PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED

AIRPLANE FLIGHT MANUAL

MOONEY

M20M

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY THE FEDERAL AVIATION REGULATIONS, AND CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL.

THIS DOCUMENT MUST BE CARRIED IN THE AIRCRAFT AT ALL TIMES.

MOONEY AIRCRAFT CORPORATION
LOUIS SCHREINER
KERRVILLE, TEXAS
78028

SERIAL NUMBER: 27-0062

REGISTRATION NUMBER: N1091A

FAA APPROVED: Henry A Armstrong 3-16-90

Henry A. Armstrong
Manager, Airplane Certification Office
FEDERAL AVIATION ADMINISTRATION
Fort Worth, Texas
76193-0150

FAA APPROVED in Normal Category based on CAR PART 3 and applicable portions of FAR PART 23; applicable to Model M20M S/N listed above only.

ORIGINAL ISSUE 3 - 90

Revision A 1 - 96

POH/AFM NUMBER - 3501

CONGRATULATIONS

WELCOME TO MOONEY'S NEWEST DIMENSION IN SPEED, QUALITY AND ECONOMY. YOUR DECISION TO SELECT A MOONEY AIRCRAFT HAS PLACED YOU IN AN ELITE AND DISTINCTIVE CLASS OF AIRCRAFT OWNERS. WE HOPE YOU FIND YOUR MOONEY A UNIQUE FLYING EXPERIENCE, WHETHER FOR BUSINESS OR PLEASURE, THE MOST PROFITABLE EVER.

- NOTICE -

This manual is provided as an operating guide for the Mooney Model M20M. It is important that you —regardless of your previous experience — carefully read the handbook from cover to cover and review it frequently.

All information and illustrations in the manual are based on the latest product information available at the time of publication approval and all sections including attached supplements are mandatory for proper operation of the aircraft. The right is reserved to make changes at any time without notice. Every effort has been made to present the material in a clear and convenient manner to enable you to use the manual as a reference. Your cooperation in reporting presentation and content recommendations is solicited.

REVISING THE MANUAL

The "i" pages of this manual contain a "List of Effective Pages" containing a complete current listing of all pages i.e., Original or Revised. Also, in the lower right corner of the outlined portion, is a box which denotes the manual number and issue or revision of the manual. It will be advanced one letter, alphabetically, per revision. With each revision to the manual a new List of Effective Pages showing all applicapable revisions with dates of approval and a "Log of Revisions" page(s) ,with only the latest Revision shown, will be provided to replace the previous ones. It is the operators responsiblilty to ensure that this manual is current through the latest published revision.

This handbook will be kept current by Mooney Aircraft Corporation when the yellow information card in front of this handbook has been completed and mailed to the Service Parts Department, Mooney Aircraft Corporation, Louis Schreiner Field, Kerrville, TX., 78028.

LIST OF EFFECTIVE PAGES

ORIGINAL	3 - 90
Revision A	1 - 96

Always destroy superseded pages when inserting revised pages.

POH/AFM NUMBER - 3501 [A]

This POH/AFM effective beginning with M20M S/N 27-0053

LIST OF EFFECTIVE PAGES (cont.)

MOONEY AIRCRAFT CORPORATION

LOUIS SCHREINER FIELD
KERRVILLE, TEXAS 78028

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date
A	T.P., Congrat., i thru iv, 1-5, 2-3, 2-4, 2-5, 2-11, 2-12, 2-14, 3-1, 3-10, 4-8, 4-10, 7-8, 7-9, 7-16, 7-17	Revised Data	Brian Hancock	1/21/96
	1-3, 1-7, 2-5, 2-6, 3-6, 3-9, 4-14, 6-13, 7-1	Added Data		
	1-6, 3-17, 3-18, 5-3, 7-20, 7-32	Relocated Data		
	3-15, 3-16, 4-5, 4-9, 7-23	Revised & Added Data		
	5-4, 7-18, 7-19, 7-21, 7-22, 7-31	Revised & Relocated Data		
	6-6, 6-7	Revised Graphs		

The revised portions of affected pages are indicated by vertical black lines in the margin.

LOG OF REVISIONS (con't.)

MOONEY AIRCRAFT CORPORATION

LOUIS SCHREINER FIELD
KERRVILLE, TEXAS 78028

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date

The revised portions of affected pages are indicated by vertical black lines in the margin.

CONTENTS

BLANK

TABLE OF CONTENTS

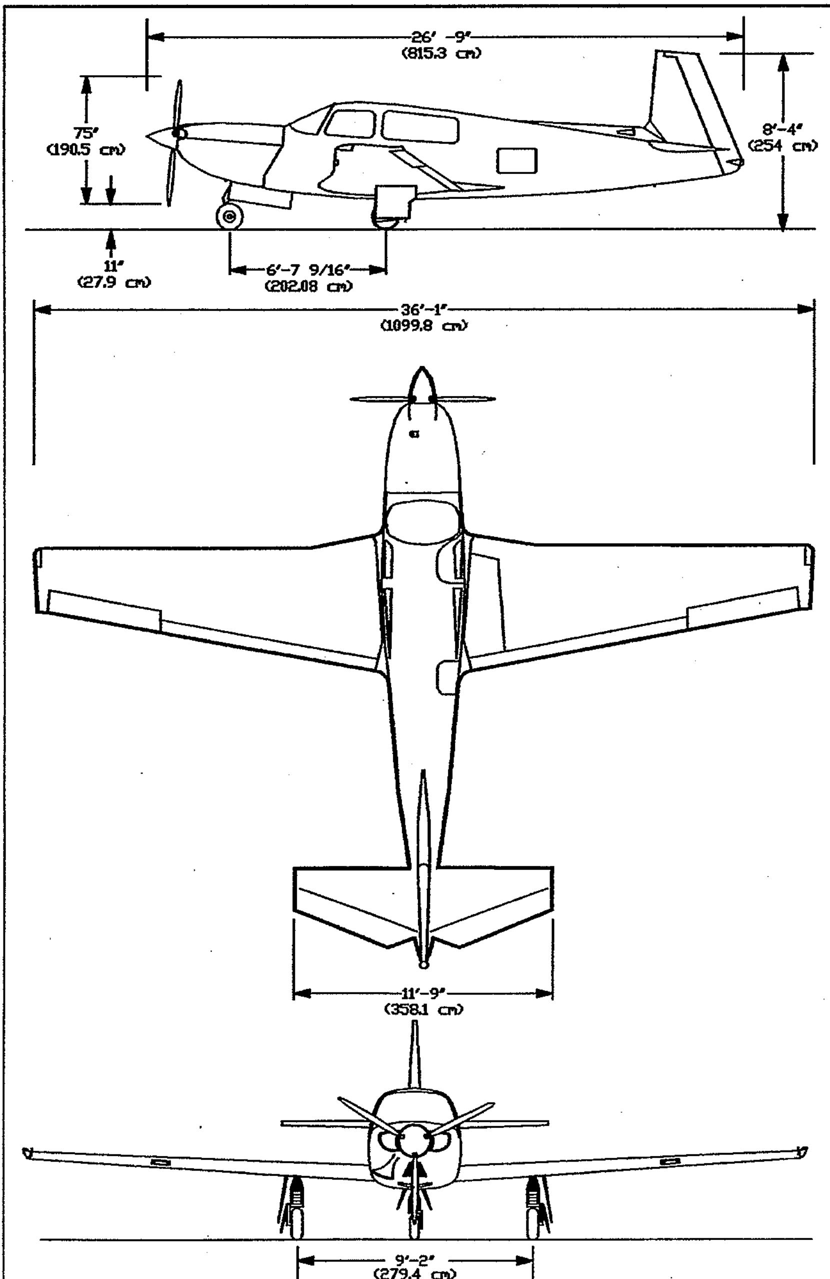


FIGURE 1 - 1 THREE VIEW

INTRODUCTION

This Operators Manual conforms to GAMA Specification No. 1 and includes both Manufacturers material and FAA APPROVED material required to be furnished to the Pilot by the applicable Federal Aviation Regulations. Section IX contains supplemental data supplied by Mooney Aircraft Corporation.

Section I contains information of general interest to the pilot. It also contains definitions of the terminology used in this Operators Manual.

This Pilot's Operating Handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives, applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in an up to date status.

All limitations, procedures, safety practices, servicing and maintenance requirements published in this POH/AFM are considered mandatory for the Continued Airworthiness of this airplane in a condition equal to that of its original manufacture.

DESCRIPTIVE DATA

ENGINE

Number of engines	1
Engine Manufacturer	Textron-Lycoming
Model	TIO-540-AF1A *
Recommended TBO	2000 Hours
Type	Reciprocating, air cooled, fuel injected, Turbocharged
Number of cylinders	6, Horizontally opposed
Displacement	541.5 Cu. In. (8875 cc)
Bore	5.125 In. (13.0 cm)
Stroke	4.375 In. (11.11 cm)
Compression ratio	8.0 : 1

* TIO-540-AF1B ENGINE INSTALLED S/N 27-0211 & ON. OPTIONAL FOR S/N 27-0053 THRU 27-0107.

Fuel System

Type	Fuel Injection
Make	Bendix
Fuel-Aviation Gasoline	100 octane - 100LL

Accessories

Magnetos	Pressurized Slick 6260 & 6261 (IMPULSE)
Ignition Harness	Shielded/Braided
Spark Plugs	Textron-Lycoming SI 1042) (18 m/m)
Oil Cooler	Stewart - Warner Full Flow
Alternator (2)	28 Volt DC, 70 AMPS
Starter	24 volt DC
Intercooler	Lycoming
Turbocharger	Airsearch - Model TA0413
Turbocharger Controller System	Density/Differential Pressure Controller

Ratings:

Maximum Takeoff Sea Level BHP/RPM	270/2575

PROPELLER

Number	1
Manufacturer	McCauley
Model Number	B3D32C417/82NRD-7
Number of Blades	3
Diameter (No cutoff allowed)	75 in. (190.5 cm)
Type	Constant Speed
Governing	Hydraulically controlled by engine oil.
Blade Angles @ 30.0 in. Sta.:	
Low	15.1 degrees + /- 0.2 degrees
High	43 degrees + /- 0.5 degrees

FUEL

Minimum Fuel Grade (Color)	100 LL (Blue) or 100 Octane (Green)
Total Capacity	95 U.S. Gal. (359.6 Liters)
Usable	89.0 U.S. Gal. (336.9 Liters)

OIL

Oil Specification	MIL-L-22851 and as Approved by Textron-Lycoming (Reference Engine Operators Manual)
Above 30° F(-1° C) Ambient Air (S.L.)	SAE 40 or SAE 15W-50
Below 30° F(-1° C) Ambient Air (S.L.)	SAE 30 or 20W-30
Total Oil Capacity	10 Qts. (9.5 liters)
(Minimum for Flight)	6 Qts. (5.7 liters)
Oil Filter	Full Flow

Oil grades, specifications and changing recommendations are contained in SECTION VIII.

LANDING GEAR

TYPE: Electrically operated, fully retractable tricycle gear with rubber shock discs. The main wheels have hydraulically operated disc brakes. The nose wheel is fully steerable 11° left to 13° right of center.

Wheel Base	79 9/16 in. (198.91 cm)
Wheel Track	110 in. (279.4 cm)

Tire Size:	
Nose	5.00 x 5 (6 ply)
Main	6.00 x 6 (6 ply)
Tire Pressure	
Nose	49 PSI
Main	42 PSI

Minimum Turning Radius (No brakes applied)	
Right	40 ft. (12.0 m)
Left	48 ft. (14.4 m)

MAXIMUM CERTIFICATED WEIGHTS

Gross Weight	3368 Lbs. (1528 Kg)
Maximum Landing Weight	3200 Lbs. (1452 Kg)
Baggage Area	120 Lbs. (54.4 Kg)
Rear Storage Area	10 Lbs. (4.5 Kg)
Cargo (Rear Seats Folded Down)	340 Lbs. (154.2 Kg)

STANDARD AIRPLANE WEIGHTS

Basic Empty Weight	See Page 1-8
Useful Load	Varies with installed equipment. See SECTION VI for specific airplane weight (pg. 6-6).

CABIN AND ENTRY DIMENSIONS

Cabin Width (Maximum)	43.5 In. (110.5 cm)
Cabin Length (Maximum)	126 In. (315 cm)
Cabin Height (Maximum)	44.5 In. (113 cm)
Entry Width (Minimum)	29.0 In. (73.4 cm)
Entry Height (Minimum)	35.0 In. (88.9 cm)

BAGGAGE SPACE AND ENTRY DIMENSIONS

Compartment Width	24 In. (60.9 cm)
Compartment Length	43 In. (109.2 cm)
Compartment Height	35 In. (88.9 cm)
Compartment Volume	20.9 Cu. Ft. (.592 cubic meters)
Cargo Area (with rear seat folded down)	38.6 Cu. Ft. (1.09 cubic meters)
Entry Height (Minimum)	20.5 In. (52.1 cm)
Entry Width	17.0 In. (43.2 cm)
Ground to Bottom of Sill	46.0 In. (116.8 cm)

SPECIFIC LOADINGS

Wing Loading - @ Maximum Gross Weight	19.26 Lbs./Sq. Ft. (94 Kg/sq. m)
Power Loading - @ Maximum Gross Weight	12.47 Lbs./HP (5.66 Kg/HP)

IDENTIFICATION PLATE

All correspondence regarding your airplane should include the Serial Number as depicted on the identification plate. The identification plate is located on the left hand side, aft end of the tail cone, below the horizontal stabilizer leading edge. The aircraft Serial Number and type certificate are shown.

SYMBOLS, ABBREVIATIONS & TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY & SYMBOLS

GS	GROUND SPEED - Speed of an airplane relative to the ground.
KCAS	KNOTS CALIBRATED AIRSPEED - The indicated speed of an aircraft,corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KIAS	KNOTS INDICATED AIRSPEED - The speed of an aircraft as shown on its airspeed indicator. IAS values published in this handbook assume zero instrument error.
KTAS	KNOTS TRUE AIRSPEED - The airspeed of an airplane relative to undisturbed air which is the KCAS corrected for altitude and temperature.
V_a	MANEUVERING SPEED - The maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{fe}	MAXIMUM FLAP EXTENDED SPEED - The highest speed permissible with wing flaps in a prescribed extended position.
V_{le}	MAXIMUM LANDING GEAR EXTENDED SPEED -The maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{lo}	MAXIMUM LANDING GEAR OPERATING SPEED - The maximum speed at which the landing gear can be safely extended or retracted.
V_{ne}	NEVER EXCEED SPEED - The speed limit that may not be exceeded at any time.
V_{no}	MAXIMUM STRUCTURAL CRUISING SPEED - The speed that should not be exceeded except in smooth air and then only with caution.
V_s	STALLING SPEED - The minimum steadyflight speed at which the airplane is controllable.
V_{so}	STALLING SPEED - The minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_x	BEST ANGLE-OF-CLIMB SPEED - The airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_y	BEST RATE-OF-CLIMB SPEED - The airspeed which delivers the greatest gain in altitude in the shortest possible time with gear and flaps up.

ENGINE POWER TERMINOLOGY

BHP	BRAKE HORSEPOWER - Power developed by the engine.
MCP	MAXIMUM CONTINUOUS POWER - The maximum power for takeoff, normal, abnormal or emergency operations.
CHT	CYLINDER HEAD TEMPERATURE - Operating temperature of engine cylinder(s) being monitored by a sensor unit. Expressed in°C.
MP	MANIFOLD PRESSURE - Pressure measured in the engine's induction system and is expressed in inched of mercury (Hg).
RPM	REVOLUTIONS PER MINUTE - Engine speed.
TIT	TURBINE INLET TEMPERATURE - The exhaust gas temperature measured at the turbocharger turbine inlet. Expressed in °F.
Turbocharger	A device used to supply increased amounts of air to an engine induction system. In operation, the trubine is driven by engine exhaust gas mixture. The turbine directly drives a compressor which pumps air into the engine intake.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Demonstrated Crosswind Velocity	The velocity of the crosswind component for which adequate control of the airplane during takeoff and landing test was actually demonstrated during certification. The value shown is not considered to be limiting.
g	Acceleration due to gravity.
Service Ceiling	The maximum altitude at which aircraft at gross weight has the capability of climbing at the rate of 100 ft/min.

ENGINE CONTROLS & INSTRUMENTS TERMINOLOGY

Propeller Control	The control used to select engine speed.
Throttle Control	The control used to select engine power by controlling MP.
Mixture Control	Provides a mechanical linkage to the fuel injector mixture control Control to control the size of the fuel feed aperture, and therefore the air/fuel mixture. It is the primary method to shut the engine down.
CHT Gauge	Cylinder head temperature indicator used to determine that engine operating temperature is within manufacturers specifications.
Tachometer	An instrument that indicates rotational speed of the Engine. The speed is shown as revolutions per minute (RPM).
Propeller Governor	The device that regulates RPM of the engine/propeller by increasing or decreasing the propeller pitch, through a pitch change mechanism in the propeller hub.

METEOROLOGICAL TERMINOLOGY

AGL	Above ground level.
Density Altitude	Altitude as determined by pressure altitude and existing ambient temperature. In standard atmosphere (ISA) density and pressure altitude are equal. For a given pressure altitude, the higher the temperature, the higher the density altitude.

Indicated Pressure Altitude	The number actually read from an altimeter when, and only when the barometric subscale has been set to 29.92 Inches of mercury or 1013.2 millibars.
ISA	INTERNATIONAL STANDARD ATMOSPHERE assumes that (1) The air is a dry perfect gas; (2) The temperature at sea level is 15 degrees Celsius (59° F); (3) The pressure at sea level is 29.92 inches Hg (1013.2 mb); (4) The temperature gradient from sea level to the altitude at which the temperature is -56.5° C (-69.7° F) is -0.00198° C (-0.003564° F) per foot.
OAT	OUTSIDE AIR TEMPERATURE - The free air static temperature, obtained either from inflight temperature indications or ground meteorological sources. It is expressed in degrees Celsius.
Pressure Altitude	The indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.

WEIGHT AND BALANCE TERMINOLOGY

Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Basic Empty Weight	The actual weight of the airplane and includes all operating equipment (including optional equipment) that has a fixed location and is actually installed in the a/c. It includes the weight of unusable fuel and full oil.
Center of Gravity (C.G.)	The point at which an airplane 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	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. in percent MAC	Center of Gravity expressed in percent of mean aerodynamic chord.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
MAC	Mean Aerodynamic Chord.
Maximum Weight	The maximum authorized weight of the aircraft and its contents as listed in the aircraft specifications.
Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance from the reference datum.
Tare	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.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Usable Fuel	Fuel available for aircraft engine combustion.
Useful Load	The basic empty weight subtracted from the maximum weight of the aircraft. This load consists of the pilot, crew if applicable, fuel, passengers, and baggage.

MEASUREMENT CONVERSION TABLES

LENGTH

U. S. Customary Unit	Metric Equivalents
1 inch	2.54 centimeters
1 foot	0.3048 meter
1 yard	0.9144 meter
1 mile (statute, land)	1, 609 meters
1 mile (nautical, international)	1, 852 meters

AREA

U. S. Customary Unit	Metric Equivalents
1 square inch	6.4516 sq. centimeters
1 square foot	929.030 sq. centimeters
1 square yard	0.836 sq. meter

VOLUME OR CAPACITY

U. S. Customary Unit	Metric Equivalents
1 cubic inch	16.387 cubic centimeters
1 cubic foot	0.028 cubic meter
1 cubic yard	0.765 cubic meter

U.S. Customary Liquid Measure	Metric Equivalents
1 fluid ounce	29.573 milliliters
1 pint	0.473 liter
1 quart	0.946 liter
1 gallon	3.785 liters

VOLUME OR CAPACITY (cont.)

U.S. Customary Dry Measure	Metric Equivalents
1 pint	0.551 liter
1 quart	1.101 liters

British Imperial Liquid and Dry Measure	U. S. Equivalents	Metric Equivalents
1 fluid ounce	0.961 U.S. fluid ounce, 1.734 cubic inches	28.412 milliliters
1 pint	1.032 U.S. dry pints, 1.201 U.S. liquid pts., 34.678 cubic inches	568.26 milliliters
1 quart	1.032 U.S. dry quarts 1.201 U.S. liquid qts., 69.354 cubic inches	1.136 liters
1 gallon	1.201 U.S. 277.420 cubic inches	4.546 liters

WEIGHT

U. S. Customary Unit (Avoirdupois)	Metric Equivalents
1 grain	64.79891 milligrams
1 dram	1.772 grams
1 ounce	28.350 grams
1 pound	453.59237 grams

PRESSURE

U.S. Customary Unit	Metric Equivalents
1 PSIG	6.895 KPA
1 Inch Hg	3.388 KPA
1 Inch Hg	25.40 mm Hg

TABLE OF CONTENTS

INTRODUCTION

Section II includes the mandatory 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 have been approved by the Federal Aviation Administration.
When applicable, limitations associated with optional systems or equipment such as autopilots are included in Section IX.

| 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 V 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 V.

Your Mooney is certificated under FAA Type Certificate No. 2A3 as a Mooney M20M.

NOISE LIMITS

The certificated noise level for the Mooney M20M at 3368 lbs. (1528 Kg.) maximum weight is 74.03 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.

AIRSPEED LIMITATIONS

Airspeed limitations and their operational significance are shown in Figure 2-1. This calibration assumes zero instrument error.

V / SPEED		KCAS/KIAS	REMARKS
V_{NE}	Never Exceed Speed	195/195	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	174/174	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed at:		
	lbs. /Kg. 2600/1179 2900/1315 3200/1452 3368/1528	 111/111 117/117 123/123 126/127	Do not make full or abrupt control movement above this speed.
V_{FE}	Maximum Flap Extended Speed	109/110	Do not exceed this speed with flaps in full down position.
V_{LE}	Maximum Landing Gear Extended Speed	165/165	Maximum speed at which the aircraft can be safely flown with the landing gear extended.
V_{LO} (EXT)	Max. Speed for Gear Extension	139/140	Max. speed at which the landing gear can be safely extended.
V_{LO} (RET)	Max. Speed for Gear Retraction	104/106	Maximum speed at which the landing gear can be safely retracted.
	Maximum Pilot Window Open Speed	133/132 * *Some A/C may show lower speeds	Do not exceed this speed with pilot window open.

FIGURE 2-1 AIRSPEED LIMITATIONS

AIRSPEED INDICATOR MARKINGS

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

MARKING	IAS VALUE or RANGE (KIAS)	SIGNIFICANCE
White Arc (Flap Operating Range)	59-110 KIAS	Lower limit is maximum weight V_{SO} in landing configuration. Upper limit is maximum speed permissable with flaps extended.
Green Arc (Normal Operating Range)	66-174 KIAS	Lower limit is maximum weight V_S with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc (Caution Range)	174-195 KIAS	Operations must be conducted with caution and only in smooth air.
Radial Red Line	195 KIAS	Maximum speed for all operations.

FIGURE 2-2 AIRSPEED INDICATOR MARKINGS

POWER PLANT LIMITATIONS

Number of Engines	1
Engine Manufacturer	TEXTRON-Lycoming
Engine Model Number	TIO-540-AF1A *
Engine Operating Limits for Takeoff and Continuous Operations:	
Maximum Continuous Power	270 BHP
Maximum Continuous RPM	2575 RPM
Transient RPM Limit	2700 RPM
Maximum Manifold Pressure	38 in. Hg.
Maximum Turbine Inlet Temperature (TIT) Continuous	1750° F
Maximum Cylinder Head Temperature	500° F(260° C)
Maximum Oil Temperature	245° F(118° C)
Minimum Oil Temperature-Grnd. Run-up	75° F(24° C)
Minimum Oil Timperature-Takeoff	100° F(38° C)
Oil Pressure	
Normal Operating	55-95 PSI
Minimum (**IDLE ONLY**)	25 PSI
Maximum (cold oil)	115 PSI
Oil Specification	MIL-L-22851 and TEXTRON-Lycoming Approved oils
Fuel Grade (Color)	100LL (Blue)** or 100 octane (Green) **
Number of Propellers	1
Propeller Manufacturer	McCauley
Propeller/Blade Model Number	B3D32C417/82NRD-7
Number of Blades	3
Propeller Diameter:	
Min	75 In. (190.5 cm)
Max.(No cutoff allowed)	75 In. (190.5 cm)
Propeller Blade Angles @ 30.0 In. sta.:	
Low	15.1 Degrees + /- 0.2 Degrees
High	43.0 Degrees + /- 0.5 Degrees
Propeller Operating Limits	2575 RPM

* TIO-540-AF1B ENGINE INSTALLED S/N 27-0211 & ON. OPTIONAL FOR S/N 27-0053 THRU 27-0107.

** 100LL fuel is calibrated at 5.82 lb/gal(.69 Kg/liter)
100 octane fuel is calibrated at 6.0 lb.gal. (.72 Kg/liter)

POWER PLANT INSTRUMENT MARKINGS

INSTRUMENT	REDLINE MINIMUM LIMIT	GREEN ARC NORMAL OPERATING	YELLOW ARC	REDLINE MAXIMUM LIMIT
Tachometer	500 RPM No Redline	2200-2575 RPM	——	2575 RPM
Manifold Pressure		10.0-38.0 In Hg.*		38.0 In Hg
Turbine Inlet Temperature		1300 - 1750° F (704 - 954°C)		1750° F (954°C)
Cylinder Head Temperature		250-500° F (121 - 260°C)		500° F (260°C)
Oil Temperature	No Redline	100 -245° F (37 - 118°C)		245° F (118°C)
Oil Pressure	25.0 PSI (IDLE ONLY)	55-95 PSI	25 - 55 PSI 95 - 115 PSI	115 PSI
Fuel Pressure	15 PSI	24 - 55 PSI	15 - 24 PSI	55 PSI

* Normal operating range, no green arc required.

NOTE

Refer to TEXTRON-Lycoming Engine Maintenance and Operators Manual Section on Engine Specifications and Operating Limits for recommended cruise power and temperature limitations.

POWER PLANT INSTRUMENT MARKINGS

FUEL LIMITATIONS

////////////////////
///WARNING///
////////////////////

Takeoff maneuvers when the selected fuel tank contains less than 12 gallons (45.4 liters) of fuel have not been demonstrated.

| NOTE |

Each fuel quantity gauge is calibrated to read zero (RED LINE) only in coordinated level flight when the quantity of fuel can no longer be safely used.

| NOTE |

An optional visual fuel quantity gauge is installed on top of each tank and is to be used as a reference for refueling tanks only.

