflictuel apparait à sa position relative (relèvement et azimut) dans un cercle orangé. Il n'y a pas d'indication numérique de la distance ou de la différence d'altitude.
- La taille de l'aéronef conflictuel varie selon sa proximité.



Alertes visuelles et sonores (Suite)

Alertes sonores, lors d'un rapprochementd'un aéronef générant des signaux FLARM ou ADS B

❑ Alerte simple

- Un message audio unique est émis sous la forme :

«Beep» … «Two O'Clock above aircraft»



❑ Alerte urgente

- Le message audio est renforcé par un signal sonore préalable, le type de l'aéronef est omis :

«Wooh-wooh» … «Two O O'Clock above » … «Wooh-wooh»

puis **« Two O'Clock above»** répété pendant toute la durée du rapprochement

- Ou si l'aéronef est positionné dans le secteur avant de notre avion, avec une faible différence de hauteur :

«Wooh-wooh» puis **«Ahead traffic» … « Wooh-wooh »**

puis **«Ahead traffic»**
répété pendant toute la durée du rapprochement



Alertes visuelles et sonores (Suite)

Alertes visuelles, lors d'un rapprochement avec un aéronef
Unniquement équipé d'un transpondeur Mode S

❑ **Alerte simple**

- Le trafic conflictuel est représenté par un cercle orange pointillé.
- La différence d'altitude est également affichée en orange et centaines de pieds.



❑ **Si l'alerte est «urgente »**

- Le trafic conflictuel est identifié par un cercle rouge pointillé.
- La différence d'altitude est également affichée en rouge et centaines de pieds.



Alertes visuelles et sonores (Suite)

***Alertes sonores**, lors d'un rapprochement avec un aéronef*

Unniquement équipé d'un transpondeur Mode S

❑ **Alerte simple**

- Un message audio est émis sous la forme d'un message unique :

«Beep» …. «Traffic»



❑ **Si l'alerte est «urgente »**

- Le message audio est renforcé par un signal sonore préalable et il est répété :
-

« Wooh-wooh » …«Traffic Traffic» … «Wooh-wooh

puis **«Traffic Traffic»**

répété pendant toute la durée du rapprochement



Actions particulières et défauts

❑ Suppression des alertes

- **Lorsque l'avion est immobile au sol** ou se déplace à faible vitesse, **les alertes générées par un autre aéronef à proximité sont neutralisées.**

Attention, si l'avion s'approche en volant à proximité d'un autre aéronef au sol dont le transpondeur Mode S ou / et le FLARM sont actifs, une alarme est susceptible d'être déclenchée (cas de l'avion en approche avec un aéronef au point d'attente),

- **Après le déclenchement d'une alerte, les messages vocaux qui lui sont associés peuvent être supprimés**, pendant 2 minutes, par un appui court sur le bouton rotatif central. Dans ce cas, les alertes visuelles demeurent et le message « ALARM ACK » (alarme acquittée) s'affiche en haut de l'écran.



- **Lors d'éventuels vols à proximité d'un autre aéronef (vols en formation), seul l'Air Traffic AT-1 de l'avion leader peut être opérant.** Les Air Traffic AT-1 des ailiers doivent être coupés pendant toute la durée du vol en patrouille pour éviter des alertes perturbantes.

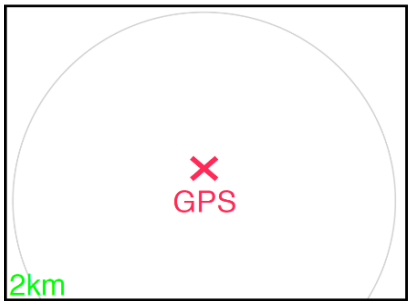


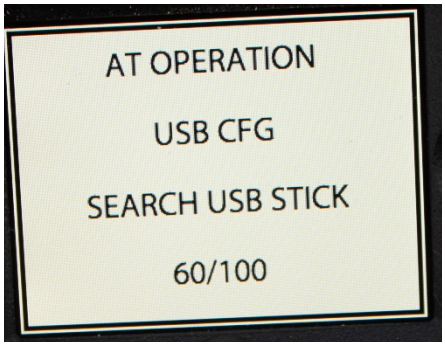
Actions particulières et défauts (suite)

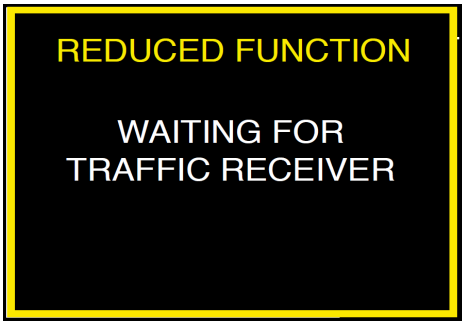
❑ Défauts et pannes

- **L'Air Traffic AT-1 peut générer des notifications de défauts ou de pannes** qu'il détecte lui-même. Des écrans spécifiques s'affichent alors (uniquement DR400 et Aquila). Certains défauts sont également accompagnés d'un message vocal unique. Par exemple :

✓ Base de données ou logiciel périmé,
✓ Perte du signal GPS,
✓ Panne d'un de ses récepteurs de trafic,
✓ Défaut d'un des composants du système.







- **Selon la gravité du défaut ou de la panne, les notifications s'effacent automatiquement au bout de quelques secondes ou nécessitent d'être prises en compte par le pilote** (par un appui court sur le bouton rotatif central). Les notifications signalant une panne majeure demeurent elles en permanence.



- **En situation de panne majeure, d'anomalie significative de fonctionnement, de gène pour le pilote, l'Air Traffic –AT1 doit être coupé** par un appui long sur la touche de fonction en haut à gauche de l'afficheur

Un AIR Traffic AT-1 est un équipement utile

MAIS



REGARDEZ DEHORS ET OUVREZ L'OEIL

IL FAUT VOIR POUR EVITER