Standard Tanks (2)	47.5 U.S. Gal. each (179.8 liters)
Total Fuel	95 U.S. Gal.(359.6 liters)
Usable Fuel:	89 U.S. Gal. (336.8 liters)
Unusable Fuel:	6 U.S. Gal. (22.7 liters)

Fuel Grade (and color):
100LL (low lead) (blue) or 100 (green) is approved.

~~~~~~~~
~ CAUTION ~
~~~~~~~~

To reduce the possibility of ice formation within the aircraft or engine fuel system it is permissible to add ISO-PROPYL alcohol to the fuel supply in quantities NOT TO EXCEED 1% of the total fuel volume per tank. DO NOT add other additives to the fuel system due to potential deteriorating effects within the fuel system.

WEIGHT LIMITS

Maximum Weight - Takeoff	3368 lb. (1528 Kg.)
Maximum Weight - Landing	3200 lb. (1452 Kg)
Maximum Weight in Baggage Compartment	120 lb. (54.4 Kg.) @ Fus. Sta. 101.5(253.7 cm)
Maximum Weight in Rear Storage Area	10 lb. (4.54 Kg.) @ Fus. Sta. 131.0(297.5 cm)
Maximum Weight in Cargo Area (Rear seats folded down)	340 lbs. (154.2 KG) @ Fus. Sta. 70.7(176.8 cm)

CENTER OF GRAVITY (GEAR DOWN)

Most Forward	41.0 In. (Fus. Sta. in IN.)(104.1 cm)
16.79% MAC	2430 lb. (1102 KG.)
Intermediate Forward	44 In. (Fus. Sta. in IN.)(111.7 cm)
21.7% MAC	3300 lb. (1497 KG.)
Forward Gross	46.0 IN. (Fus. Sta. in IN.)(116.8 cm)
24.98% MAC	3368 lb. (1528 KG.)
Aft Gross	51.0 IN. (Fus. Sta. in IN.)(129.5 cm)
33.18% MAC	3368 lb. (1528 KG.)
MAC (at Wing Sta. 94.85)(241 cm)	61.00 In.

Datum (station zero) is 13 inches (32.5 cm) aft of the center line of the nose gear trunion attach/pivot bolts.

MANEUVER LIMITS

This airplane must be operated as a Normal Category airplane. Aerobatic maneuvers, including spins, are prohibited.

| NOTE |

Up to 500 foot altitude loss may occur during stalls at maximum weight.

FLIGHT LOAD FACTOR LIMITS

Maximum Positive Load Factor	
Flaps Up	+3.8 g.
Flaps Down (33 Degrees)	+2.0 g.
Maximum Negative Load Factor	
Flaps Up	-1.5 g.
Flaps Down	.0.0 g.

FLIGHT CREW

Pilot	One
Maximum passenger seating configuration	Three

OPERATING LIMITATIONS

Maximum operating altitude is 25,000 feet MSL.

Takeoffs with the cowl flaps inoperative are prohibited.

Engine restarts should not be conducted above 23,000 ft. altitude.

When operating above 22,000 feet and at manifold pressures above 32 IN. Hg., only best power mixture (1650° F TIT) or richer is permitted

OXYGEN SYSTEM LIMITATIONS

NOTE
Only masks which have end fittings marked with a green band are acceptable for use with this system.

KINDS OF OPERATION LIMITS

This is a Normal Category airplane certified for VFR/IFR day or night operations when the required equipment is installed and operational as specified in the KINDS OF OPERATION EQUIPMENT LIST and the applicable operating rules.

Optional equipment installations may not be required to be operational.

The pilot must determine that the applicable operating rules requirements for each kind of operation are met.

OPERATIONS IN KNOWN ICING CONDITIONS ARE PROHIBITED.

Autopilot Limitations - See Section IX.

KINDS OF OPERATION EQUIPMENT LIST

The following equipment was approved during Type Certification and must be installed and operable for each kind of operation as specified.

NOTE
The KINDS OF OPERATION EQUIPMENT list may not include all the equipment as required by applicable operating rules.

KINDS OF OPERATION EQUIPMENT LIST

SYSTEM or COMPONENT	VFR DAY *	VFR NIGHT	IFR DAY	IFR NIGHT
AIRSPEED INDICATOR	1	1	1	1
ALTIMETER, SENSITIVE	1	1	1	1
MAGNETIC DIRECTION INDICATOR	1	1	1	1
MANIFOLD PRESSURE GAUGE	1	1	1	1
TACHOMETER	1	1	1	1
FUEL QUANTITY INDICATOR	2	2	2	2
FUEL PRESSURE INDICATOR	1	1	1	1
OIL PRESSURE INDICATOR	1	1	1	1
OIL TEMPERATURE INDICATOR	1	1	1	1
CYLINDER HEAD TEMPERATURE INDICATOR	1	1	1	1
TURBINE INLET TEMPERATURE INDICATOR	1	1	1	1
ALTERNATOR LOAD METER	1	1	1	1
ALTERNATOR	1	1	1	1
LANDING GEAR POSITION INDICATOR	2	2	2	2
SEAT BELT & SHOULDER HARNESS FOR EACH OCCUPANT **	1	1	1	1
OXYGEN MASK FOR EACH OCCUPANT ***	1	1	1	1
POSITIONS LIGHTS		3		3
STROBE LIGHTS (ANTI-COLLISION)		3		3

* Equipment must be installed and operable for all operations.
** If inoperative for unoccupied seat(s), seat(s) must be placarded: "DO NOT OCCUPY"
*** Only required when the operating rules require use of oxygen.

KINDS OF OPERATION EQUIPMENT LIST (con't.)

SYSTEM or COMPONENT (con't.)	VFR DAY *	VFR NIGHT	IFR DAY	IFR NIGHT
GYRO-HORIZON			1	1
DIRECTIONAL GYRO			1	1
TURN COORDINATOR or TURN & BANK INDICATOR			1	1
LANDING LIGHT ****		1		1
INSTRUMENT LIGHTS (INTERNAL or GLARESHIELD)		1		1
CLOCK (WITH SWEEP SECOND HAND or DIGITAL)			1	1
COMMUNICATION SYSTEM			1	1
NAVIGATION SYSTEM (APPROPRIATE TO FACILITIES BEING USED)			1	1
BATTERY	2	2	2	2
VACUUM SYSTEM/INDICATOR			1	1
FUEL BOOST PUMP	1	1	1	1
PILOT'S OPERATING HANDBOOK & AIRPLANE FLIGHT MANUAL	1	1	1	1
PITOT, Heated ****			1	1
OAT GAUGE ****			1	1
VSI ****			1	1
ALTERNATE STATIC SOURCE ****			1	1
STAND-BY VACUUM SYSTEM ****			1	1

* Equipment must be installed and operable for all operations.
**** When required by the appropriate regulations.

DECALS AND PLACARDS

CABIN INTERIOR

The following placards are relevent to proper operation of the airplane and must be installed inside the cabin at the locations specified.

OPERATING LIMITATIONS

THE MARKINGS AND PLACARDS INSTALLED IN THIS AIRPLANE CONTAIN OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THE NORMAL CATEGORY. THIS AIRPLANE IS CERTIFIED FOR DAY AND NIGHT VFR/IFR OPERATION WHEN THE REQUIRED EQUIPMENT IS INSTALLED AND OPERATIONAL. FLIGHT INTO KNOWN ICING CONDITIONS IS PROHIBITED. NO AEROBATIC MANEUVERS, INCLUDING SPINS ARE APPROVED. OTHER OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THIS CATEGORY ARE CONTAINED IN THE AIRPLANE FLIGHT MANUAL. MANEUVERING SPEED (3368 LBS), 127 KIAS; (2600 LBS), 111 KIAS.

EMERGENCY MANUAL GEAR EXTENSION

1. PULL LANDING GEAR ACTUATOR CIRCUIT BREAKER.
2. PUT GEAR SWITCH IN GEAR DOWN POSITION.
3. PUSH RELEASE TAB FORWARD AND LIFT UP RED HANDLE.
4. PULL T-HANDLE STRAIGHT UP (12 TO 20 INCHES).
5. ALLOW T-HANDLE TO RETURN TO ORIGINAL POSITION.
6. REPEAT UNTIL GEAR DOWN LIGHT COMES ON (12 TO 20 PULLS). IF TOTAL ELECTRICAL FAILURE-SEE MECHANICAL INDICATOR.

CAUTION

1. TURN OFF STROBE LITES WHEN TAXIING NEAR OTHER ACFT OR WHEN FLYING IN FOG OR IN CLOUDS. STD POSITION LITES MUST BE USED FOR ALL NIGHT OPERATIONS.
2. IN CASE OF FIRE, TURN OFF CABIN HEAT.
3. DO NOT SCREW VERNIER CONTROLS CLOSER THAN 1/8" FROM NUT FACE.

-980

ON LEFT SIDE PANEL BELOW PILOT'S SIDE WINDOW

CHECK LIST

TAKEOFF	CONTROLS FUEL INSTRUMENTS TRIM COWL FLAPS	RUN-UP PROP WING FLAPS SEAT LATCH BELT/HARNESS	DOOR WINDOW ALT AIR PARK BRAKE MIXTURE
	CONDUCT RUDDER/ELEV TRIM CHECK PRIOR TO FLIGHT, SEE PILOT'S OPERATING HANDBOOK.		
LDG	BELT/HARNESS FUEL BOOST PUMP	GEAR WING FLAPS	MIXTURE PROP PARK BRAKE

-924

ON CONSOLE COMPART - MENT COVER

BOTH BATTERIES MUST BE INSTALLED FOR FLIGHT.

ON BATTERY ACCESS PANELS L/H & R/H

UPPER L/H INSTR. PANEL

START STOP	CLEAR	MODE

-839

FLAPS UP

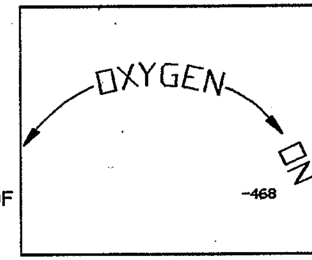
-785

FLAPS DOWN

-786

CONSOLE ABOVE & BELOW SWITCH

PILOT'S L/H PANEL FWD OF ARM REST

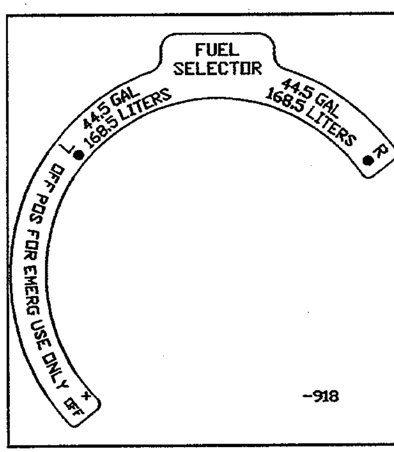


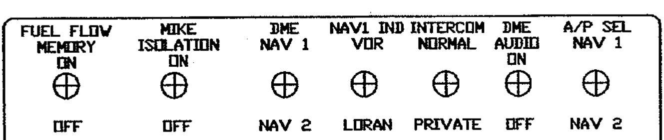
WARNING

DO NOT EXCEED 170 LBS.
(77.1 Kg) ON THIS SEAT BACK.
SEE AIRCRAFT LOADING SCHEDULE DATA
FOR BAGGAGE COMPARTMENT ALLOWABLE.

FWD END OF REAR SEAT BOTTOM STRUCTURE

FLOORBD BETWEEN SEATS





TOP RT. RADIO PANEL (VARIES W/ INSTALLED EQUIP.)

PUSH
GR SAFETY
BY PASS

GEAR UP
106 KIAS

GEAR DOWN
140 KIAS
GEAR EXTD
165 KIAS

-921

UPPER
CTR
INSTR.
PANEL

AUXILIARY EXIT
DO NOT OPEN IN FLIGHT
TO OPEN

1. PULL OFF COVER
2. PULL CABLE EXTRACTING LOCK PIN
3. ACTUATE HANDLE

TO CLOSE

1. STORE HANDLE
2. INSERT LOCK PIN
3. INSTALL COVER
4. CLOSE AND LATCH DOOR USING OUTSIDE HANDLE
5. LOCK DOOR

-834

ABOVE
INSIDE
BAGGAGE
DOOR
HANDLE

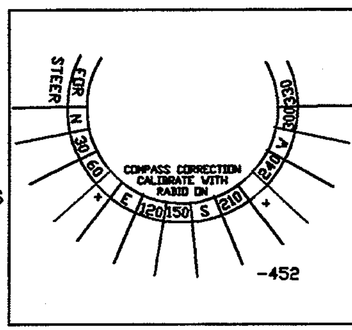
PULL FOR ALT
STATIC SOURCE

-467

LWR INSTR PNL.,BELOW
CONTROL WHEEL SHAFT

DO NOT OPEN
ABOVE 132 KIAS

BELOW PILOT'S
STORM WINDOW



ON
MAG.
COMPASS

THROTTLE
PUSH INCREASE

-383

PROP
PUSH INCREASE

-385

MIXTURE
PUSH RICH

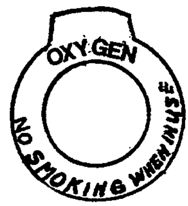
-387

ABOVE
EACH
CONTROL
ON LOWER
INSTR.
PANEL

WARNING:	DO NOT EXCEED 10 LBS (4.5 Kg) IN THIS COMPARTMENT USE FOR STOWAGE OF LIGHT SOFT ARTICLES ONLY SEE AIRCRAFT LOADING SCHEDULE DATA FOR BAGGAGE COMPARTMENT ALLOWABLE

BAGGAGE COMPARTMENT
ON HAT RACK SHELF

AROUND EACH OXYGEN OUTLET ON OVERHEAD PANEL



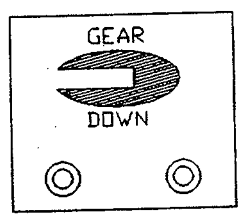
CONSOLE
ON CONTROL
KNOB

ALTERNATE AIR PULL ON

WARNING:	DO NOT EXCEED 120 LBS (54.4 Kg) IN THIS COMPARTMENT SEE AIRCRAFT LOADING SCHEDULE DATA FOR BAGGAGE COMPARTMENT ALLOWABLE

TOP OF BAGGAGE
DOOR JAMB

FLOORBOARD
BETWEEN
SEATS



NXXXXX

ON UPPER
GLARESHIELD

← **PUSH TO RELEASE**

BETWEEN SEATS - ON
EMERGENCY GEAR RELEASE
EXTENSION HANDLE

FLOORBOARD
FWD OF CO-PILOT
SEAT

FUEL DRAIN

PULL OPEN

FUSELAGE INTERIOR

The following placards must be installed inside the fuselage at the locations specified.

Placard	Location
MAINTAIN ↓ LEVEL HERE (-071)	HYDRAULIC OIL RESERVOIR
28 VOLTS ONLY (-621)	BACKSIDE OF AUX. PWR. RECEPTACLE DOOR
USE AVIATORS OXYGEN ONLY SEE PILOT'S OPERATING HANDBOOK FOR FILLING PRESSURES (-945)	INSIDE OXYGEN FILLER DOOR
ENGINE OIL OIL INSTALLED IN THIS ENGINE IS: ____________ NEXT OIL CHANGE IS DUE AT ________ HRS. (USE GREASE PENCIL) ________ TACH TIME (-750)	INSIDE ENGINE OIL FILLER DOOR

EXTERIOR

The following placards must be installed on the exterior of the aircraft at the locations specified.

Placard	Location
NO STEP	ON INBOARD END OF FLAP, WING LEADING EDGES AND WING AHEAD OF FLAPS
HOIST POINT	UNDERSIDE OF WING (2 PLCS) & AFT OF L/H COWL FLAP (1PLC)
DO NOT PUSH	HORIZ. STAB. L/E RUDDER T/E (BOTH SIDES)
STATIC DRAIN –175	UNDER TAILCONE AFT OF WING T/E
PITOT DRAIN –179	UNDER LEFT WING L/E NEAR FUSELAGE
FUEL DRAIN –183	UNDER WING, NEAR SUMP DRAINS
GASCOLATOR DRAIN –187	UNDER FUSELAGE RT. SIDE AFT OF NOSE WHEEL WELL
TIRE PRESSURE 42 PSI (2.95 Kg/cm²) –757	ON MAIN LDG GEAR DOOR
TIRE PRESSURE 49 PSI (3.44 Kg/cm²) –759	ON NOSE LANDING GEAR DOOR

TOWING LIMITS

-700

ON NOSE LANDING GEAR LEG ASSY

ON NOSE LANDING GEAR SPINDLE ASSY.

WARNING
DO NOT EXCEED
TOWING LIMITS

-701

FUEL-100(GREEN) OR
100LL(BLUE) MIN OCT
44.5 U.S. GAL USABLE
168.5 LITERS USABLE

-917

LWR L/H WING PNL OUT/BD OF HOIST PT.

MAGNETIC AZIMUTH TRANSMITTER
LOCATED INSIDE THIS INSPECTION COVER. USE ONLY NON-MAGNETIC SCREWS FOR COVER INSTALLATION.
-884

ON BOTH FUEL FILLER CAPS

INFORMATIONAL

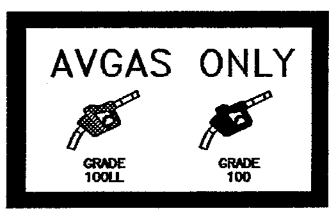
The following placards are provided for informational purposes.

IMPORTANT INSTRUCTIONS
ALWAYS ADD WATER-NEVER ADD ACID.
NEVER FILL OVER BAFFLE NOR MORE THAN
1/4" OVER THE TOPS OF SEPARATORS.
FULLY CHARGED SPECIFIC GRAVITY-1.275
RECHARGE REQUIRED WHEN SP.GR. REACHES 1.225
CHARGING RATES
START-4 AMPERES FINISH-2 AMPERES
MAXIMUM TEMPERATURE ON CHARGE-120° F(49° C)
KEEP CHARGED -- PREVENT FREEZING

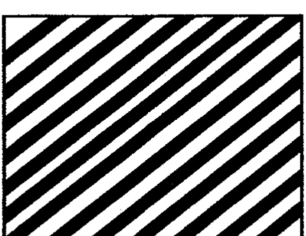
CARE SHOULD BE TAKEN NOT TO SPILL BATTERY
ACID WHEN SERVICING OR REMOVING BATTERY.

ON BATTERY ACCESS PANELS L/H & R/H OF TAILCONE

UPPER WING - AFT OF FILLER CAPS



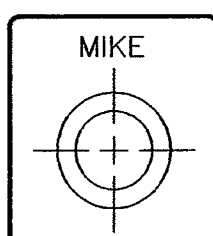
-167



UNDER FLOORBOARD ON RETRACT BELLCRANK

-191

LWR CONSOLE BELOW COMPARTMENT COVER



-868

BRIGHT
PNL LTS
DIM

LWR RADIO PANEL
- ABOVE CONSOLE,
BESIDE EACH SWITCH

BRIGHT
GLR SHLD
LTS
DIM

DEFROSTER
PULL ON

-768

CONSOLE
ON PULL
KNOB

CONSOLE
ON PULL
KNOB

CABIN HEAT
PULL ON

-769

CABIN VENT
PULL ON

-770

CONSOLE
ON PULL
KNOB

CONSOLE
ON PULL
KNOB

PARK BRAKE
PULL ON

-771

MIKE **PHONE**

LWR L/H INSTR.
AND/OR LWR R/H
C/B PANEL

DO NOT
SLAM DOOR
LOCKED

-285

ABOVE INSIDE DOOR HANDLE

CABIN LTS AFT
DIM
OFF
BRT
DIM
OFF
BRT
CABIN LTS FWD

CABIN VENT
OPEN

-875

OVERHEAD, BETWEEN
PILOT & CO-PILOT

OPTIONAL

See Section IX Supplements for Optional System's Placards Required.

TABLE OF CONTENTS

TABLE OF CONTENTS (con't)

INTRODUCTION

This section provides the recommended procedures to follow during adverse flight conditions. The information is presented to enable you to form, in advance, a definite plan of action for coping with the most probable emergency situations which could occur in the operation of your airplane.

As it is not possible to have a procedure for all types of emergencies that may occur, it is the pilot's responsibility to use sound judgement based on experience and knowledge of the aircraft to determine the best course of action. Therefore, it is considered mandatory that the pilot read the entire manual, especially this section before flight.

When applicable, emergency procedures associated with optional equipment such as Autopilots are included in Section IX.

| NOTE |

All airspeeds in this section are indicated (IAS) and assume zero instrument error unless stated otherwise.

AIRSPEEDS FOR EMERGENCY OPERATIONS

Engine Failure after Takeoff
Wing Flaps UP . . . . 85 KIAS
Wing Flaps DOWN . . . . 80 KIAS

Best Glide Speed
3368 lb/1528 kg . . . . 93.5 KIAS
3200 lb/1452 kg . . . . 89.0 KIAS
2900 lb/1315 kg . . . . 84.5 KIAS
2600 lb/1179 kg . . . . 80.0 KIAS

Maneuvering Speed
3368 lb/1528 kg . . . . .127 KIAS
3200 lb/1452 kg . . . . .123 KIAS
2900 lb/ 1315 kg . . . . .117 KIAS
2600 lb/1179 kg . . . . .111 KIAS

Precautionary Landing with Engine Power-Flaps DOWN . . 75 KIAS

Precautionary Landing above 3200 Lbs . . . . . 80 KIAS

Emergency Descent (Gear UP)
Smooth Air . . . . 195 KIAS
Turbulent Air
3368 lb/1528 kg . . . . .127 KIAS
3200 lb/1452 kg . . . . .123 KIAS
2900 lb/1315 kg . . . . .117 KIAS
2600 lb/1179 kg . . . . .111 KIAS

Emergency Descent (Gear DOWN)
Smooth Air . . . . 165 KIAS
Turbulent Air
3368 lb/1528 kg . . . . .127 KIAS
3200 lb/1452 kg . . . . .123 KIAS
2900 lb/1315 kg . . . . .117 KIAS
2600 lb/1179 kg . . . . .111 KIAS

ANNUNCIATOR PANEL WARNING LIGHTS

WARNING LIGHT	FAULT & REMEDY
GEAR UNSAFE	RED light indicates landing gear is not in fully extended/or retracted position. Refer to "Failure of Landing Gear to Extend Electrically" procedure or "Failure of Landing Gear to Retract" procedure.
LEFT or RIGHT FUEL	RED light indicates 2 1/2 to 3 gallons(9.5 to 11.4 liters) of usable fuel remain in the respective tanks. Switch to fuller tank.
SPEED BRAKE	AMBER light indicates Speed Brakes are activated.
ALT AIR	AMBER light indicates alternate induction air door is open.
PROP DE-ICE	BLUE light indicates power applied to De-Ice boots
PITOT HEAT	BLUE light indicates power is applied to heater. (On French A/C ONLY-AMBER light indicates power is NOT applied to heater.)
HI/LO VAC (Flashing)	Suction is below 4.25 in. Hg. (RED)
HI/LO VAC (Steady)	Suction is above 5.2 in. Hg. (RED)

NOTE

When either a steady (HI) or flashing (LO) VAC light is illuminated, the information obtained from the attitude and directional gyros is unreliable. Vacuum system should be checked and/or adjusted as soon as practicable.

L or R ALT VOLTS (Flashing)	RED light indicates voltage has dropped below 26.0 volts. Refer to "DUAL ALTERNATOR FAILURE".
L or R ALT VOLTS (Steady)	Overvoltage or tripped voltage relay. Refer to "Alternator Overvoltage".
START POWER	RED light indicates switch or relay is engaged and starter is energized. Flight should be terminated as soon as practicable. Engine damage may result. This is normal indication during engine start.
STBY VAC	AMBER light indicates stand by vacuum pump is clutched to the engine & providing vacuum to system.
REMOTE RNAV	AMBER light indicates DME is not slaved to the RNAV.

ANNUNCIATOR PANEL WARNING LIGHTS (con't.)

LORAN CPLD	BLUE light indicates Loran is coupled to the NAAV CDI or HSI.
BOOST PUMP	BLUE light indicates power to auxiliary boost pump.

ENGINE

POWER LOSS - DURING TAKEOFF ROLL

Throttle . . . . CLOSED
Brakes . . . . AS REQUIRED
Fuel Selector . . . . OFF
Magneto/Starter Switch . . . . OFF
Master Switch . . . . : OFF

POWER LOSS - AFTER LIFTOFF

Airspeed . . . . 85 KIAS(Flaps UP)
. . . . 80 KIAS (Flaps TAKEOFF/DOWN)
Fuel selector . . . . SELECT OTHER TANK
Throttle . . . . FULL FORWARD
Fuel Boost Pump . . . . ON to start (Engine driven fuel pump may have failed)
Fuel Boost Pump . . . . OFF if engine does not start immediately)
Propeller . . . . FULL FORWARD
Mixture . . . . FULL FORWARD
Magneto switch . . . . Verify on BOTH

If engine does not restart, proceed to **FORCED LANDING EMERGENCY.**

POWER LOSS - IN FLIGHT (RESTART PROCEDURES)

Airspeed . . . . 85 KIAS minimum
Fuel Selector . . . . SELECT OTHER TANK
Fuel Pressure . . . . Verify in Green Arc
Fuel Boost Pump . . . . ON to start (Engine driven fuel pump may have failed)
Fuel Boost Pump . . . . OFF if engine does not start immediately)
Throttle . . . . FULL FORWARD
Propeller . . . . FULL FORWARD
Mixture . . . . FULL FORWARD
Magneto/Starter Switch . . . . : VERIFY on BOTH

If engine does not start after initial attempts:
Mixture . . . . IDLE CUT-OFF (Initially)
. . . . then advance slowly toward RICH until engine starts.

If engine does not restart after several attempts establish best glide speed and proceed to **FORCED LANDING EMERGENCY.**

After engine restart:

Throttle . . . . ADJUST as required
Propeller . . . . ADJUST as required
Mixture . . . . RELEAN as power is restored

LAND AS SOON AS PRACTICABLE; CORRECT MALFUNCTION PRIOR TO NEXT FLIGHT.

| NOTE |

If engine fails when the boost pumpis turned OFF, suspect engine driven fuel pump failure. Procede to ENGINE DRIVEN FUEL PUMP FAILURE.

~ CAUTION ~

Should the engine excessively cool during engine out, care should be exercised during restart to avoid excessive oil pressure. Allow the engine to warm up at 15-20 inches MP.

OPERATING THE ENGINE AT TOO HIGH AN RPM BEFORE REACHING MINIMUM OIL TEMPERATURES MAY CAUSE LOSS OF OIL PRESSURE.

POWER LOSS - PRIMARY ENGINE INDUCTION AIR SYSTEM BLOCKAGE

Blockage of the primary engine induction air system may be experienced as a result of flying in cloud or heavy snow with cold outside air temperatures (0° C or below). At these temperatures, very small water droplets or solid ice crystals in the air may enter the primary engine induction inlet in the cowl opening and travel inside the inlet duct to the induction air filter. The ice particles or water droplets may collect and freeze on the air filter causing partial or total blockage of the primary engine induction system.

Indications of primary induction system blockage are either a loss of manifold pressure with a fixed throttle position or the need to gradually advance the throttle to maintain a given manifold pressure setting. In extreme conditions, the loss of indicated manifold pressure and engine power may be quite rapid. A loss of as much as 10 inches Hg manifold pressure within one minute can be experienced.

If primary induction air system blockage occurs, the alternate engine induction air system will automatically open, supplying the engine with an alternate air source drawn from inside the cowling rather than through the air filter. The alternate air system can also be manually opened at any time by pulling OUT the control labeled ALTERNATE AIR. Automatic or manual activation of the alternate induction system is displayed in the cockpit by the illumination of the ALT AIR light in the main annunciator panel. When operating on the alternate air system, available engine power will be less for a given propeller RPM compared to the primary induction air system. This is due to the loss of ram effect and the induction of warmer inlet air. Due to this loss of available power when using alternate air, especially when operating at altitudes above 15000 ft., if it is necessary to increase propeller RPM, RPM above 2400 will require full rich mixture .

Based upon the previous discussion, the following list should be used if a partial power loss due to primary induction air system blockage is experienced:

Engine Power . . . . Verify progressive manifold pressure loss.
Alternate Air . . . . . . Verify OPEN (annunciator light ON)

| NOTE |

The alternate air door should open automatically if there is a restriction in the primary induction system. If the alternate air door has not opened (Annunciator light-OFF) it can be opened manually by pulling the alternate air control knob OUT.

Throttle . . . . INCREASE to maintain desired manifold pressure.
Propeller . . . . INCREASE
if necessary to maintain desired cruise power setting (Ref.Section V)
Mixture . . . . RELEAN (Ref. Section V)

| NOTE |

Approximately 81% power can be maintained at 20,000 ft. with the primary induction system totally blocked, alternate air door open, full throttle, 2400 RPM and leaned to peak TIT.

Flight	CONTINUE

In the unlikely event that a total power loss due to primary engine induction air blockage is experienced, the following checklist should be used:

Airspeed	85 KIAS
Alternate Air	Manually OPEN
Throttle	Full FORWARD
Boost Pump	Verify ON
Propeller	FULL FWD (HIGH RPM)
Mixture	IDLE CUTOFF initially then advance toward RICH to attempt engine restart
Magneto/Starter Switch	Verify on BOTH

After engine restart:

Throttle	ADJUST as required
Propeller	ADJUST as required
Mixture	RELEAN as power is restored (Refer to power charts-Section V)
Boost Pump	Verify OFF

If engine does not restart after several attempts, proceed to FORCED LANDING EMERGENCY.

TURBOCHARGER FAILURE

//WARNING//

If a turbocharger failure is a result of a loose, disconnected or burned through exhaust, then a serious fire hazard exists. If a failure in the exhaust system is suspected in flight shut down the engine and LAND AS SOON AS POSSIBLE. If a suspected exhaust system failure occurs before takeoff, DO NOT FLY THE AIRCRAFT.

|NOTE|

A turbocharger malfunction at altitudes above 12,000 ft. could result in a overly rich mixture which could cause a partial power loss and rough running engine or a complete loss of engine power.

COMPLETE LOSS OF ENGINE POWER

If a suspected turbocharger or turbocharger waste gate control system failure results in a complete loss of engine power, the following procedure is recommended:

Mixture	IDLE CUTOFF
Throttle	Set a cruise position
Propeller	FULL FORWARD
Mixture	ADVANCE slowly until engine re-starts; ADJUST fuel flow for selected power setting.
Continue Flight	LAND AS SOON AS POSSIBLE.

PARTIAL LOSS OF ENGINE POWER

If turbocharger wastegate control fails in the OPEN position, a partial loss of engine power may result. The following procedure is recommended if a suspected turbocharger/wastegate control failure results in a partial loss of engine power:

Throttle . . . . AS REQUIRED
Propeller . . . . AS REQUIRED
Mixture . . . . AS REQUIRED
Continue Flight . . . . LAND AS SOON AS POSSIBLE

ENGINE POWER OVERBOOST

If the turbocharger wastegate control fails in the CLOSED position, an engine power overboost condition may be experienced. The following procedure is recommended for an overboost condition:

Throttle . . . . . REDUCE as necessary to keep manifold pressure within limits

| NOTE |

Expect manifold pressure response to throttle movements to be sensitive.

Propeller . . . . AS REQUIRED
Mixture . . . . ADJUST to fuel flow for selected power setting
Continue Flight . . . . LAND AS SOON AS POSSIBLE

ENGINE ROUGHNESS

Engine instruments . . . . CHECK
Fuel Selector . . . . OTHER TANK
Mixture . . . . READJUST for smooth operation
Magneto/Starter Switch . . . . Select R or L or BOTH
If roughness disappears on single magneto, monitor power and continue on selected magneto.

//////////////////
//WARNING//
//////////////////

The engine may quit completely when one magneto is switched off if the other magneto is faulty. If this happens, close throttle to idle and mixture to idle cutoff before turning magnetos ON to prevent a severe backfire. When magnetos have been turned back ON, proceed to POWER LOSS - IN FLIGHT. Severe roughness may be sufficient to cause propeller separation. Do not continue to operate a rough engine unless there is no other alternative.

Throttle . . . . REDUCE
. . . . check for a throttle setting that may cause roughness to decrease.
If severe engine roughness cannot be eliminated, LAND AS SOON AS POSSIBLE.

COWL FLAPS FAILURE - FULL CLOSED POSITION

Acceptable engine operating temperatures can always be maintained in flight if cowl flaps fail in the full closed position using the following procedure:

Power . . . . AS REQUIRED
Mixture . . . . RICH
Airspeed . . . . 140 KIAS
Cylinder Head & Oil Temperature . . . . . MONITOR - *normal operating range*

HIGH CYLINDER HEAD TEMPERATURE

Mixture . . . . ENRICH As Necessary
Cowl Flaps . . . . OPEN as Required
Airspeed . . . . INCREASE As Required
Power . . . . . REDUCE — if temperature cannot be maintained within limits

HIGH OIL TEMPERATURE

| NOTE |

Prolonged high oil temperature indications will usually be accompanied by a drop in oil pressure. If oil pressure remains normal, then a high temperature indication may be caused by a faulty gauge or thermocouple.

Cowl Flaps . . . . OPEN *as required*
Airspeed . . . . INCREASE
Power . . . . REDUCE

PREPARE FOR POSSIBLE ENGINE FAILURE IF TEMPERATURE CONTINUES HIGH.

LOW OIL PRESSURE

Oil temperature and pressure gauges . . . . Monitor
Pressure below 25 PSI . . . . **EXPECT ENGINE FAILURE,**
. . . . *proceed to* **FORCED LANDING EMERGENCY.**

LOW FUEL PRESSURE

Fuel Boost Pump Switch . . . . ON
Throttle . . . . REDUCE to 34 In. or below
Fuel Pressure . . . . MONITOR
Fuel Boost Pump Switch . . . . OFF
If condition persists:
Fuel Boost Pump Switch . . . . ON
Repeat above procedures until Fuel Pressure stabilizes.
LAND AS SOON AS POSSIBLE

ENGINE DRIVEN FUEL PUMP FAILURE

An engine driven fuel pump failure is probable when low fuel pressure is indicated and when the engine will only operate with boost pump ON. Operation of the engine with a failed engine driven fuel pump and the BOOST PUMP **ON** will require smooth operation of engine controls and corresponding mixture change when throttle is repositioned or engine speed is changed. Always lean to obtain a smooth running engine.

The following procedure should be followed when a failed engine driven fuel pump is suspected:

Fuel Boost Pump Switch . . . . ON
Throttle . . . . CRUISE Position
Mixture . . . . ADJUST for smooth engine operation.
LAND AS SOON AS PRACTICABLE.

FUEL VAPOR SUPPRESSION (Fluctuating Fuel Pressure)

Fuel Boost Pump Switch . . . . ON
Fuel Flow . . . . MONITOR
Fuel Boost Pump Switch . . . . OFF
. . . . - (If condition still exists, REPEAT PROCEDURE).

FIRES

ENGINE FIRE-DURING START ON GROUND

Starter Switch . . . . Continue cranking or until fire is extinguished.

If engine starts:

Power . . . . 1500 RPM for several minutes
Engine . . . . . . SHUTDOWN and inspect for damage

If engine does NOT start:

Starter Switch . . . . CONTINUE CRANKING
Mixture . . . . IDLE CUTOFF (Full Aft)
Throttle . . . . FULL OPEN
Fuel Selector Valve . . . . OFF
Magneto/Starter Switch . . . . OFF
Master Switch . . . . OFF
Fire . . . . . EXTINGUISH with Fire Extinguisher(if available)

ENGINE FIRE - IN FLIGHT

Fuel Selector Valve . . . . OFF
Throttle . . . . CLOSED (Full Aft)
Mixture Control . . . . IDLE CUTOFF (Full Aft)
Magneto/Starter Switch . . . . OFF
Cabin Ventilation & Heating Controls . . . . . . .CLOSED (Controls Forward)
Cowl Flaps . . . . .CLOSED

NOTE

If fire is not extinguished, attempt to increase airflow over the engine by increasing glide speed and open cowl flap. Proceed with FORCED LANDING EMERGENCY as described on page 3-13. DO NOT attempt an engine restart.

ELECTRICAL FIRE IN FLIGHT (Smoke in Cabin)

Master Switch . . . . OFF

//////////////////
///WARNING///
//////////////////

Stall warning and landing gear warning are not available with Master Switch OFF.

Alternator Field Switch(es) . . . . OFF
Cabin Ventilation . . . . OPEN
Heating Controls . . . . . . CLOSED (Control Forward)
Circuit Breakers . . . CHECK to identify faulty circuit if possible
LAND AS SOON AS PRACTICABLE.

If electrical power is essential for the flight, attempt to identify and isolate the faulty circuit as follows:

Master Switch . . . . .ON
L. & R. Alternator Field Switches . . . . .ON

Select ESSENTIAL switches ON one at a time, and permit a short time to elapse before activating an additional circuit.

EMERGENCY DESCENT PROCEDURE

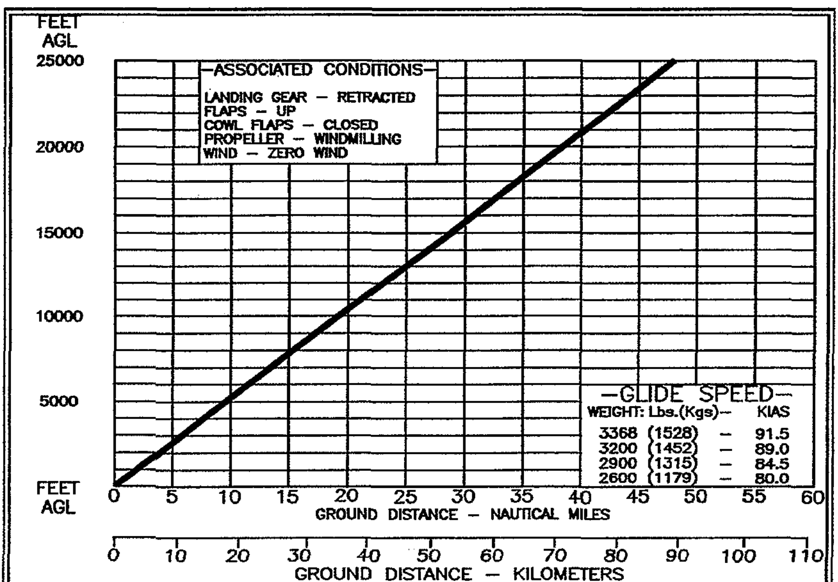
In the event an emergency descent from high altitude is required, rates of descent of at least 3,000 feet per minute can be obtained in two different configurations:(1) With landing gear and flaps retracted and cowl flap closed an airspeed of 195 KIAS will be required for maximum rate of descent.(2) With the landing gear extended, flaps retracted and cowl flap closed an airspeed of 165 KIAS will also give approximately the same rate of descent. At 165 KIAS and the gear extended, the angle of descent will be greater, thus resulting in less horizontal distance traveled than a descent at 195 KIAS. Additionally, a descent at 165 KIAS will provide a smoother ride and less pilot work load.
THEREFORE; The following procedure is recommended for an emergency descent:

Power	RETARD INITIALLY
Airspeed	140 KIAS
Landing Gear	EXTEND
Airspeed	INCREASE TO 165 KIAS after landing gear is extended.
Wing Flaps	UP
Cowl Flap	CLOSED
Power During Descent	MP not less than 15 In. Hg.
Airspeed	MAINTAIN 165 KIAS during descent.
Speedbrakes (If installed)	EXTEND
Altitude	AS DESIRED

~ CAUTION ~

Do not exceed 20" Hg. Manifold Pressure before cylinder head temperature is above 250° F (121° C).

GLIDE



**MAXIMUM GLIDE DISTANCE
MODEL M20M**

Note

Greater glide distances can be attained by moving the propeller control FULL AFT (LOW RPM).

FORCED LANDING EMERGENCY

GEAR RETRACTED OR EXTENDED

Emergency Locator Transmitter	ARMED
Seat Belts and Shoulder Harnesses	SECURE
Cabin Door	UNLATCHED
Fuel Selector	OFF
Mixture	IDLE CUTOFF
Magneto/Starter Switch	OFF
Flaps	Full DOWN
Gear	DOWN-If conditions permit
Approach Speed	80 KIAS
Master Switch	OFF, prior to landing

OVERWEIGHT LANDING PROCEDURES

In the event it is necessary to land with a weight exceeding 3200 Lbs. (1452 Kg.) (max. landing weight) the following procedure is recommended in addition to normal Approach For Landing procedures:

Approach Airspeed . . . . 80 KIAS
Use a flatter approach angle than normal, with power as necessary until a smooth touchdown is assured.
Expect landing distance over a 50 feet obstacle (Ref. Section V) to increase at least 600 ft.
Conduct Gear and Tire Servicing inspection as required (Ref. Section VIII).

SYSTEMS EMERGENCIES

PROPELLER

PROPELLER OVERSPEED

Throttle	RETARD
Oil Pressure	CHECK
Propeller	DECREASE set if any control available
Airspeed	REDUCE
Throttle	AS REQUIRED to maintain RPM below 2575 RPM

FUEL

LOW FUEL FLOW

Check mixture	ENRICH
Fuel Selector	Switch TANKS

If condition persists, use Boost Pump Switch if necessary and LANDING should be made as soon as PRACTICABLE.

ELECTRICAL

ALTERNATOR OVERVOLTAGE

(Alternator warning light illuminated steady and Alternator Field circuit breaker popped on affected alternator.)

Alternator Field Circuit Breaker . . . . RESET

If circuit breaker will not reset, the following procedures are required:

1. Monitor ammeter for discharge.
2. Reduce electrical load, if needed, to maintain a buss voltage of 28 VDC and to eliminate a discharge indication on ammeter.
3. Continue flight on the remaining alternator and land, when practical, to correct the malfunction.

ALTERNATOR OUTPUT LOW
(Alternator warning light flashing)

Affected Alternator Field Switch . . . . OFF then ON

If annunciator light still flashes:

Affected Alternator Field Switch . . . . OFF

1. Monitor ammeter for discharge.
2. Reduce electrical load, if needed, to maintain a buss voltage of 28 VDC and to eliminate a discharge indication on ammeter.
3. Continue flight on the remaining alternator and land, when practical, to correct the malfunction.

DUAL ALTERNATOR FAILURE

If alternators will not reset:
Non-esential electrical equipment . OFF to conserve battery power

LAND AS SOON AS PRACTICABLE

Battery endurance will depend upon battery condition and the electrical load on the battery.
If one battery becomes depleted, switch to the other battery.

LANDING GEAR

FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY

Airspeed . . . . 140 KIAS or less
Landing Gear Actuator Circuit Breaker . . . . . . PULL
Gear Switch . . . . DOWN
Manual Gear Extension Mechanism . LATCH FORWARD, LEVER BACK to engage manual extension mechanism

| NOTE |

Slowly pull "T" handle 1 to 2 inches (2.5 to 5.1 cm) to rotate clutch mechanism and allow it to engage drive shaft.

T-Handle . . . . PULL (12 to 20 times) and RETURN until gear is down and locked, GEAR DOWN light ON; STOP when resistance is felt.
Visual Gear Down Indicator . . . . . . CHECK alignment by viewing from directly above the indicator

~ CAUTION ~

Continuing to pull on T-Handle after GEAR DOWN light ON may bind actuator; electrical retraction MAY NOT be possible until binding is eliminated.

Return lever to normal position and secure with latch. Reset landing gear actuator circuit breaker.

////////////////
//WARNING//
////////////////
Do not operate landing gear electrically with manual extension system engaged

FAILURE OF LANDING GEAR TO RETRACT

AIRSPEED . . . . Below 107 KIAS
GEAR Switch . . . . UP Position

GEAR FAILS TO RETRACT
GEAR HORN - **SOUNDING;**
GEAR ANNUNCIATOR LIGHT & GEAR SAFETY BY-PASS LIGHT - **ILLUMINATED**

GEAR SAFETY BY-PASS SWITCH . . . . DEPRESS
. . . . HOLD until landing gear is fully retracted

"GEAR UNSAFE" and "GEAR DOWN" Lights . . . . EXTINGUISHED

"GEAR RELAYS" Ckt. Bkr . . . . PULL
. . . . (Warning Horn and Gear By Pass light will go OFF)
Check "Airspeed Safety Switch" or other malfunction as soon as practicable.
"GEAR RELAYS" Ckt. Bkr . . . . PUSH IN

GEAR FAILS TO RETRACT
GEAR HORN - **DOES NOT SOUND**
GEAR ANNUNCIATOR LIGHTS & GEAR BY-PASS LIGHT - **NOT ILLUMINATED**

EMERGENCY GEAR EXTENSION LEVER . . Verify LATCHED in proper position
GEAR RELAYS C/B . . . . RESET
FLIGHT . . . . CONTINUE (if desired)

When ready to extend landing gear:
AIRSPEED . . . . Below 140KIAS
GEAR RELAYS C/B . . . . RESET
GEAR SWITCH . . . . DOWN Position
If gear will not extend electrically, refer to FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY.

| NOTE |

If above procedures do not initiate retraction process, check emergency manual extension lever on floor for proper position.

VACUUM

When "HI/LO VAC" annunciator light illuminates (flashing or steady), vacuum operated instruments are considered to be unreliable. Push stand-by vacuum pump switch ON. The Hi/LO VAC annunciator light should extinguish and the STBY VAC annunciator will illuminate. The vacuum operated gyro instruments will be operating on the stand-by vacuum system.

OXYGEN

In the event of oxygen loss above 20,000 ft. refer to "EMERGENCY DESCENT PROCEDURE". Refer to SECTION X for the physiological characteristics of high altitude flight.

ALTERNATE STATIC SOURCE

The alternate static air source should be used whenever it is suspected that the normal static air sources are blocked. Selecting the alternate static source changes the source of static air for the altimeter, airspeed indicator and rate-of-climb from outside of the aircraft to the cabin interior.
When alternate static source is in use, adjust indicated airspeed and altimeter readings according to the appropriate alternate static source airspeed and altimeter calibration tables in SECTION V.

The alternate static air source valve is located on the instrument panel below pilot's control wheel.

| NOTE |

When using the Alternate Static Source the pilot's window and air vents MUST BE KEPT CLOSED.

Alternate Static Source . . . . PULL ON
Airspeed and Altimeter Readings . . CHECK Calibration Tables (Ref SECTION V)

UNLATCHED DOORS IN FLIGHT

CABIN DOOR

If cabin door is not properly closed it may come unlatched in flight. This may occur during or just after take-off. The door will trail in a position approximately 3 inches (7.6 cm) open, but the flight characteristics of the airplane will not be affected. Return to the field in a normal manner. If possible, secure the door in some manner to prevent it from swinging open during the landing.

If it is deemed impractical to return and land, the door can be closed in flight, after reaching a safe altitude, by the following procedures:

Airspeed . . . . 95 KIAS
Pilot's Storm Window . . . . OPEN
Aircraft . . . . RIGHT SIDESLIP (Right bank with left rudder)
Door . . . . PULL SHUT & LATCH

BAGGAGE DOOR

If baggage door is not properly closed, it may come unlatched in flight. This may occur during or after takeoff. The door may open to its full open position and then take an intermediate position depending upon speed of aircraft. There will be considerable wind noise; loose objects, in the vicinity of the open door, may exit the aircraft. There is no way to shut and latch the door from the inside; fly aircraft in normal manner; LAND AS SOON AS POSSIBLE and secure the baggage door.

Baggage Door latching mechanism . . . . . VERIFY PROPERLY ENGAGED
(inside latching mechanism) then shut from outside.

ICE PROTECTION

////////////////////
// WARNING //
////////////////////

DO NOT OPERATE IN KNOWN ICING CONDITIONS.

The Model M20M is **NOT APPROVED** for flight into known icing conditions and operation in that environment is prohibited. However, if those conditions are inadvertently encountered or flight into heavy snow is unavoidable, the following procedures are recommended until further icing conditions can be avoided:

INADVERTENT ICING ENCOUNTER

Pitot Heat . . . . ON
Propeller De-Ice . . . . ON (if installed)
Alternate Static Source . . . . ON (if required)
Cabin Heat & Defroster . . . . ON
Manifold Pressure Gauge . . . . . . MONITOR for any engine power reduction

Turn back or change altitude to obtain an outside air temperature less conducive to icing.

Move propeller control to maximum RPM to minimize ice build-up on propeller blades. If ice builds up or sheds unevenly on propeller, vibration will occur. If excessive vibration is noted, momentarily reduce engine speed with propeller control to bottom of GREEN ARC, then rapidily move control FULL FORWARD.

| NOTE |

Cycling RPM flexes propeller blades and high RPM increases centrifugal force which improves propeller capability to shed ice.

As ice builds on the airframe, move elevator control fore and aft slightly to break any ice build-up that may have bridged gap between elevator horn and horizontal stablilizer.

Watch for signs of induction air filter blockage due to ice build-up; increase throttle setting to maintain manifold pressure.

| NOTE |

If ice blocks induction air filter, alternate air sysem will open automaticallly.

With ice accumulation of 1/4 inch or more on the airframe, be prepared for a significant increase in aircraft weight and drag. This will result in significantly reduced cruise and climb performance and higher stall speeds. Play for higher approach speeds requiring highe power settings and longer landing rolls.

~ CAUTION ~

Stall warning system may be inoperative.

The defroster may not clear ice from windshield. If necessary open pilot's storm window for visibility in landing approach and touchdown.

With ice accumulations of 1 inch or less, use no more than 15^{0} wing flaps for approach and landing. For ice accumulation of 1 inch or more, fly approaches and landing with flaps retracted to maintain better pitch control. Fly approach speed at least 15 knots faster than normal, expect a higher stall speed resulting in higher touchdown speed with longer landing roll. Use normal flare and touchdown technique.

Missed approaches **SHOULD BE AVOIDED** whenever possible because of severly reduced climb performance. If a go-around is mandatory, apply full power, retract landing gear when obstacles are cleared; maintain 90 KIAS and retract wing flaps.

— AVOID FURTHER ICING CONDITIONS —

EMERGENCY EXIT OF AIRCRAFT

CABIN DOOR

PULL latch handle AFT.
OPEN door and exit aircraft.

BAGGAGE COMPARTMENT DOOR (Auxiliary Exit)

Release (Pull UP) rear seat back latches on spar.
Fold rear seat backs forward, CLIMB OVER.
PULL off plastic cover.
PULL latch pin.
Lift red handle "UP".
OPEN door and exit aircraft.

To **VERIFY RE-ENGAGEMENT** of baggage door, outside, latch mechanism:

Open outside handle fully.
Close inside RED handle to engage pin into cam slide of latch mechanism.
Place latch pin in shaft hole to hold RED handle DOWN.
Replace cover.
CHECK & operate outside handle in normal manner.

SPINS

////////////////
//WARNING//
////////////////

Up to 2,000 ft. altitude may be lost in a one turn spin and recovery; STALLS AT LOW ALTITUDE ARE EXTREMELY CRITICAL.

| NOTE |

The best spin avoidance technique is to avoid flight conditions conducive to **spin entry. Low speed flight near stall should be approached with caution and excessive flight control movements in this flight regime should be avoided. Should an unintentional stall occur, the aircraft should not be allowed to progress into a deep stall. Fast, but smooth stall recovery will minimize the risk of progressing into a spin. If an unusual post stall attitude develops and results in a spin, quick application of antispin procedures should shorten the recovery.**

INTENTIONAL SPINS ARE PROHIBITED.

In the event of an inadvertent spin, the following recovery procedure should be used:

Throttle . . . . RETARD to IDLE
Ailerons . . . . NEUTRAL
Rudder . . . . Apply FULL RUDDER *opposite direction of spin*

Control Wheel . . . . FORWARD of neutral in a brisk motion

ADDITIONAL FORWARD elevator control may be required if rotation does not stop.

—— HOLD ANTI-SPIN CONTROLS UNTIL ROTATION STOPS ——

Wing Flaps (If extended) . . . . RETRACT as soon as possible
Rudder . . . . NEUTRALIZE when spin stops
Control Wheel . . . . SMOOTHLY MOVE AFT
to bring the nose up to level flight attitude.

OTHER EMERGENCIES

Refer to SECTION IX for Emergency Procedures of Optional Equipment.

TABLE OF CONTENTS

TABLE OF CONTENTS (con't.)

INTRODUCTION

This section describes the recommended procedures for the conduct of normal operations for the airplane. All of the required (FAA regulations) procedures and those necessary for operation of the airplane as determined by the operating and design features of the airplane are presented.

These procedures are provided to present a source of reference and review and to supply information on procedures which are the same for all aircraft. Pilots should familiarize themselves with the procedures given in this section in order to become proficient in the normal operations of the airplane.

Normal procedures associated with those optional systems and equipment which require handbook supplements are provided by Section IX (Supplemental Data).

SPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 3368 pounds and may be used for any lesser weight. However, to achieve the performance specified in Section V for takeoff distance and climb performance, the speed appropriate to the particular weight must be used.

TAKEOFF:

Normal Climb Out . . . . 80-90 KIAS

Short Field Takeoff, Speed At 50 Ft. . . . . 75 KIAS

ENROUTE CLIMB, GEAR and FLAPS UP:

Best Rate of Climb . . . . .105 KIAS

Best Angle of Climb . . . . 85 KIAS

LANDING APPROACH (3200 lbs.):

Normal Approach, Flaps 10 degrees . . . . . . 80 KIAS

Normal Approach, Flaps 33 degrees . . . . . . 75 KIAS

Short Field Approach, Flaps 33 degrees . . . . . 70 KIAS

BALKED LANDING (3200 lbs.):

Maximum Power, Flaps 10 degrees . . . . 85 KIAS

MAXIMUM RECOMMENDED TURBULENT AIR PENETRATION SPEED:

3368 lbs./1528 Kgs . . . . .127 KIAS

3200 lbs./1452 Kgs . . . . .123 KIAS

2900 lbs./1315 Kgs . . . . .117 KIAS

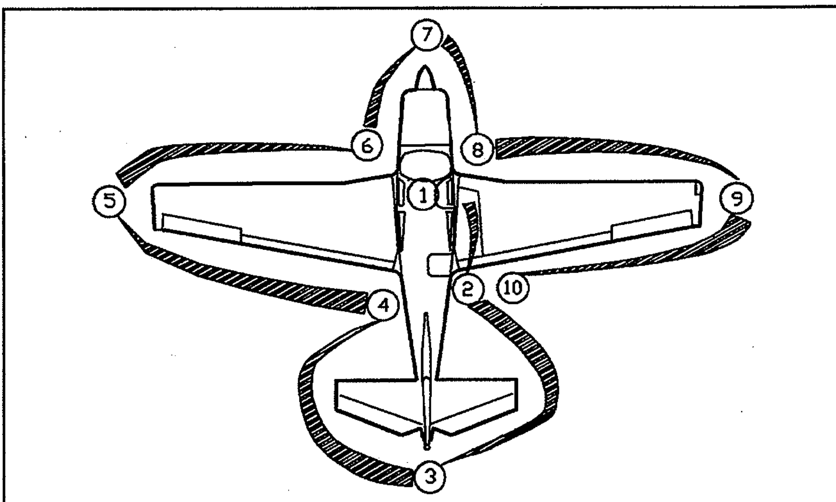
2600 lbs./1179 Kgs . . . . .111 KIAS

2400 lbs./1089 Kgs . . . . .106 KIAS

MAXIMUM DEMONSTRATED CROSSWIND VELOCITY:

Takeoff or Landing . . . . 13 Knots
(This is NOT a Limitation)

(See CROSSWIND COMPONENT CHART, Section V)



PREFLIGHT INSPECTION

1. Cockpit -
Gear Switch . . . . DOWN
Magneto/Starter Switch . . . . OFF
All Rocker Switches . . . . OFF
Master Switch . . . . ON
All Circuit Breakers . . . . IN
Battery Select Switch . . . . SELECT from 1 to 2 or 2 to 1.
CHECK Voltmeter after each selection. Leave on Battery with highest voltage.
Internal/External Lights . . . . CHECK operation
(Check for ammeter fluctuations as each light is checked)
Pitot Heat Switch . . . . ON
(Check Pitot Heat annunciator light illuminated)
Fuel Quantity Gauges . . . . CHECK QTY
Fuel Selector
It is recommended that wing tank sumps be drained prior to draining Gascolator.
. . . . Rt. Tank: Pull Gascolator ring (5 seconds)
Lt. Tank: Pull Gascolator ring (5 seconds)
Oxygen Supply Control Knob . . . . OFF
Oxygen Pressure Gauge . . . . CHECK
Verify adequate oxygen supply for trip, (if use of oxygen is anticipated), refer to oxygen duration chart (Fig. 7-13).
Also check that face masks and hoses are accessible and in good condition.

2. Right Fuselage/Tailcone
Oxygen Filler Access Door and Filler Cap . . . . SECURED
Battery # 2 Access Panel . . . . SECURED
Instrument Static Pressure Port . . . . UNOBSTRUCTED
General Skin Condition . . . . INSPECT
Tailcone/Empennage Access Panel . . . . SECURED
Tail tiedown rope/chain . . . . REMOVE

3. Empennage
Elevator and rudder attach points and control linkage attachments . . . . INSPECT
Empennage Freeplay-Vertical/Horizontal . . . . INSPECT
General skin condition . . . . INSPECT
Remove ice, snow, or frost.

4. LEFT FUSELAGE

Cabin Fresh Air Vent (Dorsal Fin)	UNOBSTRUCTED
Tailcone/Empennage Access Panel	SECURED
Instrument Static Pressure Port	UNOBSTRUCTED
Avionics/Battery # 1 Access Panel	SECURED
Auxiliary Power Plug Access Door	SECURED
Static System Drain	PUSH Plunger UP, (Hold 3-5 Seconds)
General Skin Condition	CHECK

5. LEFT WING

General Skin Condition	CHECK Remove all ice, snow, or frost.
Wing Flap attach points	CHECK
Aileron attach points	CHECK
Control linkages	CHECK
Wing Tip, Lights and Lens	CHECK
Fuel Tank Vent	UNOBSTRUCTED
Pitot Tube	UNOBSTRUCTED/SECURED Heat element Operative
Landing/Taxi Lights	CHECK Lens & Bulbs
Stall Switch Vane	CHECK operation
Fuel Tank	CHECK QUANTITY/SECURE CAP

| NOTE |

The optional visual fuel quantity gauge is to be use for partial refueling purposes only; DO NOT use for preflight quantity check.

Tiedown	REMOVE
Wheel chock	REMOVE
Main Landing Gear, shock discs,tire & doors	CHECK
Fuel Tank Sump Drain	DRAIN

Use sampler cup to VERIFY fuel is free of water, sediment & other contamination;
VERIFY proper fuel (BLUE/100LL)(GREEN/100).
VERIFY drain closes and does not leak.

Pitot System Drain	PUSH plunger UP, (Hold for 3-5 seconds)

6. LEFT COWL AREA

Windshield	CLEAN
Left Side Engine Cowl Fasteners	SECURED
Cowl Flap	CHECK
Exhaust Pipe	CHECK SECURED
Engine Oil Filler Door	OPEN & INSPECT AREA

| NOTE |

The engine compartment must be free of foreign objects which could result in possible over heating and serious damage to the engine.

Engine Oil	CHECK QUANTITY 10 Qts.(9.5 li) MAX/6 Qts. (5.7 li)Minimum quantity for flight
Engine Oil Filler Door	CLOSE & SECURE
Cooling Air Inlet	Verify UNOBSTRUCTED

7. PROPELLER/SPINNER & FRONT COWL AREA

Propeller/Spinner	CHECK for nicks, cracks, oil leaks/rotational movement.
Prop De-Ice Boots (if installed)	CHECK condition
Induction Air Inlet/Filter	UNOBSTRUCTED
Nose gear, shock discs, tire & doors	CHECK
Wheel chock	REMOVE

8. RIGHT COWL AREA

Right Side Engine Cowl Fasteners	SECURED
Cooling Air Inlet	Verify UNOBSTRUCTED
Intercooler Inlet	UNOBSTRUCTED
Cowl Flap	CHECK
Windshield	CLEAN
Cabin Air Inlet	UNOBSTRUCTED

9. RIGHT WING

Gascolator Drain Valve	CLOSED(check for drips)
Fuel Tank Sump Drain	DRAIN

Use sampler cup to VERIFY fuel is free of water, sediment & other contamination.

VERIFY proper fuel (BLUE/100LL)(GREEN/100).
VERIFY drain closes and does not leak.

Right main gear, shock discs, tire & doors	CHECK
Wheel chock	REMOVE
General Skin Condition	CHECK Remove ice, snow and frost.
Fuel Tank	CHECK QUANTITY/SECURE CAP

| NOTE |

The optional visual fuel quantity gauge is to be use for partial refueling purposes only; DO NOT use for preflight quantity check.

Tiedown	REMOVE
Fuel Tank vent	UNOBSTRUCTED
Landing/Taxi Lights	CHECK Lens & Bulbs
Wing tip, lights and lens	CHECK
Aileron and attach points	CHECK
Wing Flap and attach points	CHECK
Control linkages	CHECK

10. Baggage Door

Baggage Door	VERIFY SECURED (VERIFY inside handle is properly secured) (CHECK outside handle operation)

RETURN TO COCKPIT -- MASTER/ROCKER SWITCHES . . OFF

BEFORE STARTING CHECK

Preflight Inspection	COMPLETED
Seats, Seat Belts/Shoulder Harness (one occupant per restraint)	ADJUST & SECURED
Magneto/Starter Switch	OFF
Master Switch	OFF
Alternator Field Switches	OFF
Radio Master Switch	OFF
Fuel Boost Pump	OFF
Directional Gyro (slave/free switch)	SLAVED (If installed)
Circuit Breakers	CHECK - ALL IN
ELT Switch	ARMED
Rocker Switches	OFF
Alternate Static Source	Push OFF
Throttle	CLOSED
Propeller	FULL FORWARD (HIGH RPM)
Mixture	IDLE CUT-OFF
Cowl Flaps	VERIFY-FULL OPEN
Parking Brakes	SET
Wing Flap Switch	FLAPS UP
Defrost	PUSH OFF
Cabin Heat	PUSH OFF
Cabin Vent	AS DESIRED
Fuel Selector	FULLEST TANK
All Rocker Switches	OFF
Landing Gear Switch	DOWN
RED Emergency Gear Extension Handle	DOWN AND LATCHED
Internal Lights	OFF
Passenger Briefing	COMPLETED (Emergency and general information briefing)

Refer to SECTION IX for Optional Equipment Procedures and Checks.

Obtain local information prior to engine start.

ENGINE START

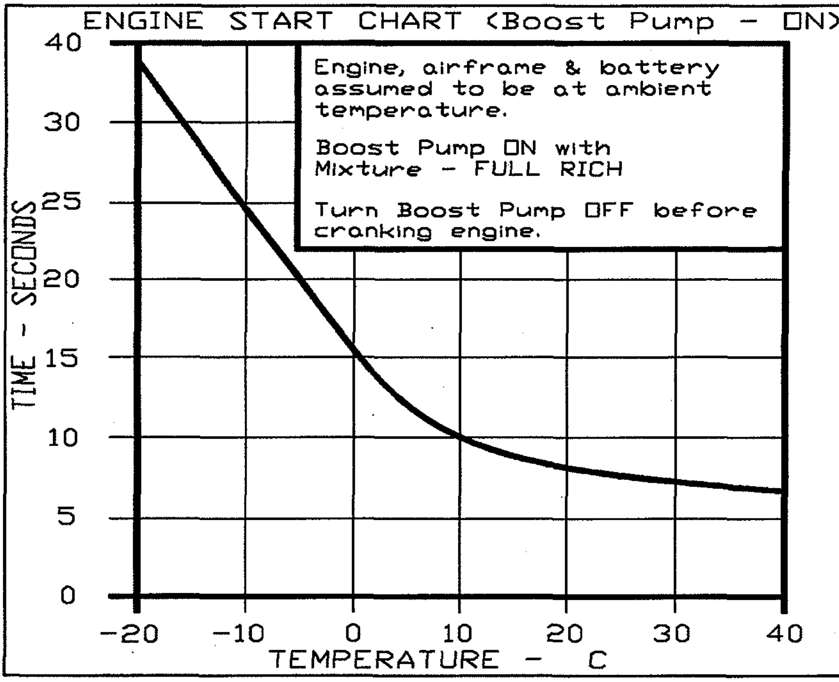
| NOTE |

When starting engine using the approved external power source no special starting procedure is necessary. Use normal starting procedures below. DO NOT START THE ENGINE IF BOTH BATTERIES ARE COMPLETELY DEAD; recharge dead batteries for at least one hour before starting engine. Only No. 1 battery (left side of tailcone) is connected to the Auxiliary Power plug.

Before Starting Checklist	COMPLETED
Throttle	OPEN 1/4 in.
Cowl Flaps	OPEN
Propeller	FULL FWD(High RPM)
Mixture	Full Forward (RICH)
Master Switch	ON
Alternator Field Switches	ON
Annunciator Lights	PRESS TO TEST (All lights should illuminate)
Fuel Boost Pump	ON (See ENGINE START CHART for time vs. temperature)

~ CAUTION ~

For engine operation at outside air temperatures below -25° C (-13°F), the engine and engine oil should be preheated to at least -25° C (-13°F) before the engine is started.



~ CAUTION ~

When either battery voltage is low, inspection should be conducted to determine condition of battery and/or reason for battery being low. Replacement or servicing of batteries is essential and charging for at least one hour should be done before engine is started. Batteries must be serviceable and it is recommended that batteries be fully charged to operate aircraft. Electrical components may also be damaged if aircraft is operated when batteries are low.

Fuel Boost Pump . . . . OFF
Propeller Area . . . . CLEAR
Magneto/Starter Switch . . . . TURN & PUSH to START, release to BOTH when engine starts.
If No. 1 battery will not start engine . . . . SELECT No. 2 battery

| NOTE |

"START POWER" warning light should illuminate when Magneto/Starter switch is in "START" position.

| NOTE |

Cranking should be limited to 30 seconds, and several minutes allowed between cranking periods to permit the starter to cool.

Throttle . . . . IDLE 700 - 750 RPM
* Engine Oil Pressure . . . . CHECK in GREEN ARC
If minimum oil pressure is not indicated within 30 seconds, accomplish engine shutdown procedures.

* Volt meter	CHECK (26-28 VDC) Turn LDG LT ON & observe Negative movement of needle.
* Interior/Exterior Lights	AS DESIRED
* Engine Instruments	CHECKED
* Fuel Flow Indicator	TEST/RESET (if desired)

~ CAUTION ~

Do not operate engine above 1000 RPM unless oil temperature is 75° F (24°C) minimum. Operation of engine above 1000 RPM at temperatures below 75° F (24°C) may damage engine.

FLOODED ENGINE START

Fuel Boost Pump	OFF
Throttle	1/ 2 OPEN
Mixture	IDLE CUTOFF
Magneto/Starter Switch	TURN & PUSH to START release to BOTH when engine starts.
Mixture	FULL RICH
Throttle	IDLE 700 - 750 RPM

* SEE REMAINING ENGINE START PROCEDURES ABOVE.

WARM ENGINE START

Throttle	OPEN 1/8
Mixture	FULL FORWARD
Fuel Boost Pump	ON-PRIME engine for 1 to 3 seconds **(DO NOT PRIME, IF ENGINE IS HEAT SOAKED)**
Magneto/Starter Switch	TURN & PUSH to START release to BOTH when engine starts.
Throttle	IDLE 700 - 750 RPM

* SEE REMAINING ENGINE START PROCEDURES ABOVE.

BEFORE TAXI

Engine Start Checklist	COMPLETED
Radio Master Switch	ON
Elevator Trim Switch	ON
Internal/External Lights	As Desired
Directional Gyro	SET or Slave switch ON
Instruments	Normal Operation
Altimeter	SET
Radios	CHECKED and SET
Fuel Selector	SWITCH TANKS verify engine runs on other tank
Cowl Flaps	FULL OPEN or As Desired
Cabin Heat	AS DESIRED
Defroster	AS DESIRED
Cabin Vent	AS DESIRED
Optional Equipment Checks	Reference SECTION IX.

| NOTE |

During cold weather, ground operations may be conducted with cowl flaps positioned partially or fully closed to help keep engine temperatures in normal operational ranges prior to takeoff. However, if cowl flaps are fully closed operations, monitor engine temperatures to avoid exceeding maximum allowable limits.

TAXI

Before Taxi Checklist	COMPLETED
Rudder Trim	AS DESIRED

CAUTION

With rudder trim in the full right position, the aircraft will tend to steer to the right during taxi.

Parking brake	**PUSH OFF**
Brakes	**CHECK**
Directional Gyro	Proper indication during turns
Turn Coordinator	Proper indication during turns
Artificial Horizon	**ERECT** during turns
Throttle	Minimum power
Cowl Flaps	OPEN or As Desired
Propeller	Full Forward (HIGH RPM)

| NOTE |

If necessary, increase RPM slightly to extinguish a flashing " L or R ALT VOLTS" annunciator light.

BEFORE TAKEOFF

Taxi Checklist	COMPLETED
Parking Brake	**SET**
Fuel Selector	**FULLEST TANK**
Throttle	1000 RPM
Oil Temperature	100°F minimum
CHT	250°F minimum
Alternate Air	Verify CLOSED
Throttle	2000 RPM
Magneto Switch	**CHECK** - BOTH to L, BOTH to R, BOTH

Verify engine operates smoothly on each magneto separately. (150 RPM MAX drop on each magneto, 50 RPM MAX difference)

| NOTE |

An absence of RPM drop may be an indication of faulty magneto grounding or improper timing. If there is doubt concerning ignition system operation, RPM checks at a leaner mixture setting or higher engine speed will usually confirm whether a deficiency exists.

Ammeter	CHECK Positive Charge Indication
Propeller	CYCLE/Return to high RPM
Throttle	RETARD to 1000 RPM
Boost Pump Switch	ON-Verify annunciator light will illuminate BLUE
Boost Pump Switch	OFF (Full throttle position will automatically turn Boost Pump ON)
Elevator Trim	TAKEOFF SETTING
Rudder Trim	TAKEOFF SETTING
Wing Flaps	CHECK operation. SET AT TAKEOFF position (10 Degrees)
Flight Controls	CHECK free and correct movement
Avionics and Auto Pilot	CHECK - (Refer to Section IX)
Seats, Seat Belts and Shoulder Harness	SECURED
Cabin Door	CHECK SECURED
Pilots Window	CLOSED
Internal/External Lights	AS DESIRED

Parking Brake . . . . RELEASE
Strobe Lights . . . . ON

TAKEOFF PROCEDURES

~~~~~~~~~
~ CAUTION ~
~~~~~~~~~

Proper engine operation should be checked early in the takeoff roll. Any significant indication of rough or sluggish engine response is reason to discontinue the takeoff.
When takeoff must be made over a gravel surface, it is important that the throttle be applied SLOWLY. This will allow the aircraft to start rolling before a high RPM is developed, and gravel or loose material will be blown back from the propeller area instead of being pulled into it.

TAKEOFF

If the turbocharger and its controlling system are properly rigged, manifold pressure will increase to 35 to 38 in. Hg. when the throttle is full open. However, engine operation with oil temperature below 100° F will result in an overboost (manifold pressure above 38 in. Hg.). If an overboost occurs, retard throttle to lower manifold pressure below 38 in. Hg. and continue flight. As the oil warms above 100° F, throttle can be moved to full throttle position and controller will maintain proper manifold pressure for maximum continuous power.
Full throttle operation during hot weather conditions may result in manifold pressure over 38 in. Hg. If this occurs retard the throttle below 38 in. Hg. and continue flight.

Power . . . . **FULL THROTTLE** (2575 RPM)
Annunciator . . . . CHECK
(BLUE Boost Pump Light - **ON**)
Engine Instruments . . . . . . CHECK for proper indications
Lift Off/Climb Speed . . . . As specified in Section V
. . . . (Takeoff Distance)
Landing gear . . . **RETRACT IN CLIMB** after clearing obstacles.
Wing flaps . . . . UP
Fuel Pressure . . . . 24 PSI (minimum)

| NOTE |

If maximum performance takeoffs are desired obtain full power before brake release and lift off at 65 KIAS and climb at 75 KIAS.

CLIMB PROCEDURES

| NOTE |

If applicable,use noise abatement procedures as required.

CLIMB (CRUISE CLIMB)

Power . . . . 34 In. Hg./2400 RPM)
Mixture . . . . RICH
Cowl Flaps . . . . FULL OPEN or AS REQUIRED
Rudder Trim . . . . As Desired
Airspeed . . . . 120 KIAS

| NOTE |

See Section V, for rate of climb graph.

CLIMB (BEST RATE)(V_y)

Power . . . . FULL THROTTLE /2575 RPM
(DO NOT EXCEED 38" MP)
Mixture . . . . RICH
Cowl Flaps . . . . FULL OPEN
Rudder Trim . . . . As Desired
Airspeed . . . . 105 KIAS

CLIMB (BEST ANGLE)(V_x)

Power . . . . FULL THROTTLE/2575 RPM
(DO NOT EXCEED 38" MP)
Mixture . . . . RICH
Cowl Flaps . . . . FULL OPEN
Rudder Trim . . . . As Desired
Airspeed . . . . 85 KIAS

CRUISE

| NOTE |

Use recommended engine break-in procedures as published by engine manufacturer.

Airspeed . . . . **ACCELERATE** to cruise airspeed
Throttle . . . . SELECTED SETTING
(Ref. CRUISE PERFORMANCE CHARTS in SECTION V)

As the throttle is reduced, the BOOST PUMP annunciator light will extinguish. Verify fuel pressure remains in GREEN arc.

| NOTE |

Prolonged climbs to high cruise altitudes during hot weather operations may result in some fuel pressure fluctuations when the throttle is reduced. If fluctuations occur, turn Boost Pump Switch ON until cooling has alleviated fluctuations.

Propeller . . . . Set RPM to selected setting
Mixture . . . . LEAN TO PEAK TIT
(See CAUTION below)

~ ~ ~ ~ ~ ~
~ CAUTION ~
~ ~ ~ ~ ~ ~

Operation at a TIT in excess of 1750° F(954°C). is prohibited. Cruise power settings at and below 34 in. Hg., 2400 RPM, peak TIT or 1750° F. (954°C), which ever is lower, are permitted from sea level to 25,000 ft. However, at altitudes above 22,000 ft, power settings above 32 In. Hg. must be operated at 1650° F(898°C)(best power mixture) or richer.

| NOTE |

Cruise operation at BEST POWER will result in a substantial increase in fuel flow, greatly decreasing range and endurance; reference charts published in SECTION V.

Engine instruments . . . . **CHECK**

| NOTE |

Careful leaning of the mixture control will result in best fuel efficiency. This requires operating at peak TIT (where permissable) for the power setting being used. Failure to do so will result in excessive fuel burn. After leveling off at cruise altitude, set MP and RPM for desired power setting per Cruise Power Chart in Section V. Slowly lean Mixture until TIT reaches peak value. TIT indications become sensitive as peak is approached; careful adjustments are necessary for accurate setting. Changes in altitude or power MAY REQUIRE readjustment of TIT.

DO NOT LEAN ONLY TO TIT, ALL ENGINE GAUGES SHOULD BE IN NORMAL OPERATING RANGES FOR OPTIMUM AND PROPER ENGINE OPERATION.

Cowl Flaps . . . . AS REQUIRED
to maintain cylinder head and oil temperatures in normal operation ranges.

~ CAUTION ~

When cruising in conditions where OAT is well above standard or at very high altitudes, it may be necessary to slightly OPEN cowl flaps in order to keep engine temperatures within operating limits. When the cowl flaps are OPEN during cruise the following effects on cruise speed will result:

Cowl Flaps - 1/2 Open . . . . Approx. loss in TAS 2.5 KTS

Engine temperatures . . . . STABILIZE at cruise condition.
Rudder Trim . . . . As Desired

When increasing power always return mixture to full rich, then increase RPM before increasing manifold pressure; when decreasing power decrease manifold pressure before reducing RPM. Always stay within the established operating limits, and always operate the controls slowly and smoothly.

FUEL TANK SELECTION

Fuel Boost Pump Switch . . . . ON
Fuel Selector . . . . OPPOSITE TANK
Fuel Boost Pump Switch . . . . OFF
(Observe Fuel Pressure Gauge for Proper Pressure Reading)

OXYGEN SYSTEM

// WARNING //

Greasy lipsticks and waxed mustaches have been known to ignite spontaneously inside oxygen masks. Passengers should be suitably advised prior to flight.

For safety reasons no smoking should be allowed in the airplane while oxygen is being used.

When ready to use the oxygen system, proceed as follows:
Mask and Hose . . . . SELECT - either MIC or STD
Adjust mask to face and adjust metallic nose strap for snug mask fit.
Delivery Hose . . . . PLUG INTO OUTLET assigned to that seat.

| NOTE|

When the oxygen system is turned on, oxygen will flow continuously at the appropriate rate of flow for the altitude without any manual adjustments.

Oxygen Supply Control Knob . . . . ON.
Face Mask Hose Flow Indicator . . . . CHECK

Oxygen is flowing if the indicator is being forced toward the mask.
Delivery Hose . UNPLUG from outlet when discontinuing use of oxygen. This automatically stops the flow of oxygen.
Oxygen Supply Control Knob .OFF when oxygen is no longer required.

WARNING

Proper oxygen flow is critical to pilot/passenger safety, especially at altitudes above 20,000 ft. MSL. It is important to monitor closely the face mask hose flow indicator to ensure oxygen is constantly flowing to the mask. A green indication on the flow indicator denotes proper oxygen flow. Always place the flow indicator in a position where it is in the normal scan area of the cockpit.

Refer to duration chart (Fig. 7-13) for safe operational quantities.

DESCENT PROCEDURES

| NOTE |

Avoid extended descents at manifold pressure setting below 15 In.Hg. as the engine can cool excessively and may not accelerate satisfactorily when power is reapplied. Additionally, leaning the mixture to peak TIT during descent will save fuel and will eliminate any engine roughness associated with an overly rich mixture setting. During descent engine MP will tend to increase as the aircraft loses altitude. Occasional power reductions with the throttle may be required to maintain the original descent manifold pressure setting.

NORMAL - GEAR UP

Seats, Seat Belts, Shoulder Harness	ADJUST AND SECURE
Wing Flaps	**UP**
Landing Gear	**UP**
Throttle	ABOVE 15 In. Hg. (keep CHT in Green)
Propeller	2400 RPM
Mixture	Peak TIT
Cowl Flaps	CLOSED
CHT	MONITOR (250° F minimum)
Airspeed	AS DESIRED(195 KIAS max.)
Rudder Trim	AS DESIRED

| NOTE |

Plan descents to arrive at pattern altitude on downwind leg for maximum fuel effeciency and minumum aircraft noise.

~ CAUTION ~

DO NOT fly in the YELLOW ARC speed range unless the air is smooth.

NORMAL - GEAR DOWN

Seats, Seat Belts, Shoulder Harness	ADJUST AND SECURE
Airspeed	**DECELERATE** to 140 KIAS
Landing Gear	**DOWN**
Throttle	ABOVE 15 In. Hg. (Keep CHT in Green Arc)
Propeller	2400 RPM
Mixture	Peak TIT
Cowl Flaps	Closed
Cylinder Head Temperature	Monitor (250 ° F min)
Airspeed	165 KIAS or LESS.

| NOTE |

Using the landing gear as a descent aid will result in a steeper descent rate (greater altitude loss per horizontal distance traveled).

APPROACH FOR LANDING

~ CAUTION ~

The airplane must be within the allowable weight and balance envelope for landing (REF. Section VI). It will require a minimum of one hour of flight before a permissable landing weight is attained when takeoffs are made at maximum gross weight. If a landing at a weight exceeding maximum landing weight (3200 Lbs.)(1452 Kgs.) is required, see OVERWEIGHT LANDING PROCEDURE, Section III.

Seats, Seat Belts, Shoulder Harness	ADJUST AND SECURE
Internal/External lights	AS DESIRED
Landing gear	**DOWN** below 140 KIAS (Check Gear Down light **ON**-Check visual indicator)
Boost Pump	**ON**
Fuel Selector	**FULLEST TANK**
Wing flaps	AS DESIRED (FULL down below 110 KIAS)
ElevatorTrim	AS DESIRED
Rudder Trim	AS DESIRED

~ CAUTION ~

To minimize control wheel forces during maneuvering, timely nose-up trimming is recommended to counteract the nose down pitching moment as power is reduced and/or the flaps are extended

Parking Brake	VERIFY **OFF**

GO AROUND (BALKED LANDING)

Power	FULL FORWARD/2575 RPM)
Mixture	Verify FULL RICH
Boost Pump	Verify ON(BLUE light on Annunciator) (Full Throttle automatically turns Boost Pump ON)
Wing Flaps	**TAKEOFF POSITION** (10°) (After POSITIVE climb established)
Trim	NOSE DOWN to reduce forces

~ CAUTION ~

To minimize control wheel forces during maneuvering, timely nose-down trimming is recommended to counteract the nose up pitching moment as power is increased and/or the flaps are retracted.

Airspeed	85 KIAS
Landing Gear	RETRACT
Wing Flaps	RETRACT
Airspeed	105 KIAS

LANDING

Approach for Landing Checklist	COMPLETED
Wing Flaps	FULL DOWN
Landing Gear	DOWN and LOCKED
Approach Airspeed	As specified In Section V (Landing Distance)
Touchdown	**MAIN WHEELS FIRST**
Landing Roll	**LOWER** nose wheel gently
Brakes	**MINIMUM** required

NOTE

Landing information for reduced flap settings are not available. See Section V for Landing Distance tables.

NOTE

If maximum performance landings are desired, use the above procedures except, reduce the approach airspeed to 70 KIAS (flaps full down) and apply maximum braking (without skidding tires) during rollout.

NOTE

Crosswind landings should be accomplished by using the above procedures except maintain approach speed appropriate for the wind conditions. Allow aircraft to crab until the landing flare. Accomplish the touchdown in a slight wing low sideslip (low wing into the wind) and the aircraft aligned with the runway. During the landing roll, position the flight controls to counteract the crosswind.

~ CAUTION ~

The landing gear may retract during landing roll if landing gear switch is placed in the UP position.

TAXI AFTER LANDING

Throttle	AS REQUIRED
Boost Pump	OFF
Cowl Flaps	**OPEN**
Wing Flaps	**RETRACT**
Elevator Trim	**TAKEOFF SETTING**
Avionics/Radios	AS REQUIRED
Interior/Exterior Lights	AS DESIRED

SHUTDOWN

~ CAUTION ~

Operate the engine at idle (below 1000 RPM) for 5 minutes to allow the TURBOCHARGER to COOL. Taxi time after landing may be considered as part of the 5 minutes.

Parking brake	**SET**
Throttle	700 - 750 RPM
Radio Master Switch	**OFF**

Interior/Exterior Lights	**OFF**
Pitot Heat	**OFF**
Mixture	**IDLE CUT-OFF**
Alternator Field Switches (L/R)	**OFF**
Master Switch	**OFF**
Magneto/Starter Switch	**OFF**

SECURING THE AIRCRAFT

Magneto/Starter Switch	**VERIFY OFF**/ Key removed
Master Switch	VERIFY **OFF**
Radio Master Switch	Verify **OFF**
Rocker Switches	Verify **OFF**
Interior Light Switches	VERIFY **OFF**
Parking Brake	**RELEASE** - INSTALL WHEEL CHOCKS
Extended parking	**CONTROL WHEEL SECURED** with seat belts, cabin vents closed;
Cabin Windows and Doors	CLOSED AND LOCKED

TIE DOWN AIRCRAFT at wing and tail points.

TABLE OF CONTENTS

TABLES AND CHARTS

TABLE OF CONTENTS (con't)

INTRODUCTION

The purpose of this section is to present the owner or operator with information needed to facilitate planning of flights with reasonable accuracy.
The Performance Data and charts presented herein are calculated, based on actual flight tests with the airplane and engine in good condition and the engine power control system properly adjusted.
The flight test data has been corrected to International Standard Atmosphere conditions and then expanded analytically to cover various airplane gross weights, operating altitudes, and outside air temperatures.

VARIABLES

It is not possible to make allowances in the charts for varying levels of pilot technique, proficiency or environmental conditions. Mechanical or aerodynamic changes are not authorized because they can affect the performance or flight characteristics of the airplane. The effect of such things as soft runways, sloped runways, winds aloft or airplane configuration changes must be evaluated by the pilot. However, the performance on the charts can be duplicated by following the stated procedures in a properly maintained, standard MOONEY M20M.

Examples are given to show how each chart is used. The only charts with no example are those where such an example of use would be repetitive.

To obtain effect of altitude and OAT on aircraft performance:

1. Set altimeter to 29.92 and read "pressure altitude".

2. Using the OAT grid for the applicable chart read the corresponding effect of OAT on performance.

~ ~ ~ ~ ~ ~
~ CAUTION ~
~ ~ ~ ~ ~ ~

Be sure to return to local altimeter setting in calculating aircraft elevation above sea level.

OPERATIONAL PROCEDURES FOR MAXIMUM FUEL EFFICIENCY

For maximum fuel efficiency on the M20M, proper mixture leaning during cruise flight must be accomplished. The Textron-Lycoming TIO-540-AF1A or AF1B engine in the M20M has been designed to attain maximum fuel efficiency at desired cruise power and peak TIT (turbine inlet temperature). Best power mixture (at 34 in. Hg./2400 RPM) has been determined to be 1650°F (898°C) TIT. TIT is usually a more accurate indication of engine operation and fuel burn than indicated fuel flow. Therefore, it is recommended that the mixture be set using TIT as the primary reference instead of setting to a particular fuel flow.

The following procedures is recommended for setting cruise power and leaning to recommended TIT.

1. After leveling off, set manifold pressure and RPM for the desired cruise power settings (as shown in this SECTION). At this point, mixture is at full rich from the climb.

2. Slowly move mixture control toward lean while observing TIT indicator. If leaning mixture toward peak TIT causes the original manifold pressure setting to change, adjust throttle to reset the desired cruise manifold pressure and continue leaning.
Continue this procedure until TIT peaks (not to exceed 1750° F (954° C)). Peak TIT is defined as that point where further leaning causes a drop rather than a rise in TIT, or until best power TIT is obtained (whatever is desired). Several throttle and mixture adjustments may be required before peak TIT and the desired cruise manifold pressure are obtained.

3. Under conditions of high outside air temperatures and high power, peak TIT may be found to be in excess of 1750°F (954° C). If that is found to be the case, the leanest allowable condition for operation will be at 1750° F (954° C) TIT.

NOTE
When operating above 22,000 feet, and at manifold pressures above 32 In. Hg. only best power mixture (1650°F (898°C) TIT or richer is permitted.

PERFORMANCE CONSIDERATIONS

RANGE and ENDURANCE ASSUMPTIONS

Range and endurance allowance is based on climbing at maximum continuous power to cruise altitude.
Range and endurance reserves of 45 minutes at cruise power have been allowed for. Other conditions used for Range and Endurance are listed on each chart.

OPTIONAL PROPELLER DE-ICE BOOTS

With the optional propeller de-ice boots installed, expect climb performance to be degraded approximately 50 FPM from what is presented in the manual.

LANDING GEAR DOORS

When snow and ice are likely to be present on taxi and runway surfaces, inboard landing gear doors should be removed. Accumulation of ice and snow could prevent landing gear operation.
If inboard landing gear doors are removed, a decrease in cruise speed and range can be expected and should be considered in preflight planning. To be conservative the following figures should be used:

Decrease of true airspeed at normal cruise power setting by approximately 5 KTAS.

USE OF COWL FLAPS
When in level cruise flight, with outside air temperatures well above standard or when cruising at very high altitudes, it may be necessary to open the cowl flaps to keep engine temperatures in the normal operating range. Since the cowl flaps in the M20M are multi-position, numerous open settings are available to keep cylinder head and oil temperatures in the green arc under the most adverse conditions.

Using the cowl flaps position indicator as a reference, the following cowl flaps open positions are given along with their effects on cruise speed:

Cowl flaps closed to cowl flap 1/2 open:
(Indicator positioned at second index)
Approximate loss in TAS . . . . 2.5 KTS

An approximate adjustment to the range data shown in this manual can be made based on the flight time planned with the cowl flaps partially open. For example, using the above speed decrement for the cowl flap 1/2 open for a 5 hour flight will result in the following decrease in range:

5 HR X 2.5 KTS = ... 12.5 N.M. reduction in range.

MISSION PROFILE CHARTS

The Mission Profile Charts are presented as a flight planning aid. They can provide information to assist in the selection of altitude and power setting to fly as well as provide the flight time and fuel to fly a given distance.

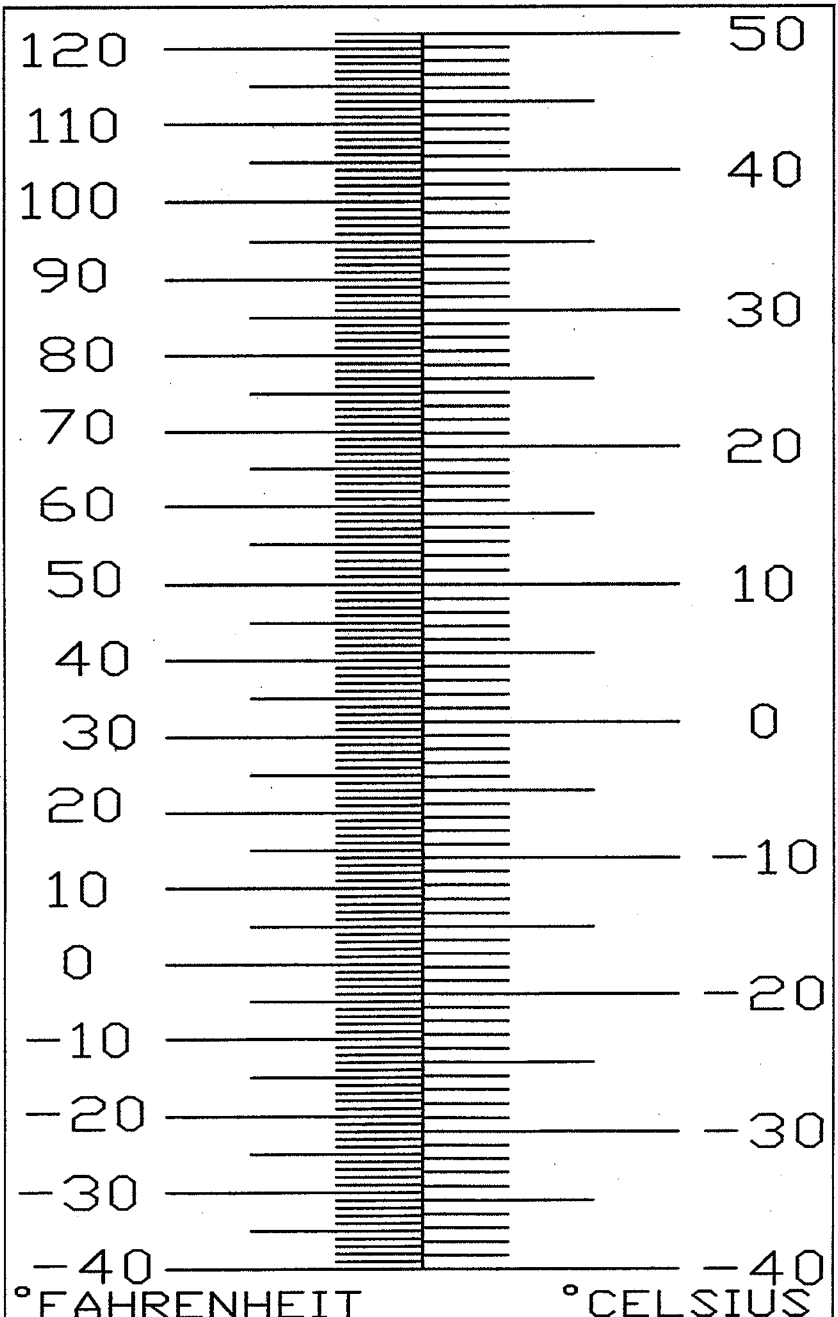
The charts are based on the following:

Fuel used to warmup, taxi and takeoff.
Time and fuel to climb at maximum power.
Time and fuel to cruise at the specified power setting.
Cruise with cowl flaps closed and with the gear and flaps UP.
Time and fuel to descend at 750 FPM at 150 KIAS.
Zero wind.
Gross weight.

CAUTION
Zero wind conditions seldom occur. In addition, varying atmospheric conditions, aircraft weight, the mechanical condition of the aircraft and piloting techniques all affect the actual flight time and fuel used during a flight.

It is the pilot's responsibility to determine the actual operating conditions and plan the flight accordingly.

TEMPERATURE CONVERSION

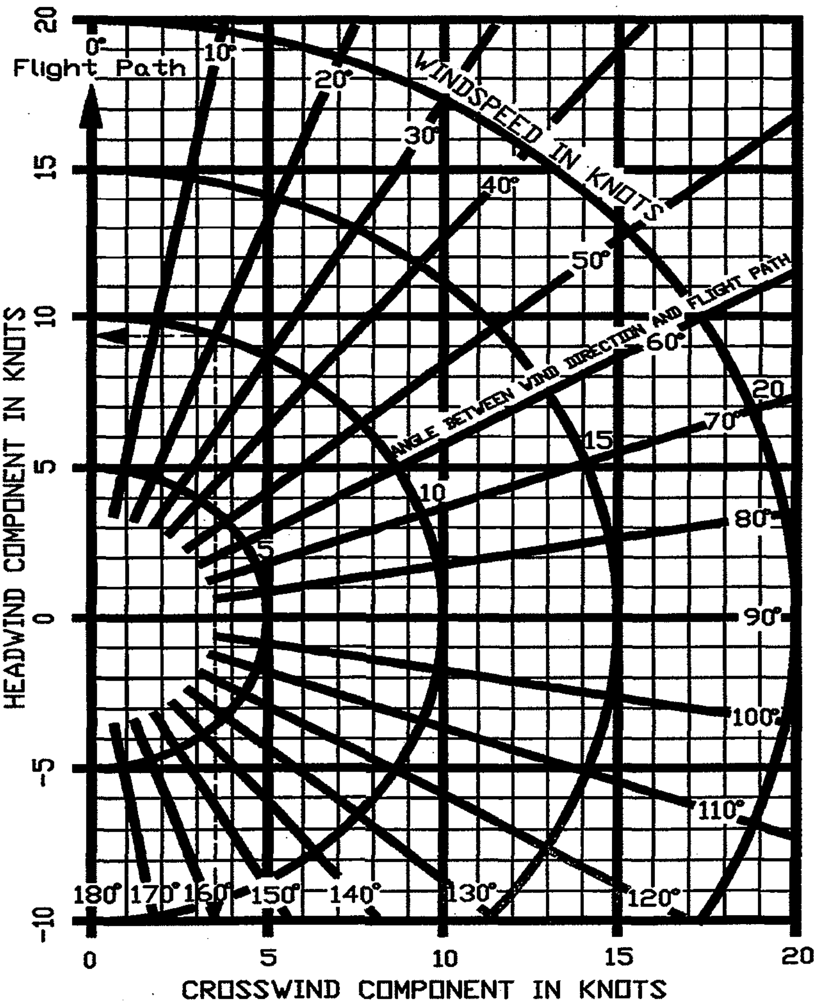


CROSSWIND COMPONENT CHART

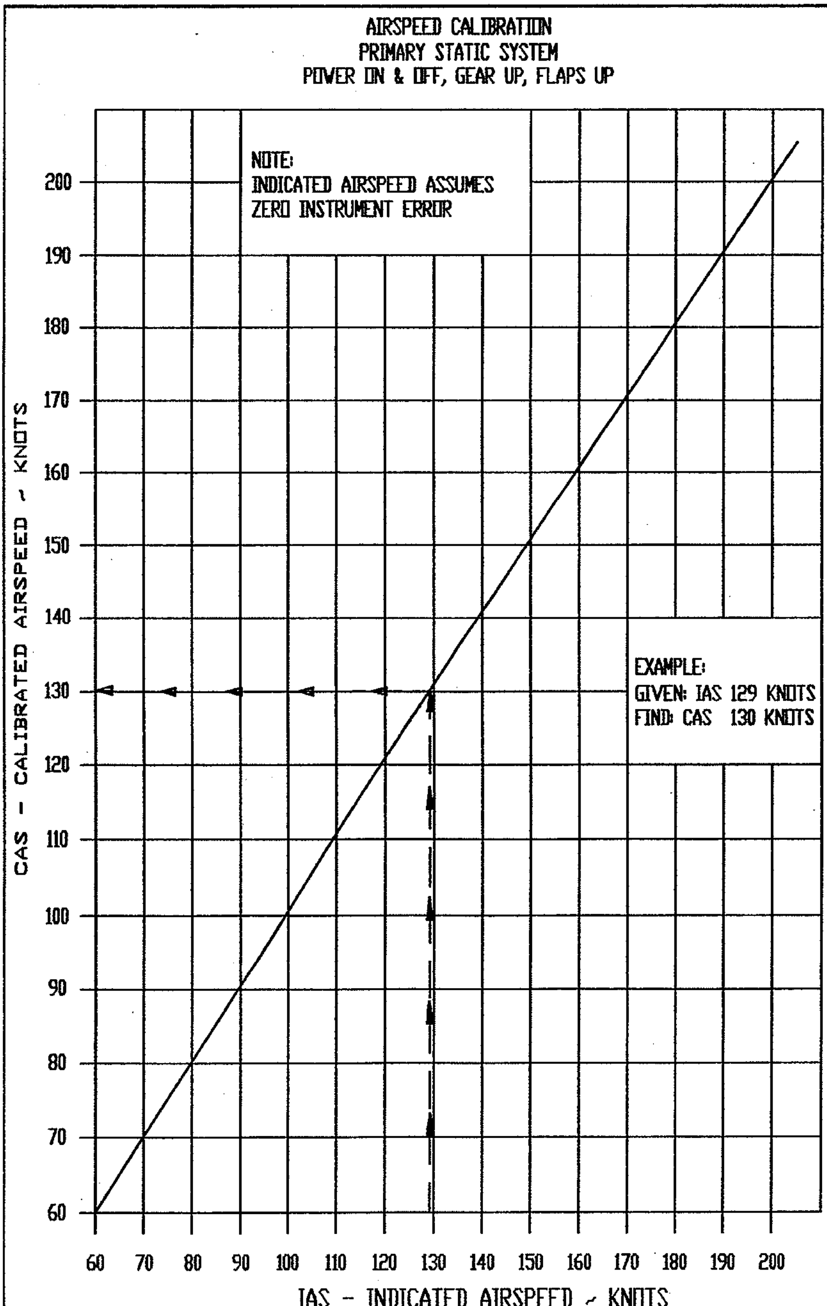
NOTE:
MAXIMUM DEMONSTRATED CROSSWIND IS 13 KNOTS

EXAMPLE:

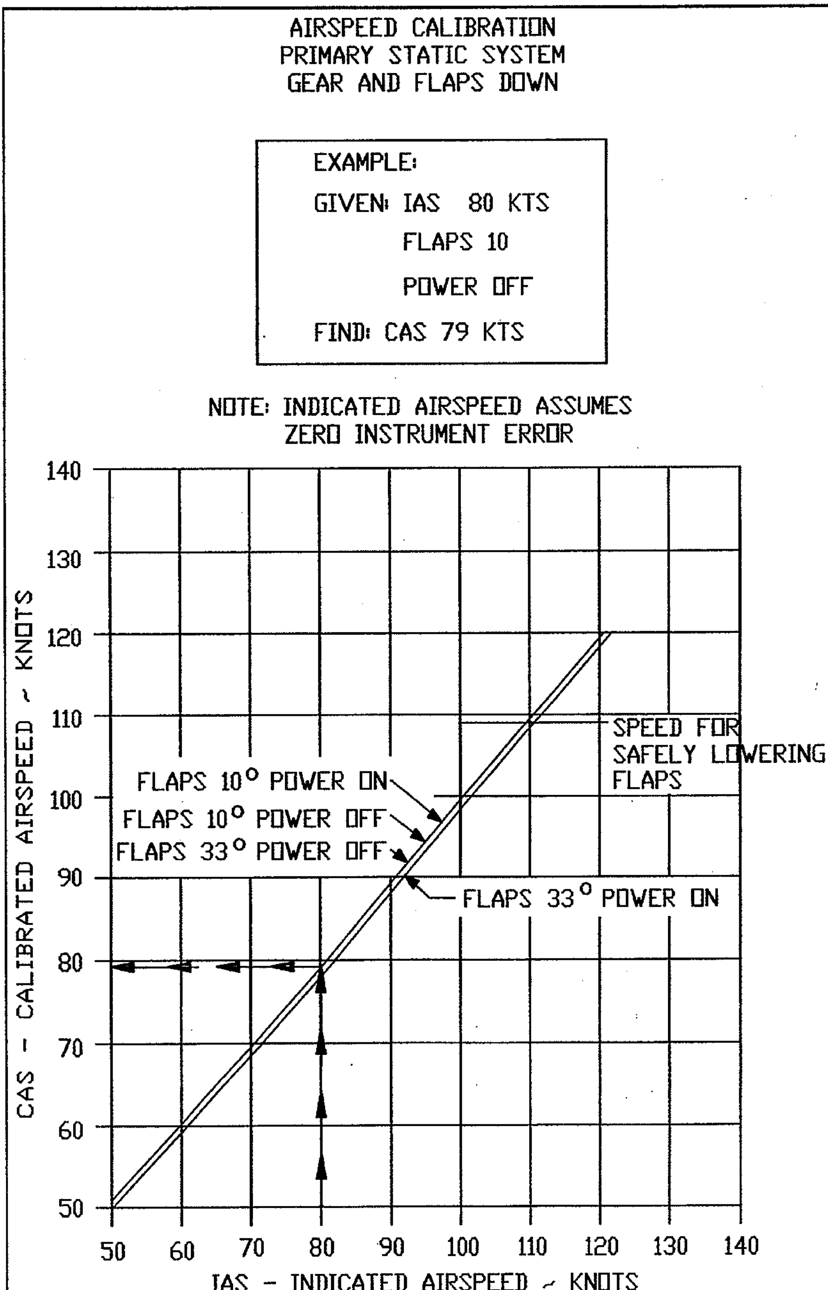
WIND SPEED	10 KNOTS
ANGLE BETWEEN WIND DIRECTION AND FLIGHT PATH	20
HEADWIND COMPONENT	9.5 KNOTS
CROSSWIND COMPONENT	3.5 KNOTS



AIRSPEED CALIBRATION - PRIMARY STATIC SYSTEM (GEAR UP)



AIRSPEED CALIBRATION-PRIMARY STATIC SYSTEM (GEAR DN)



AIRSPEED CALIBRATION - ALTERNATE STATIC SYSTEM

KIAS	GEAR & FLAPS UP KIAS	GEAR & FLAPS DN (10°) KIAS	GEAR & FLAPS DN (33°) KIAS
50	3.0	0.0	-1.0
60	1.5	-1.2	-2.0
70	0.0	-2.2	-3.2
80	-1.8	-3.2	-4.5
90	-2.8	-4.0	-6.0
100	-3.0	-4.7	-7.4
110	-3.0	-5.4	-8.8
120	-3.0	-	-
130	-3.6	-	-
140	-4.5	-	-
150	-5.1	-	-
160	-5.6	-	-
170	-6.1	-	-
180	-6.5	-	-
190	-7.2	-	-
200	-7.9	-	-

NOTE: The minus sign indicates subtraction of the given numbers from KIAS to obtain the corrected airspeed.

CONDITIONS: Power-ON, Storm Window & Vents - CLOSED, Heater & Defroster - ON or OFF

ALTIMETER CORRECTION - PRIMARY STATIC SYSTEM

	SEA LEVEL			12,500 FT.			25,000 FT.		
KIAS	Gear & Flaps UP	Gear Dn /10° Flaps	Gear Dn/33° Flaps	Gear & Flaps UP	Gear Dn/10° Flaps	Gear Dn/33° Flaps	Gear & Flaps UP	Gear Dn/10° Flaps	Gear Dn/33° Flaps
50	-2	4	-3	-4	7	-4	-5	10	-5
60	-3	3	-5	-4	4	-7	-7	7	-10
70	-3	-2	-9	-5	-3	-13	-8	-4	-20
80	-4	-8	-14	-6	-12	-20	-9	-17	-30
90	-8	-11	-19	-12	-17	-28	-18	-25	-43
100	-6	-11	-22	-9	-16	-33	-13	-24	-50
110	2	-5	-23	2	-7	-33	4	-11	-51
120	9	--	--	13	--	--	20	--	--
130	21	--	--	31	--	--	47	--	--
140	23	--	--	33	--	--	51	--	--
150	15	--	--	22	--	--	33	--	--
160	12	--	--	17	--	--	26	--	--
170	9	--	--	13	--	--	26	--	--
180	8	--	--	12	--	--	18	--	--
190	10	--	--	14	--	--	22	--	--
200	12	--	--	18	--	--	27	--	--

NOTE:The minus sign indicates subtraction of the given numbers from the indicated pressure to obtain altitude assuming zero instrument error.

EXAMPLE:
KIAS = 110 . . . . ALTIMETER CORRECTION: -7 ft.
FLAPS = 10° . . . . (Subtract from Indicated Altitude)
INDICATED PRESSURE ALTITUDE:12500 ft. **PRESSURE ALTITUDE; =12493 ft.**

ALTIMETER CORRECTION - ALTERNATE STATIC SYSTEM

KIAS	SEA LEVEL			12,500 FT.			25,000 FT.		
	GEAR UP FLAPS UP	GEAR & FLAPS DN 10°	33°	GEAR UP FLAPS UP	GEAR & FLAPS DN 10°	33°	GEAR UP FLAPS UP	GEAR & FLAPS DN 10°	33°
50	13	0	-4	20	0	-7	30	0	-10
60	8	-6	-11	12	-9	-16	18	-14	-24
70	0	-14	-20	0	-20	-29	0	-31	-45
80	-13	-23	-32	-19	-34	-47	-29	-51	-72
90	-23	-32	-48	-33	-47	-71	-50	-72	-108
100	-27	-42	-66	-39	-62	-97	-68	-94	-148
110	-30	-53	-87	-43	-78	-127	-66	-119	-194
120	-32	-	-	-48	-	-	-72	-	-
130	-53	-	-	-77	-	-	-118	-	-
140	-57	-	-	-84	-	-	-127	-	
150	-69	-	-	-102	-	-	-155	-	-
160	-82	-	-	-128	-	-	-182	-	-
170	-95	-	-	-139	-	-	-211	-	-
180	-107	-	-	-158	-	-	-248	-	-
190	-126	-	-	-185	-	-	-282	-	-
200	-146	-	-	-215	-	-	-327	-	-

NOTE: The minus sign indicates subtraction of the given number from the indicated altitude to obtain the corrected altitude.

CONDITIONS: Power -ON, Vents & Storm Window - CLOSED, Heater & Defroster - ON or OFF.

STALL SPEED VS ANGLE OF BANK

STALL SPEED vs. ANGLE OF BANK

ASSOCIATED CONDITIONS:
FORWARD C.G.
POWER IDLE

NOTE: UP TO 500 FEET ALTITUDE LOSS MAY OCCUR DURING STALLS AT MAXIMUM WEIGHT

EXAMPLE:

WEIGHT	3000 LBS (1361 KGS)
LANDING GEAR	DOWN
FLAPS	10°
ANGLE OF BANK	45°
STALL SPEED	72.5 KCAS (73.0 KIAS)

GROSS WEIGHT	GEAR AND FLAP POSITION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS
3368 LBS (1528 KGS)	GEAR UP, FLAPS 0°	66.0	66.5	71.0	71.5	78.5	79.0	93.5	94.0
	GEAR DOWN, FLAPS 10°	64.5	64.5	69.5	69.5	76.5	77.5	91.0	92.0
	GEAR DOWN FLAPS 33°	59.0	59.0	63.5	63.5	70.0	70.0	83.5	84.5
3000 LBS (1361 KGS)	GEAR UP, FLAPS 0°	62.5	63.0	67.0	67.5	74.5	75.0	88.5	89.5
	GEAR DOWN, FLAPS 10°	61.0	61.0	65.5	65.5	72.5	73.0	86.5	87.5
	GEAR DOWN FLAPS 33°	55.5	55.5	59.5	59.5	66.0	66.0	78.5	79.5
2700 LBS (1225 KGS)	GEAR UP, FLAPS 0°	59.0	59.5	63.5	64.0	70.0	70.5	83.5	84.0
	GEAR DOWN, FLAPS 10°	58.0	58.0	62.5	62.5	69.0	69.0	82.0	83.0
	GEAR DOWN FLAPS 33°	53.0	53.0	57.0	57.0	63.0	63.0	75.0	76.0

TAKEOFF DISTANCE - HARD SURFACE

TAKEOFF DISTANCE

TAKEOFF WEIGHT - LBS (KGS)	TAKEOFF SPEED KIAS	SPEED AT 50 FT. - KIAS
3368 LBS (1528 KGS)	66	80
3100 LBS (1406 KGS)	64	78
2700 LBS (1225 KGS)	59	74

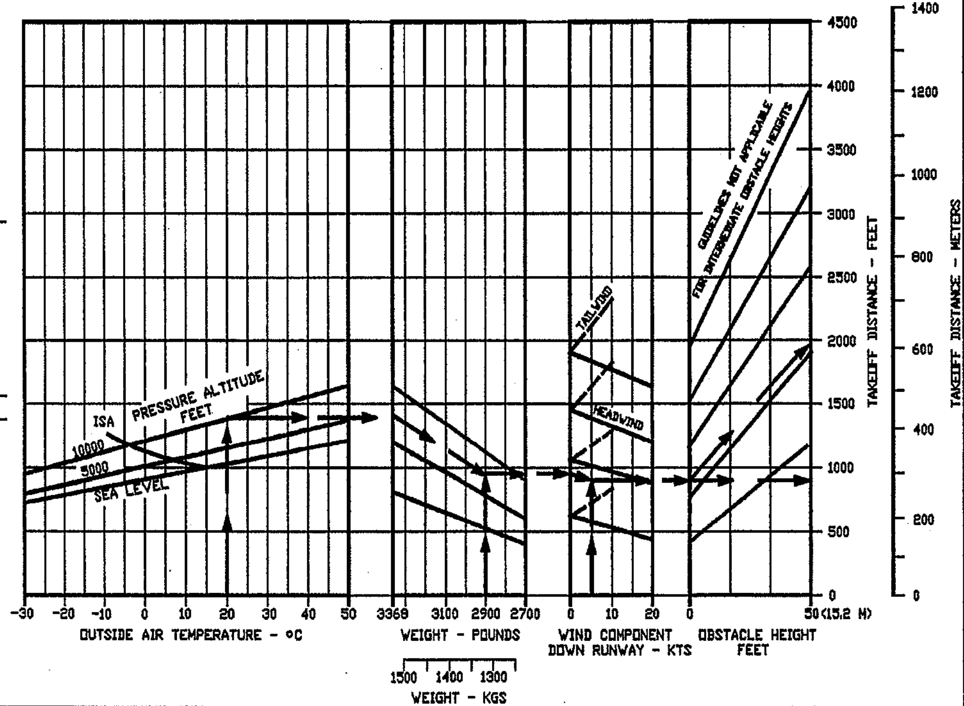
NOTE: 1) MAXIMUM DEMONSTRATED CROSSWIND IS 13 KNOTS.
2) CONDITIONS OF HIGH HUMIDITY CAN RESULT IN AN INCREASE OF UP TO 10% TO THE TAKEOFF DISTANCE.

ASSOCIATED CONDITIONS:

POWER	FULL THROTTLE/2575 RPM
LANDING GEAR	DOWN UNTIL OBSTACLE CLEARED
WING FLAPS	10°
COWL FLAPS	FULL OPEN
RUNWAY SURFACE	PAVED, LEVEL, DRY

EXAMPLE:

OAT	20° C
PRESSURE ALTITUDE	10000 FT.
WEIGHT	2900 LBS (1315 KGS)
HEADWIND COMPONENT	5 KTS
GROUND ROLL	900 FT. (274 M)
TOTAL TAKEOFF DISTANCE (50 FT. OBSTACLE)	1950 FT. (594 M)



TAKEOFF DISTANCE - GRASS SURFACE

TAKEOFF DISTANCE - GRASS SURFACE

TAKEOFF WEIGHT - LBS (KGS)	TAKEOFF SPEED KIAS	SPEED AT 50 FT. - KIAS
3368 LBS (1528 KGS)	66	80
3100 LBS (1406 KGS)	64	78
2700 LBS (1225 KGS)	59	74

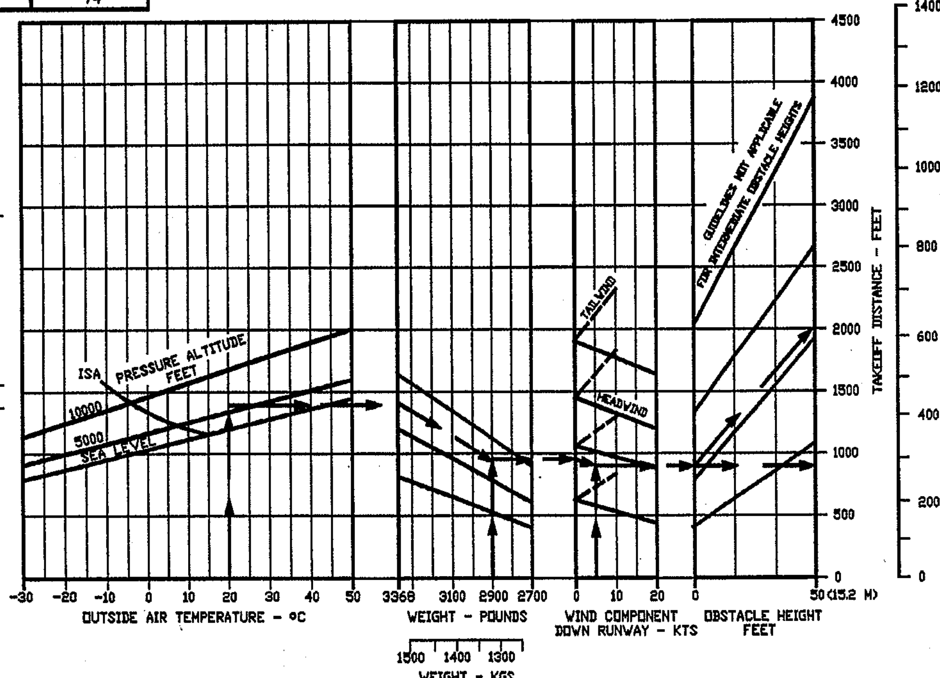
NOTE: 1) MAXIMUM DEMONSTRATED CROSSWIND IS 13 KNOTS.
2) CONDITIONS OF HIGH HUMIDITY CAN RESULT IN AN INCREASE OF UP TO 10% TO THE TAKEOFF DISTANCE.

ASSOCIATED CONDITIONS:

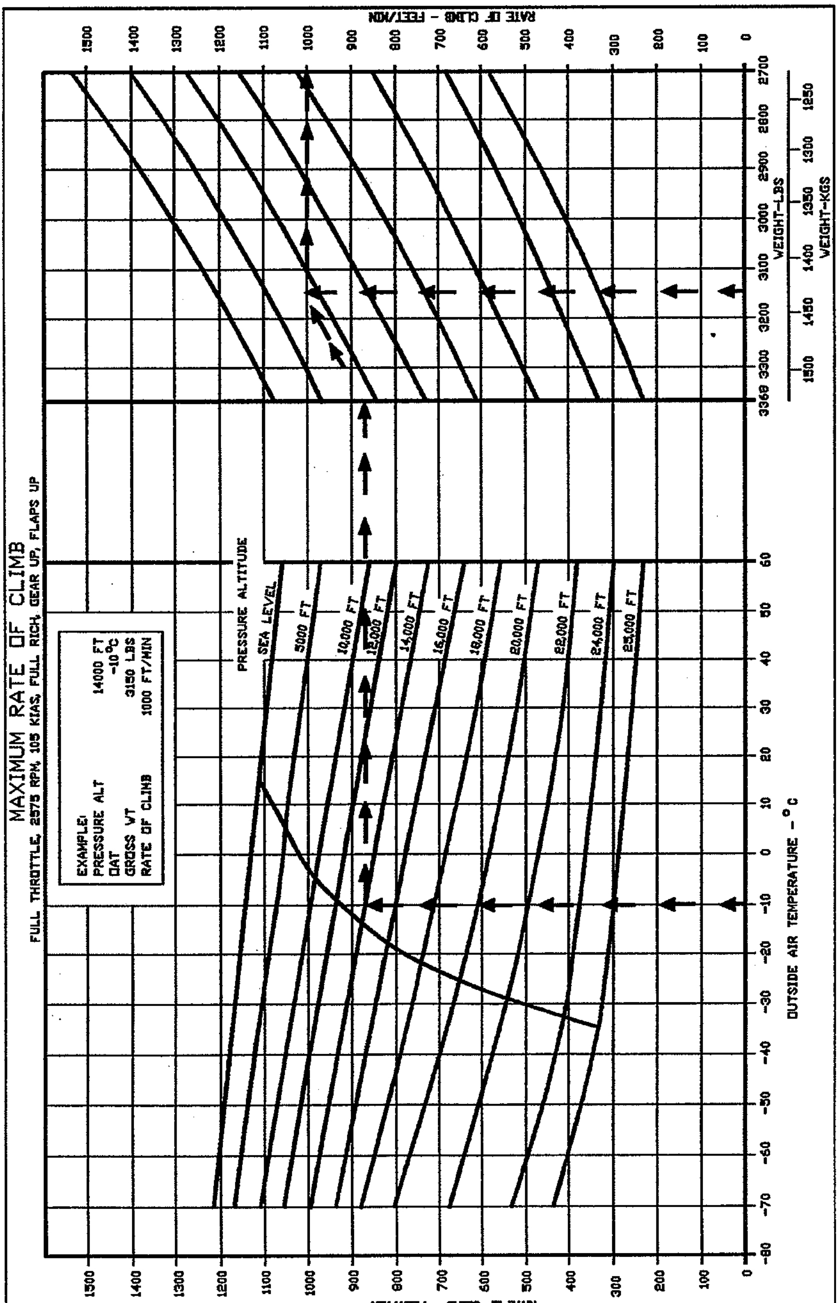
POWER	FULL THROTTLE/2575 RPM
LANDING GEAR	DOWN UNTIL OBSTACLE CLEARED
WING FLAPS	10°
COWL FLAPS	FULL OPEN
RUNWAY SURFACE	SHORT DRY GRASS, LEVEL

EXAMPLE:

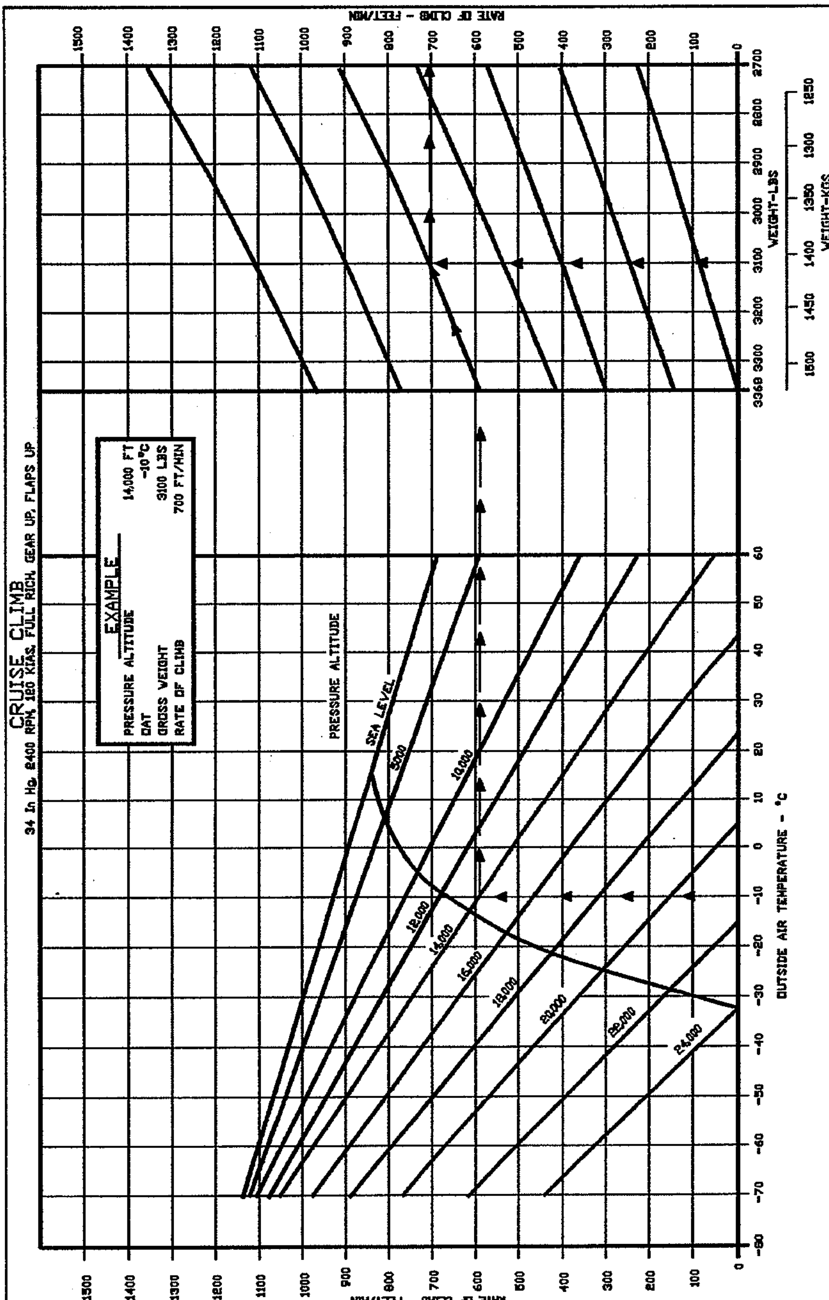
OAT	20° C
PRESSURE ALTITUDE	6000 FT.
WEIGHT	2900 LBS (1315 KGS)
HEADWIND COMPONENT	5 KTS
GROUND ROLL	900 FT. (274 M)
TOTAL TAKEOFF DISTANCE (50 FT. OBSTACLE)	2000 FT. (610 M)



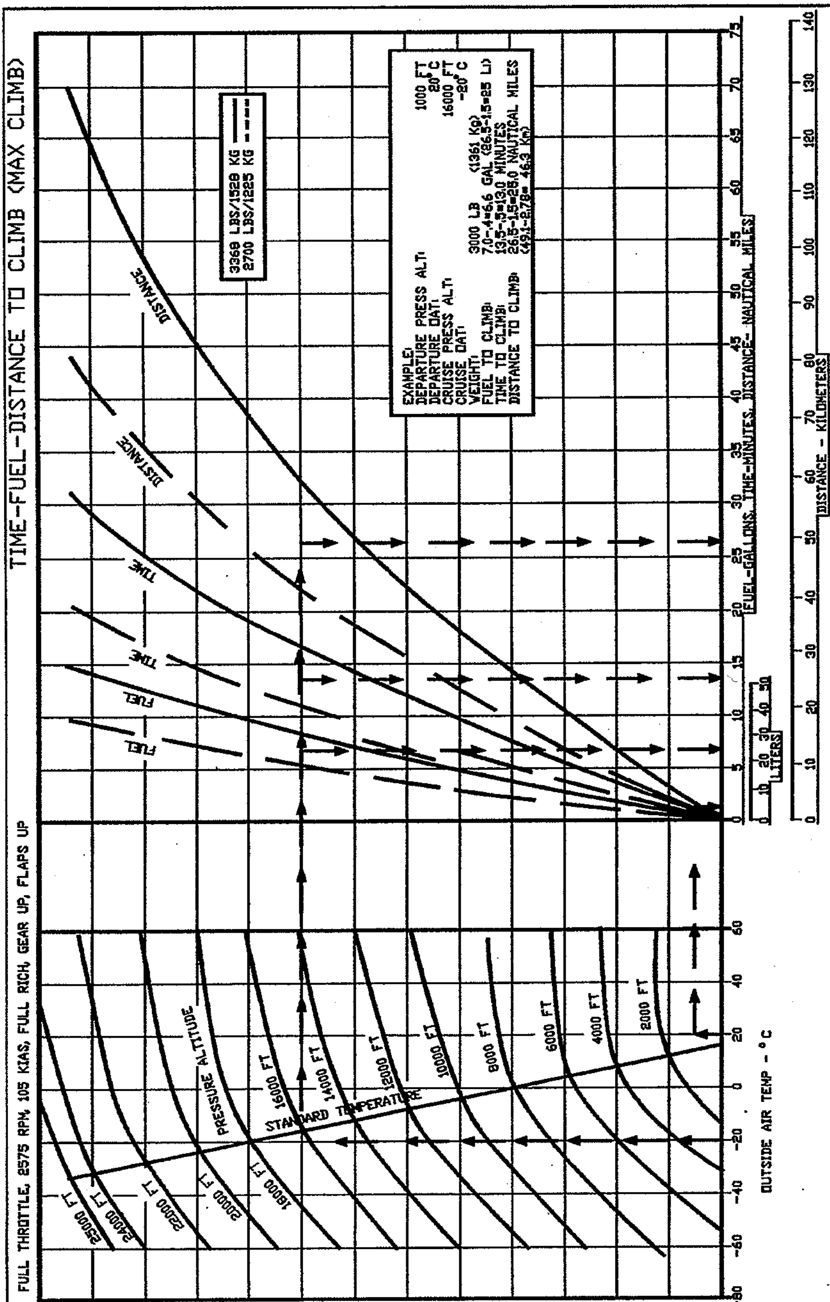
RATE OF CLIMB - MAX CLIMB



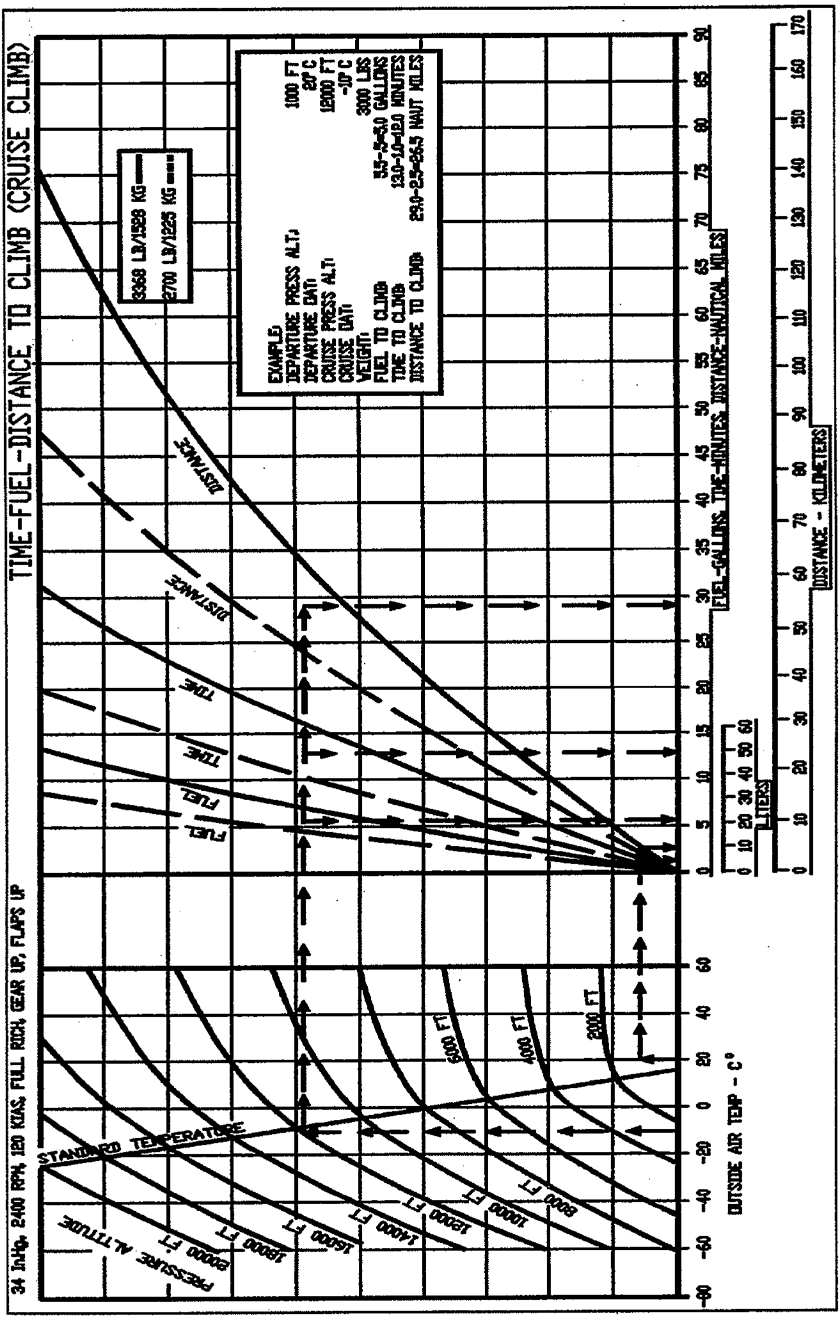
RATE OF CLIMB - CRUISE



TIME-FUEL-DISTANCE TO CLIMB (MAX CLIMB)



TIME-FUEL-DISTANCE TO CLIMB (CRUISE CLIMB)



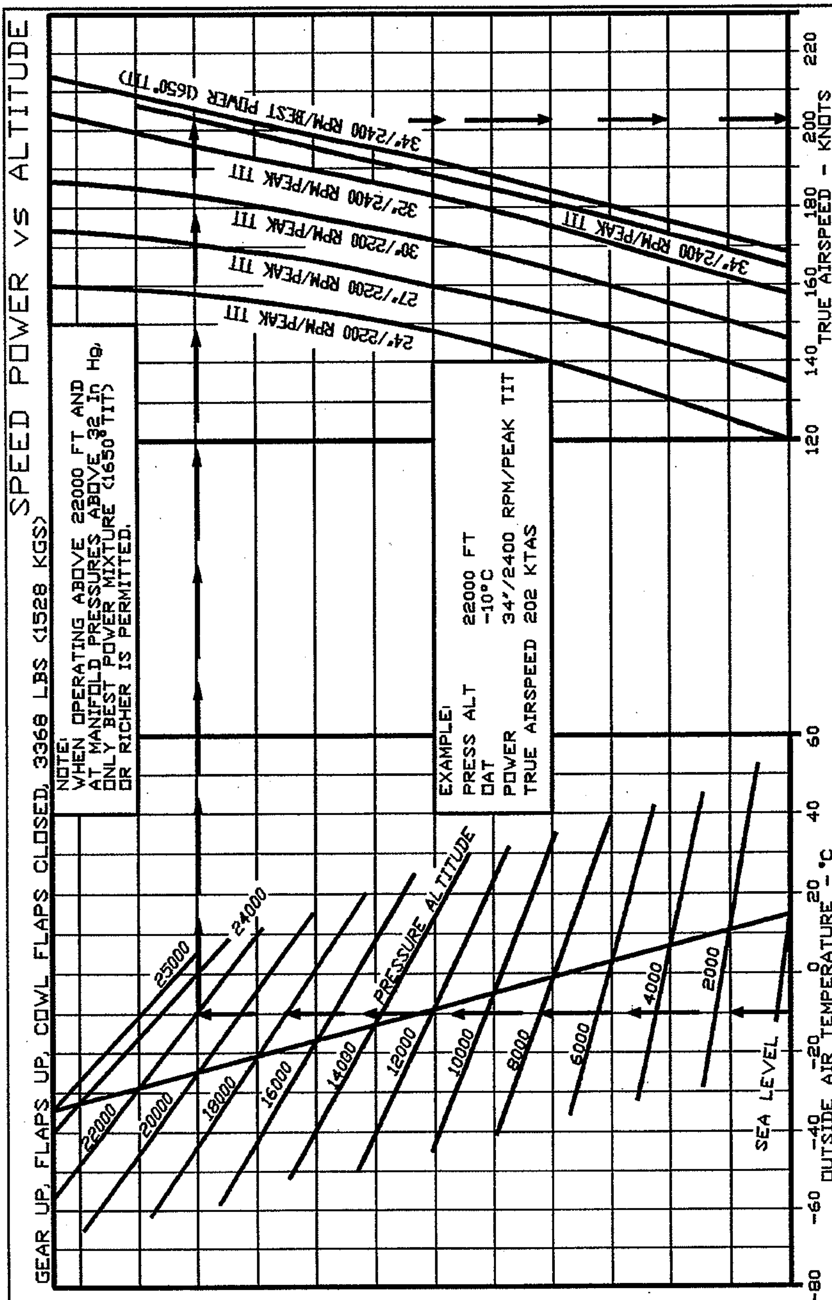
CRUISE POWER SETTINGS AND FUEL FLOWS

M20M CRUISE POWER SETTINGS & FUEL FLOWS
STANDARD DAY CONDITIONS

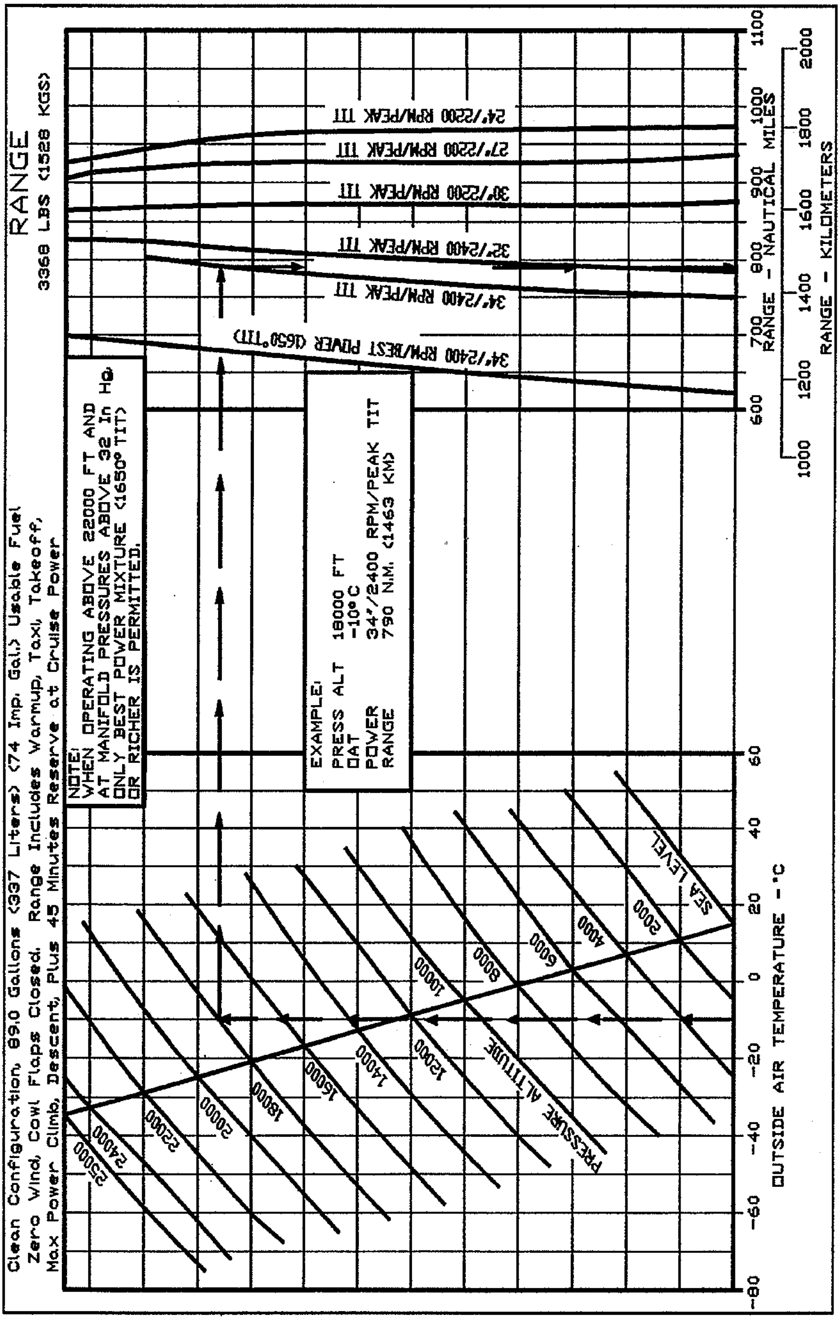
ALTITUDE	OAT	34"/2400 RPM		32"/2400RPM	27"/2200 RPM	24"/2200 RPM
	C	BEST POWER	PEAK TIT	PEAK TIT	PEAK TIT	PEAK TIT
0	15	19.6	16.3	15.3	11.4	9.8
5000	5	20.1	17.0	16.0	12.3	10.7
10000	-5	20.4	17.4	16.4	12.8	11.3
15000	-15	20.6	17.5	16.5	13.1	11.7
20000	-25	20.6	17.6	16.6	13.3	12.0
25000	-35	20.5	---	16.6	13.3	12.1

NOTE: 1) PEAK TIT INDICATES PEAK TIT OR 1750 DEGREES F TIT.
2) BEST POWER (AT 34 In. Hg./2400 RPM) IS 1650 DEGREES F TIT.
3) WHEN OPERATING ABOVE 22000 FEET, AND AT MANIFOLD PRESSURES ABOVE 32 In. Hg., ONLY BEST POWER MIXTURE (1650 DEG. F TIT) or RICHER IS PERMITTED.
4) CRUISE FUEL FLOWS DECREASE APPROX. .5 GPH FOR EACH 20 DEG. C ABOVE STANDARD TEMPERATURE.
5) CRUISE FUEL FLOWS INCREASE APPROX. .5 GPH FOR EACH 20 DEG. C BELOW STANDARD TEMPERATURE.

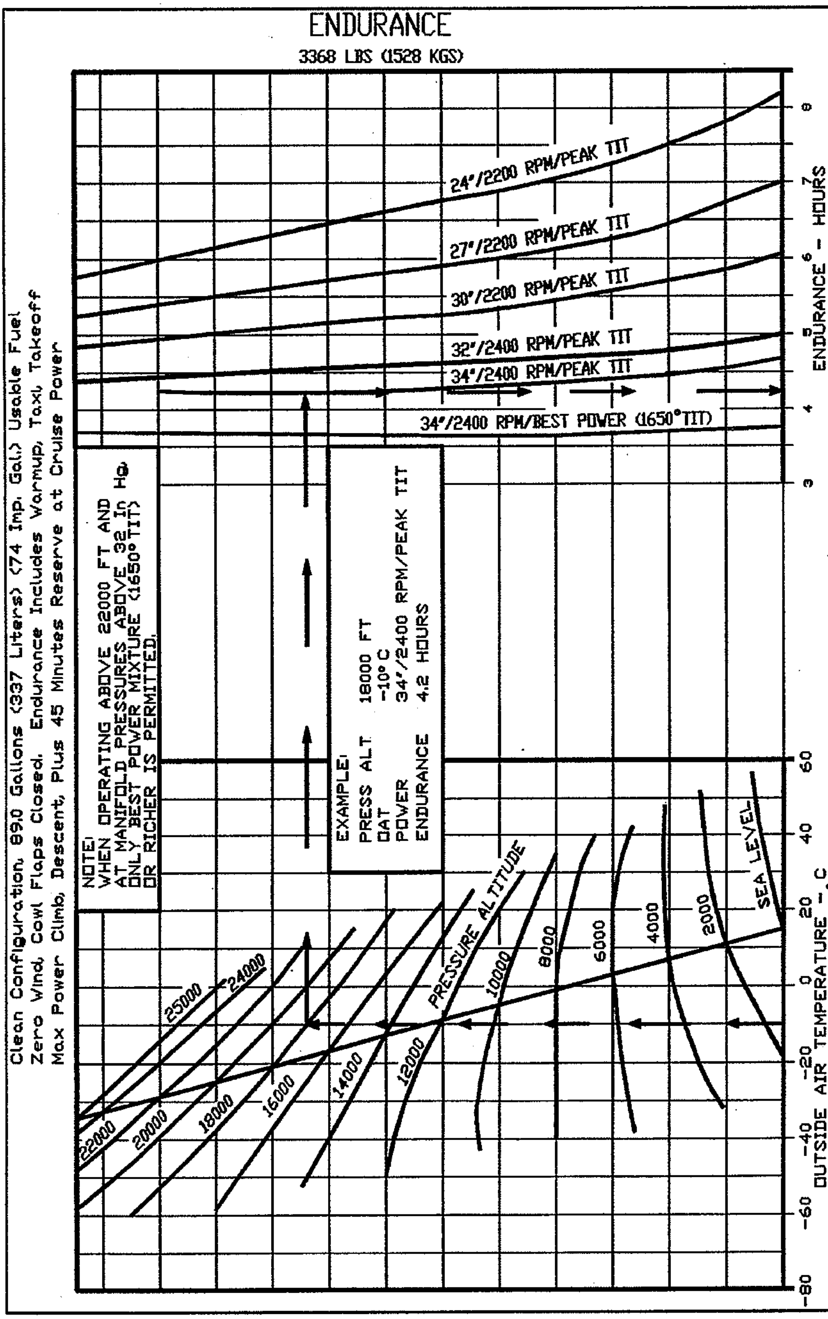
SPEED POWER VS ALTITUDE



RANGE


RANGE
3368 LBS (1528 KGS)
Clean Configuration, 89.0 Gallons (337 Liters) (74 Imp. Gal.) Usable Fuel
Zero Wind, Cowl Flaps Closed. Range Includes Warmup, Taxi, Takeoff,
Max Power Climb, Descent, Plus 45 Minutes Reserve at Cruise Power
NOTE:
WHEN OPERATING ABOVE 22000 FT AND
AT MANIFOLD PRESSURES ABOVE 32 In Hg,
ONLY BEST POWER MIXTURE (1650° TIT)
OR RICHER IS PERMITTED.
EXAMPLE:
PRESS ALT 18000 FT
OAT -10° C
POWER 34"/2400 RPM/PEAK TIT
RANGE 790 N.M. (1463 KM)
24"/2200 RPM/PEAK TIT
27"/2200 RPM/PEAK TIT
30"/2200 RPM/PEAK TIT
32"/2400 RPM/PEAK TIT
34"/2400 RPM/PEAK TIT
34"/2400 RPM/BEST POWER (1650°TIT)
600
700
800
900
1000
1100
RANGE - NAUTICAL MILES
1000
1200
1400
1600
1800
2000
RANGE - KILOMETERS
-80
-60
-40
-20
0
20
40
60
OUTSIDE AIR TEMPERATURE - °C
PRESSURE ALTITUDE
SEA LEVEL
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
22000
24000
25000

ENDURANCE


ENDURANCE
3368 LBS (1528 KGS)
Clean Configuration, 89.0 Gallons (337 Liters) (74 Imp. Gal.) Usable Fuel
Zero Wind, Cowl Flaps Closed. Endurance Includes Warmup, Taxi, Takeoff
Max Power Climb, Descent, Plus 45 Minutes Reserve at Cruise Power
24"/2200 RPM/PEAK TIT
27"/2200 RPM/PEAK TIT
30"/2200 RPM/PEAK TIT
32"/2400 RPM/PEAK TIT
34"/2400 RPM/PEAK TIT
34"/2400 RPM/BEST POWER (1650°TIT)
NOTE:
WHEN OPERATING ABOVE 22000 FT AND
AT MANIFOLD PRESSURES ABOVE 32 In Hg,
ONLY BEST POWER MIXTURE (1650°TIT)
OR RICHER IS PERMITTED.
EXAMPLE:
PRESS ALT 18000 FT
OAT -10° C
POWER 34"/2400 RPM/PEAK TIT
ENDURANCE 4.2 HOURS
ENDURANCE - HOURS
3
4
5
6
7
8
OUTSIDE AIR TEMPERATURE - °C
-80
-60
-40
-20
0
20
40
60
PRESSURE ALTITUDE
SEA LEVEL
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
22000
24000
25000

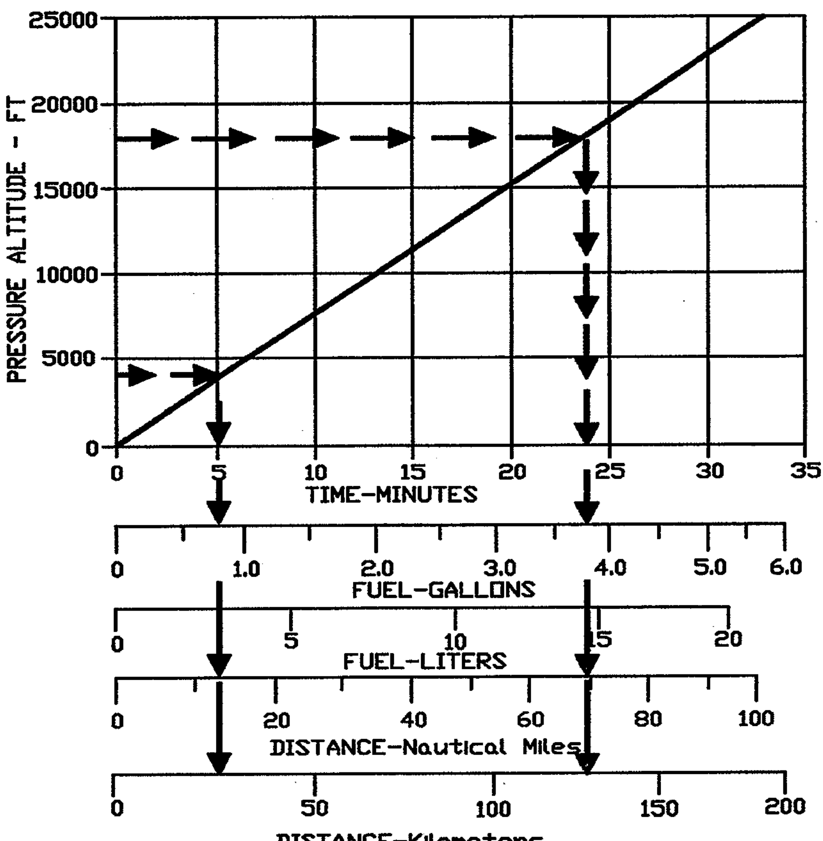
TIME-FUEL-DISTANCE TO DESCEND

TIME-FUEL-DISTANCE TO DESCEND

150 KIAS DESCENT SPEED

ASSOCIATED CONDITIONS:
POWER: 2000 RPM/MAP AS REQ'D TO MAINTAIN 750 FPM RATE OF DESCENT
LANDING GEAR: UP
FLAPS: UP
COWL FLAPS: CLOSED
MIXTURE: PEAK TIT (DO NOT EXCEED 1750°F TIT)

EXAMPLE:
INITIAL PRESSURE ALT: 18000
FINAL PRESSURE ALT: 4000
TIME TO DESCEND: 24.0-5.0=19 MINUTES
FUEL TO DESCEND: 3.8-0.8=3.0 GALLONS (14.39-3.03=11.36 LI)
DISTANCE TO DESCEND: 69.0-13.0=56.0 NAUTICAL MILES (127.79-24.08=103.71 Km)



LANDING DISTANCE - HARD SURFACE

LANDING DISTANCE

LANDING WEIGHT - LBS (KGS)	APPROACH SPEED KIAS
3200 (1452)	75
2900 (1315)	71
2600 (1175)	68

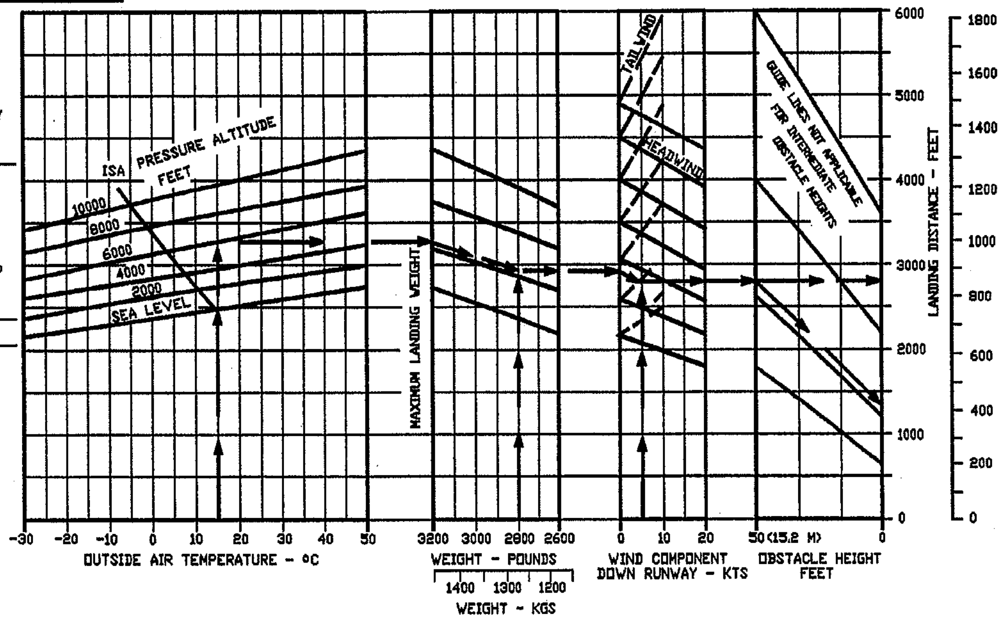
ASSOCIATED CONDITIONS:

POWER	IDLE
LANDING GEAR	DOWN
WING FLAPS	FULL DOWN (33°)
RUNWAY SURFACE	PAVED, LEVEL, DRY
BRAKING	MAXIMUM

EXAMPLE:

OAT	15 ° C
PRESSURE ALTITUDE	6000 FT.
WEIGHT	2800 LBS (1270 KGS)
HEADWIND COMPONENT	5 KTS
GROUND ROLL	1350 FT. (411 M)
TOTAL LANDING DISTANCE (50 FT. OBSTACLE)	2800 FT. (853 M)

NOTE: 1) MAXIMUM DEMONSTRATED CROSSWIND IS 13 KNOTS.



LANDING DISTANCE - GRASS SURFACE

LANDING DISTANCE - GRASS SURFACE

LANDING WEIGHT - LBS (KGS)	APPROACH SPEED KIAS
3200 (1452)	75
2900 (1315)	71
2600 (1175)	68

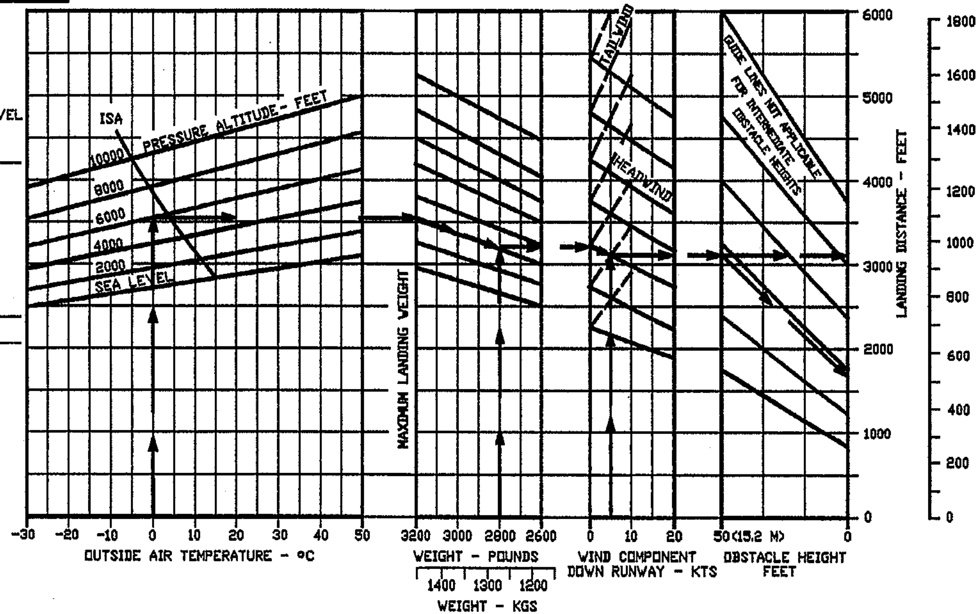
NOTE: 1) MAXIMUM DEMONSTRATED CROSSWIND IS 13 KNOTS.

ASSOCIATED CONDITIONS:

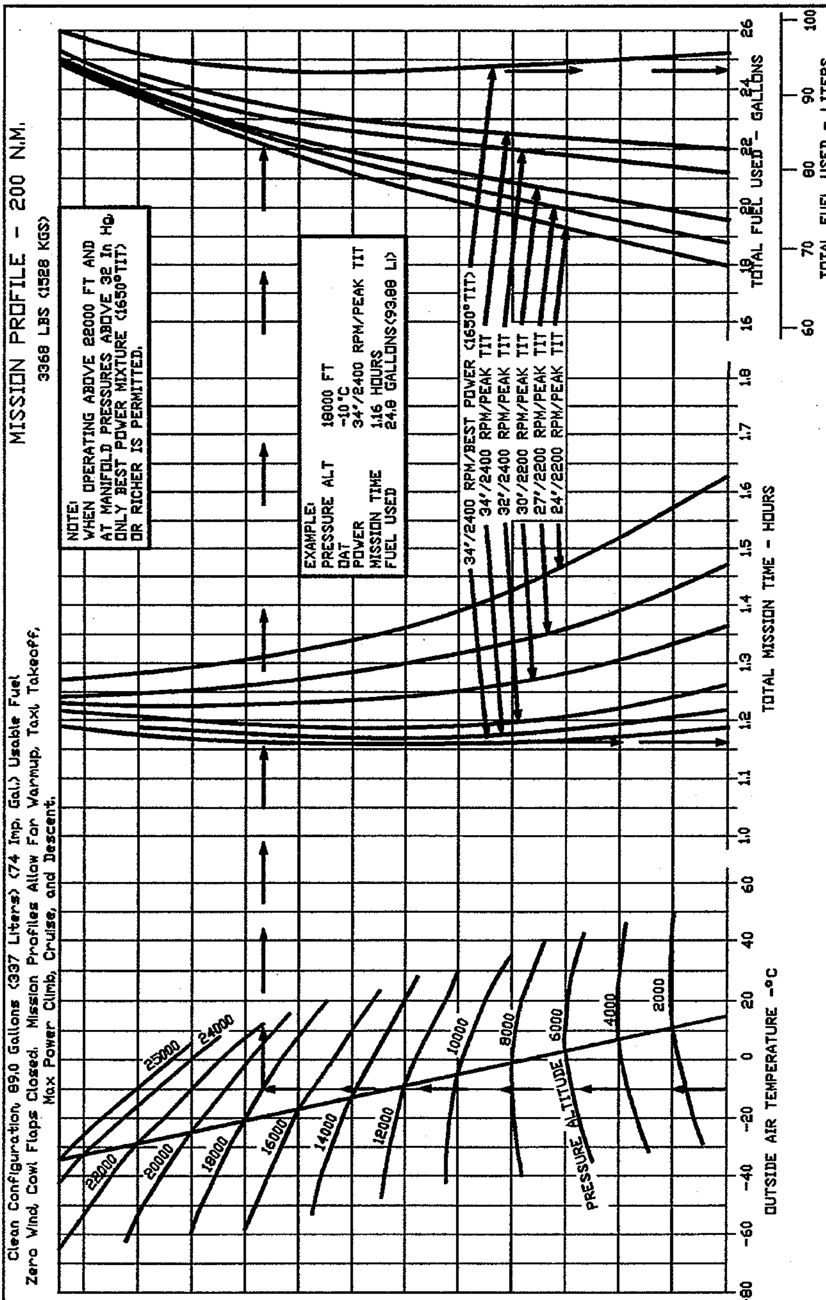
POWER	IDLE
LANDING GEAR	DOWN
WING FLAPS	FULL DOWN (33°)
RUNWAY SURFACE	SHORT DRY GRASS, LEVEL
BRAKING	MAXIMUM

EXAMPLE:

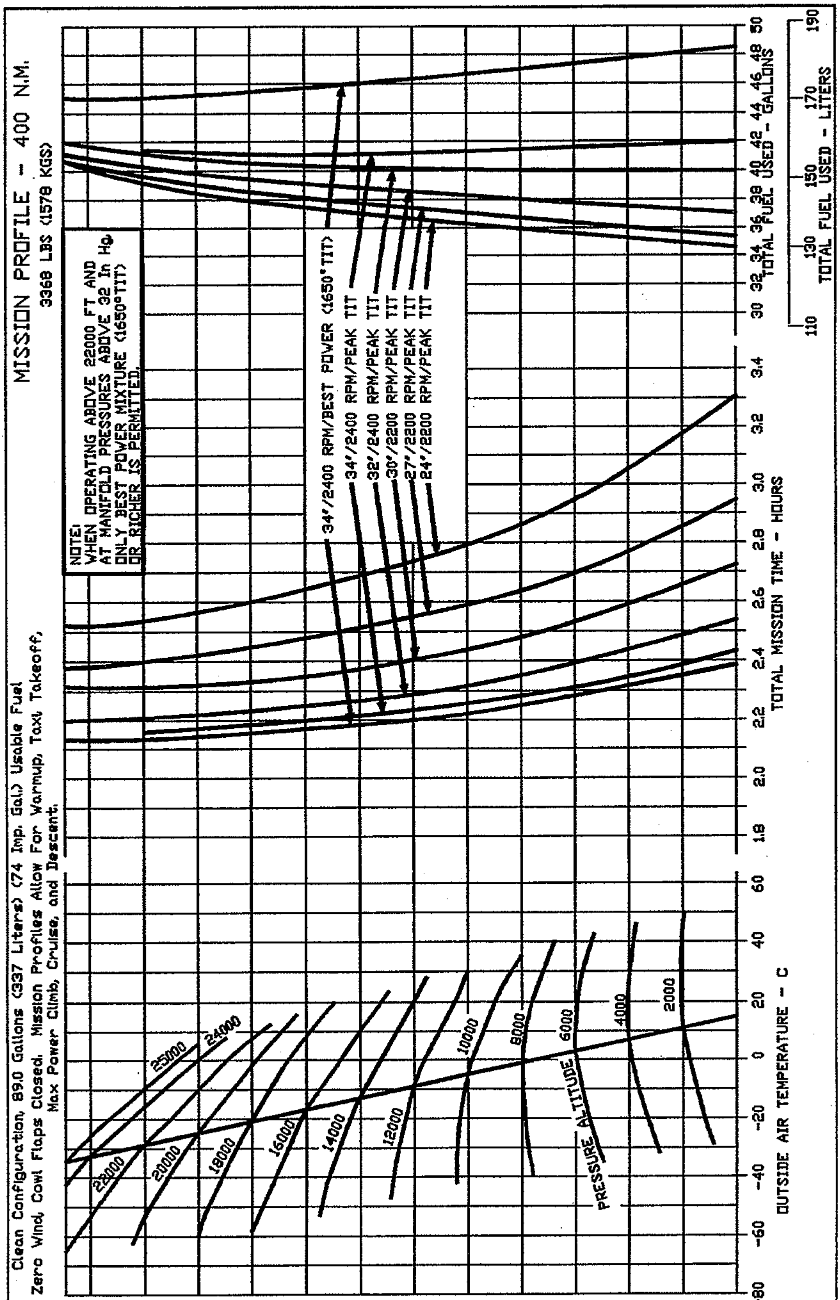
OAT	0 °C
PRESSURE ALTITUDE	6000 FT.
WEIGHT	2800 LBS (1270 KGS)
HEADWIND COMPONENT	5 KTS
GROUND ROLL	1650 FT. (503 M)
TOTAL LANDING DISTANCE (50 FT. OBSTACLE)	3100 FT. (945 M)



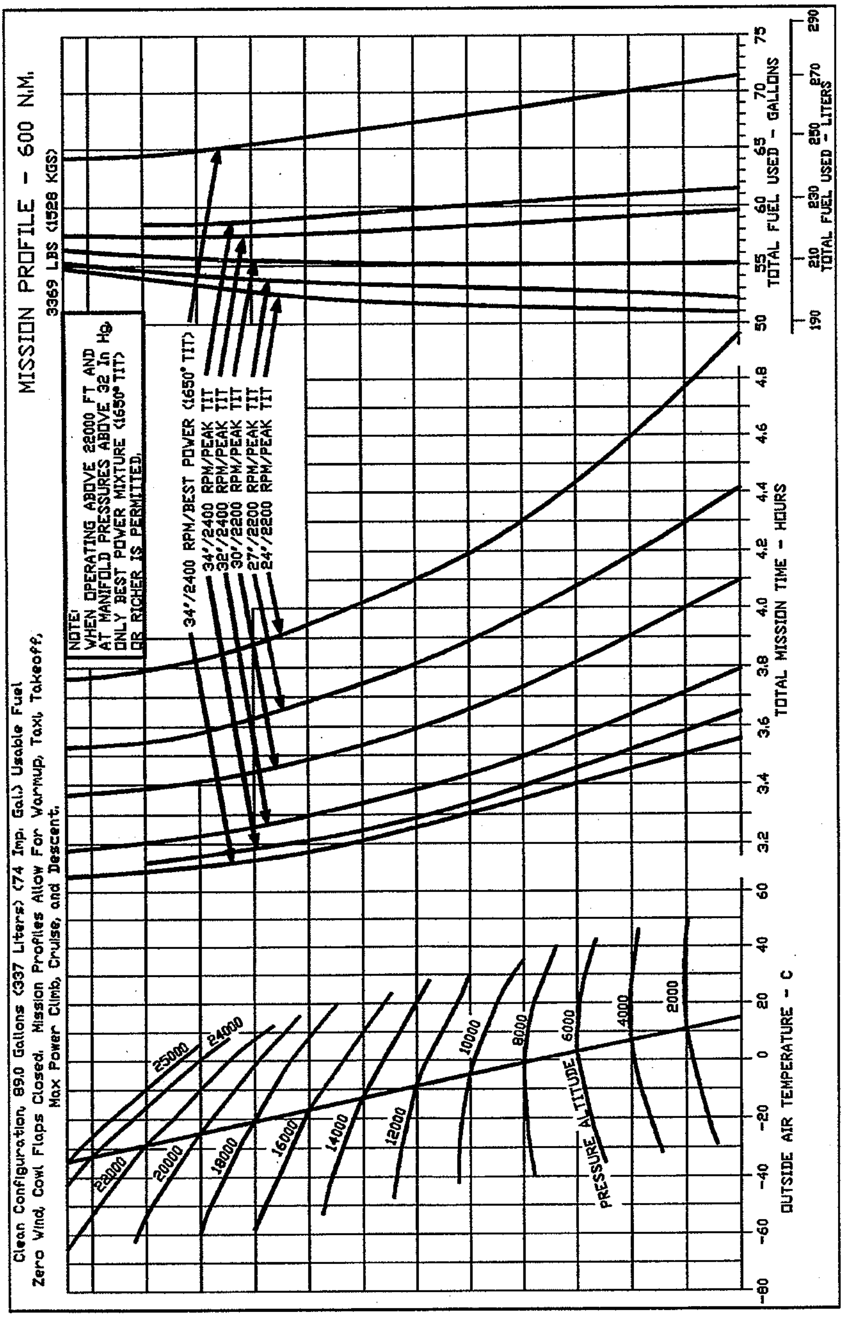
MISSION PROFILE - 200



MISSION PROFILE - 400



MISSION PROFILE - 600



MISSION PROFILE - 800

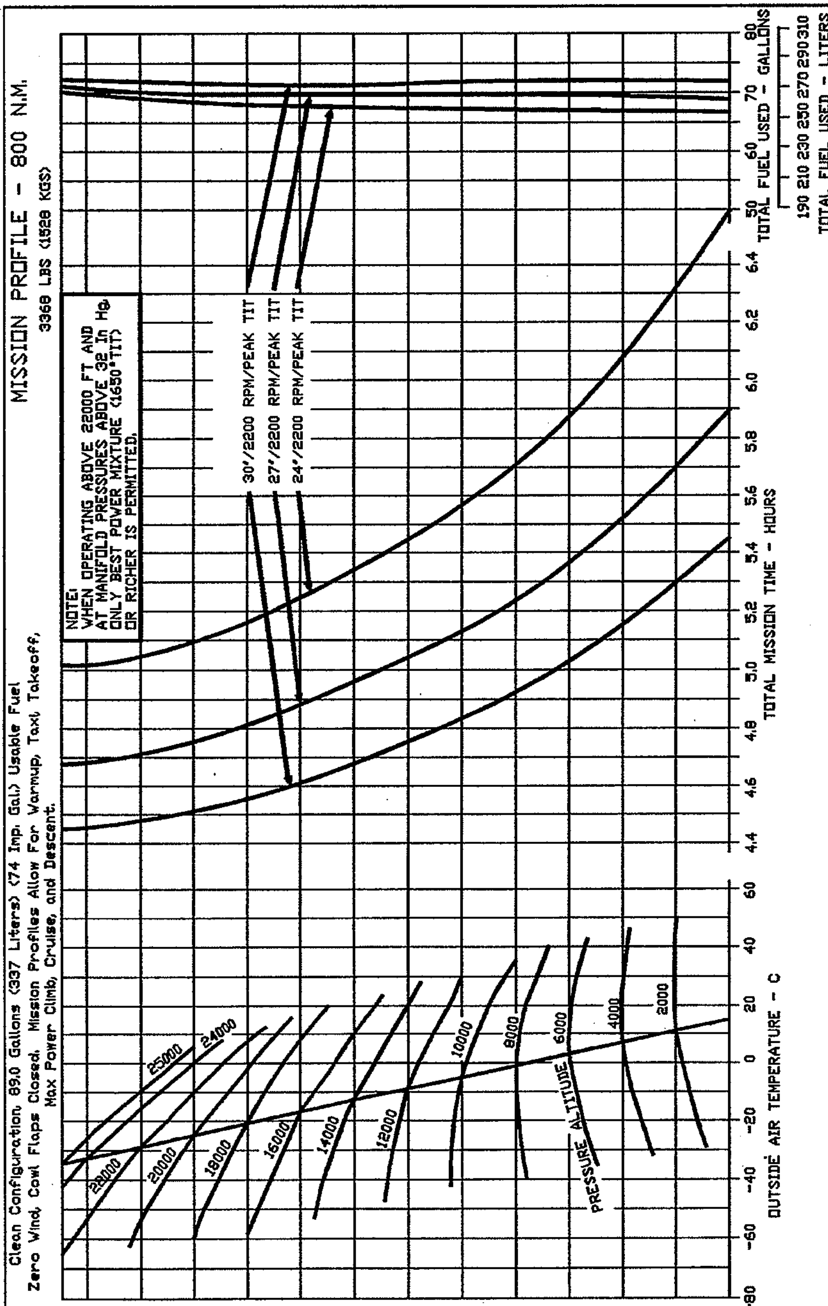


TABLE OF CONTENTS

NOTE:

The empty weight, center of gravity, and equipment list for the airplane as delivered from Mooney Aircraft Corporation is contained in this section.
The use of this section is valid for use with the airplane identified below when approved by Mooney Aircraft Corporation.

MOONEY - M20M

AIRCRAFT SERIAL NO.____________________

AIRCRAFT REGISTRATION NO.____________________

____

Mooney Aircraft Corporation - Approval Signature & Date

INTRODUCTION

This section describes the procedure for calculating loaded aircraft weight and moment for various flight operations. In addition, procedures are provided for calculating the empty weight and moment of the aircraft when the removal or addition of equipment results in changes to the empty weight and center of gravity. A comprehensive list of all Mooney equipment available for this airplane is included in this section. Only those items checked (X) were installed at Mooney and are included in the empty weight-and-balance data.

The aircraft owner and/or pilot, has the responsibility of properly loading the aircraft for safe flight. Data presented in this section will enable you to carry out this responsibility and insure that your airplane is loaded to operate within the prescribed weight and center- of-gravity limitations.

At the time of delivery, Mooney Aircraft Corporation provides the empty weight and center of gravity data for the computation of individual loadings. (The empty weight and C.G. (gear extended) as delivered from the factory is tabulated on page 6-5 when this manual is supplied with the aircraft from the factory.)

FAA regulations also require that any change in the original equipment affecting the empty weight and center of gravity be recorded in the Aircraft Log Book. A convenient form for maintaining a permanent record of all such changes is provided on page 6-5. This form, if properly maintained, will enable you to determine the current weight- and-balance status of the airplane for load scheduling. The weight-and-balance data entered as your aircraft left the factory, plus the record you maintain on page 6-5, is all of the data needed to compute loading schedules.

The maximum certificated gross weight for the Textron-Lycoming powered M20M is 3368 lbs (1528 Kg) for Takeoff and 3200 pounds (1452 Kgs) for Landing. Maximum useful load is determined by subtracting the corrected aircraft empty weight from its maximum gross weight. The aircraft must be operated strictly within the limits of the Center-of-Gravity Moment Envelope shown on page 6-7.

AIRPLANE WEIGHING PROCEDURE

(A) LEVELING: Place a spirit level on the leveling screws above the tailcone left access door when leveling the aircraft longitudinally. Level the aircraft by increasing or decreasing air pressure in the nose wheel tire.

(B) WEIGHING: To weigh the aircraft, select a level work area and:

1. Check for installation of all equipment as listed in the Weight & Balance Record Equipment List.
2. Top off both wing tanks with full fuel. Subtract usable fuel, 89.0 U.S. gals. (337 liters) @ 5.82 lb/gal(100LL)(.69 Kg/l) =518 lbs. (235 Kgs.), from total weight as weighed.

OPTIONAL METHOD - Ground aircraft and defuel tanks as follows:

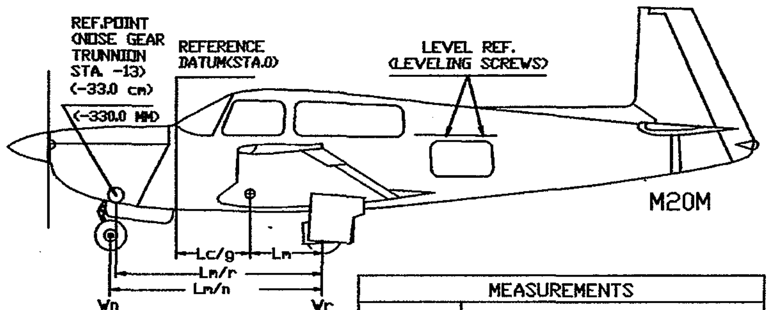
a. Disconnect fuel line at fuel system union located forward of the firewall on the lower left hand side.
b. Connect a flexible line to output fitting that will reach fuel receptacle.
c. Turn fuel selector valve to tank to be drained; remove filler cap from fuel filler port.

d. Turn on fuel boost pump until tank is empty. Repeat steps c. and d. to drain other tank.
e. Replace 3.0 gallons (11.4 liters) fuel into each tank (unusable fuel). (Use 5.82lb/gal.(.69 Kg/liter) for 100LL fuel).
f. Replace filler caps.

3. Fill oil tank to capacity (10 qts.).
4. Position front seats in full forward position.
5. Position flaps in full up position.
6. Position a 2000-pound (907.2 Kg.) capacity scale under each of the three wheels.
7. Level aircraft as previously described making certain nose wheel is centered.
8. Weigh the aircraft and deduct any tare from each reading.
9. Find reference point by dropping a plumb bob from center of nose gear trunion (retracting pivot axis) to the floor.
Mark the point of intersection.
10. Locate center line of nose wheel axle and main wheel axles in the same manner.
11. Measure the horizontal distance from the reference point to main wheel axle center line. Measure horizontal distance from center line of nose wheel axle to center line of main wheel axles.
12. Record weights and measurements, and compute basic weight and CG as follows:

NOTE: Wing Jack Points are located at Fus. Sta. 56.658 in. (143.91 cm). Nose Jack Point is located at Fus. Sta. -5.51 in. (- 14.0 cm.)

WEIGHT & BALANCE CHART



If fuel has not been drained, the usable fuel must be analytically subtracted to determine the basic empty wt. & c.g. Use the loading calculation procedure shown on pg. 6-10.

MEASUREMENTS	
$L_{M/R}$	INCHES/CM/MM
$L_{M/N}$	INCHES/CM/MM

SCALE POSITION AND SYMBOL	SCALE READING	TARE	NET WEIGHT	
NOSE WHEEL (W_N)				
RIGHT MAIN WHEEL (W_R)				
LEFT MAIN WHEEL (W_L)				
BASIC EMPTY WEIGHT (W_T)				(If fuel has been drained)
AS WEIGHED (W_T)				(If fuel has not been drained)

a. CG Forward of Main Wheels:

____Lbs/Kg Weight of Nose (W_N)	X	____In/cm/mm Distance Between Main and Nose Wheel Axle Centers ($L_{M/N}$)	÷	____Lbs/Kg Total weight of Aircraft (W_T)	=	____In/cm/mm CG Forward of Main Wheels (L_M)

b. CG Aft of Datum (Station 0):

____In/cm/mm Distance from Center Nose Gear Trunion to Center of Main Wheel Axles (Horizontal) (L_{MR})	—	13 in/33.0 CM Distance from Nose Gear TDrunion to Datum (CONSTANT)	—	____In/cm/mm Result of Computation Above (L_M)	=	____In/cm/mm CG (FUS. STA) Distance Aft of DAtum (Empty Weight CG) ($L_{C/G}$)

If fuel has not been drained, the usable fuel must be analytically subtracted to determine the Basic Empty Wt. and CG. Use loading calculation procedure shown on page .

WEIGHT	LBS. (Kg)	C.G. IN/cm/mm	MOMENT Lb-In(Kg-cm)(Kg-mm)/1000
As Weighed (W_T)			
Usable fuel	—	48.43/123.0cm/1230mm	—
Basic Empty Wt.			

OWNERS WEIGHT & BALANCE RECORD

OWNERS WEIGHT AND BALANCE RECORD

(ENTER BELOW ALL WEIGHT CHANGE DATA FROM AIRCRAFT LOG BOOK)

AIRPLANE MODEL - M20M	SERIAL NO.	FAA REG. NO.

DATE	DESCRIPTION OF MODIFICATION	WEIGHT CHANGE				RUNNING EMPTY WEIGHT			
		ADDED (+)		REMOVED (-)					
		WT. (LBS) (Kg)	ARM (INCHES) (cm)/(mm)	WT. (LBS) (Kg)	ARM (INCHES) (cm)/(mm)	WT. (LBS) (Kg)	MOMENT /1000	ARM (IN) (cm)/(mm)	USEFUL LOAD
	BASIC EMPTY WEIGHT AS DELIVERED (Wt) (Includes full oil - 10 Qts. (9.5 liters)	—	—	—	—				

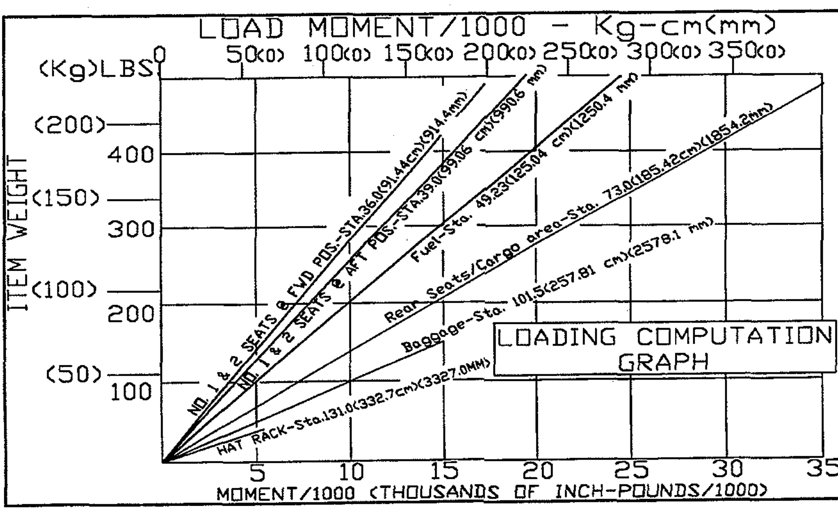
(Mult. inches by 25.4 mor mm) (Mult. inches by 2.54 for Cm) (Mult. pounds by .4536 for Kg)

M20M WT. & BAL. RECORD

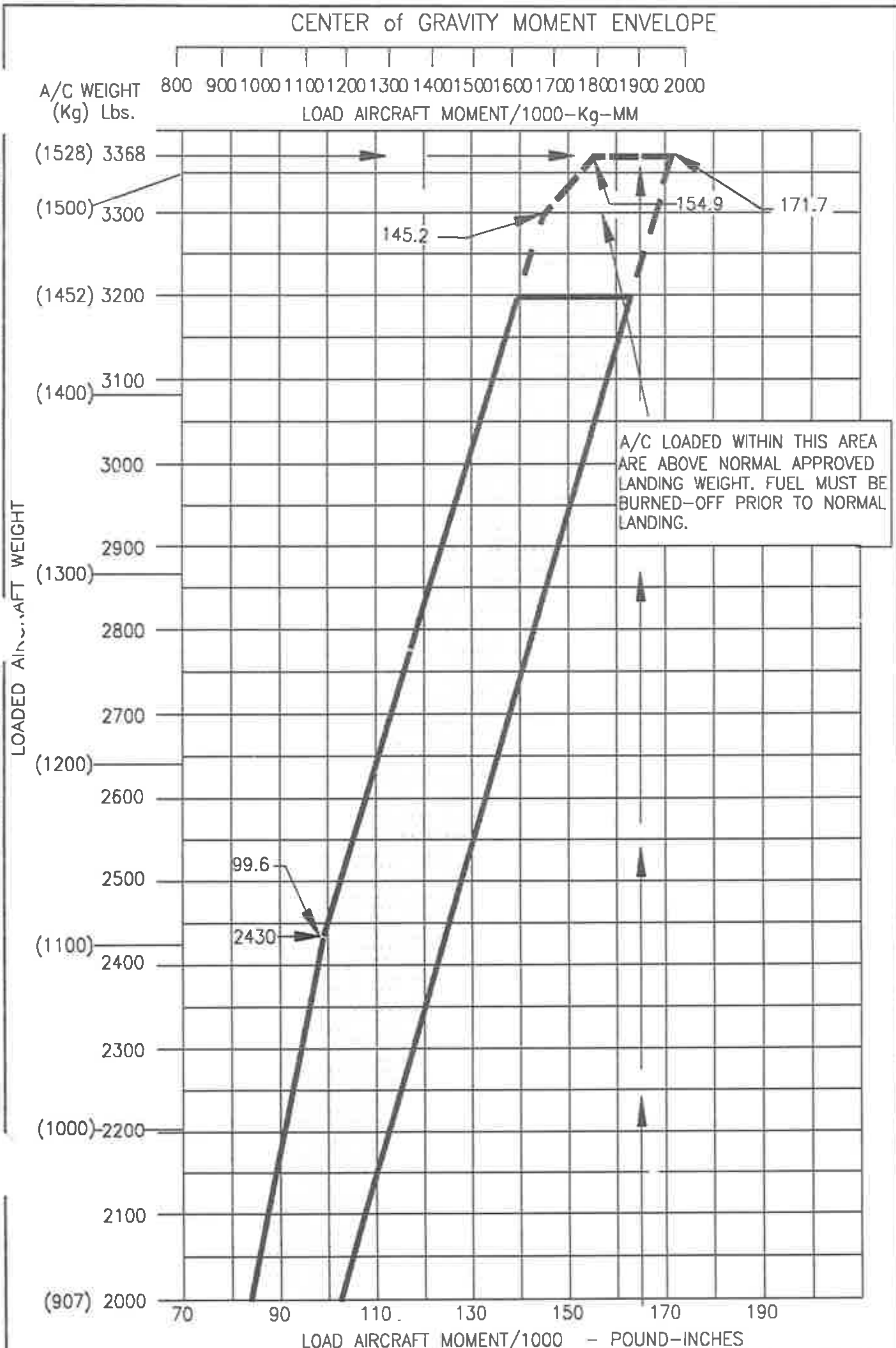
PROBLEM FORM							
STEP	ITEM	SAMPLE PROBLEM			YOUR PROBLEM		
		WEIGHT (Kg) Lbs	MOMENT (Kg-cm /1000)	MOMENT lb-in /1000	WEIGHT (Kg) Lbs	MOMENT (Kg-cm /1000)	MOMENT lb-in /1000
1.	A/C Basic Empty Wt.(W)(from page 6-5) (Includes Full Oil) 10 Qts.(9.5 Li) @1.875lbs /Qt.(.80 Kg/Li)(Sta. -20.19)(-51.3 cm) (Oil sump assumed FULL for all flights)	(1009) 2225	(114.6)	99.46			
2.	Pilot Seat (#1) *	(77.1) 170	(7.64)	6.63			
	Co-Pilot Seat (#2) *	(77.1) 170	(6.66)	5.78			
3.	Left Rear Seat (#3) or Cargo Area	(77.1) 170	13.85	12.02			
	Right Rear Seat (#4) or Cargo Area	(77.1) 170	13.85	12.02			
4	Fuel (Max. Usable - 89.0 Gal/534 Lbs) (337 Li/242Kg) @ Sta 49.23(125 cm)	(164.7) 363	20.59	17.87			
5.	Baggage (Max. 120 Lbs(54.4 cm)@Sta.101.5 (257.8 cm)	(45.4) 100	11.70	10.15			
	Hat Rack (Max. 10 Lbs(4.54 Kg)@Sta. 131.0 (332.7 cm)						
6.	Loaded A/C Weight(Takeoff at Max. Weight) A/C will have to burn off 168 lbs. fuel before normal landing is accomplished.	(1528) 3368	(190.2)	165.0			
7.	Required Fuel Burn-Off 28 Gals (105.9 Li) @ 6 Lbs./Gal.	(76.2) 168	(-9.53)	-8.27			
8.	MAXIMUM LANDING WEIGHT of A/C	(1452) 3200	(180.6)	156.7			
9.	Refer to Center of Gravity Moment Envelope, to determine whether your A/C loading is acceptable. CAUTION-DO NOT LAND A/C WHEN OVER 3200 LBS EXCEPT IN AN EMERGENCY SITUATION.						
*	Obtain the moment/1000 value for each seat position (FWD, MID or AFT) from loading computation graph.						

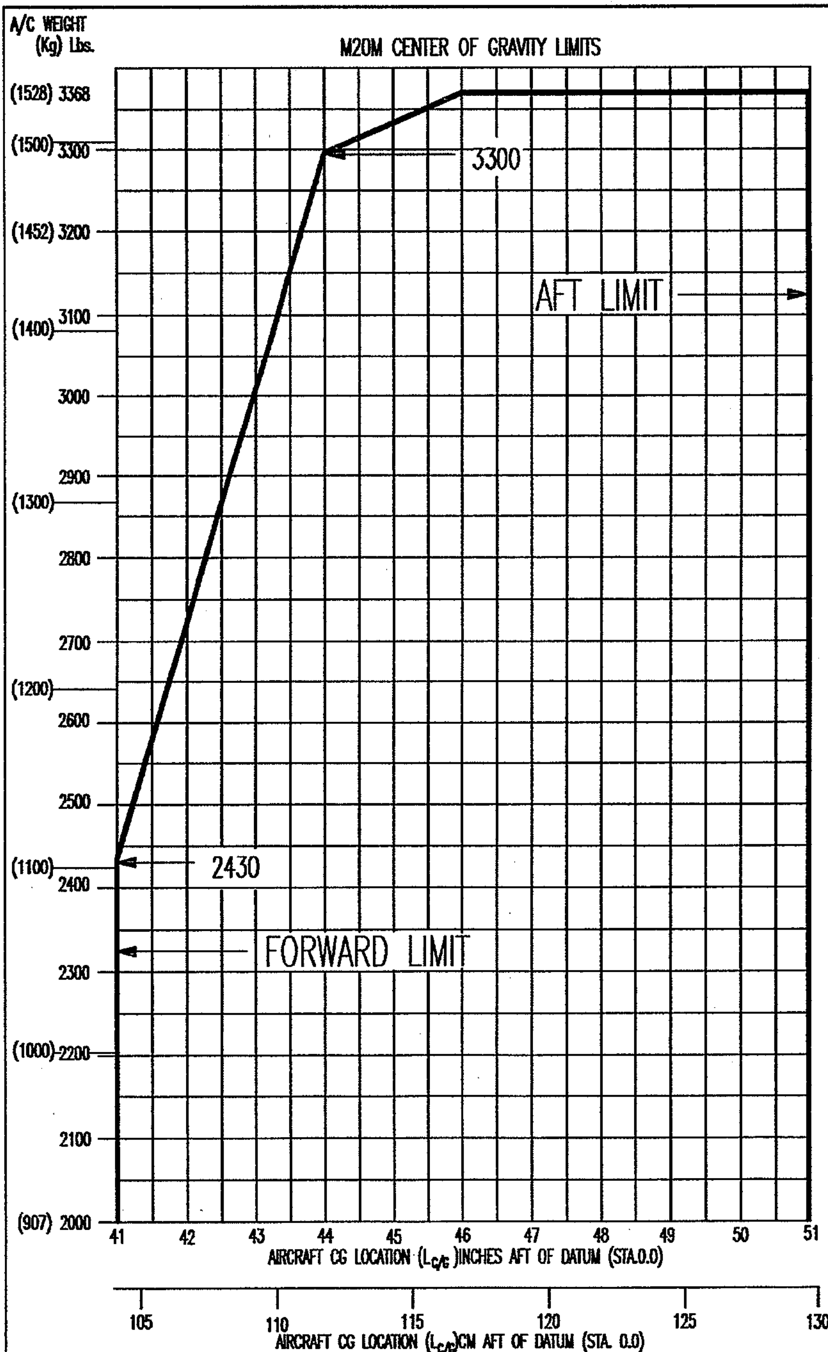
CAUTION

Cargo loaded in rear seat area, with seat backs folded down, should have *center of gravity over fuselage station 70.7.*



M20M - CENTER OF GRAVITY MOMENT ENVELOPE




A/C WEIGHT
(Kg) Lbs.
M20M CENTER OF GRAVITY LIMITS
(1528) 3368
(1500) 3300
(1452) 3200
(1400) 3100
3000
2900
(1300)
2800
2700
(1200)
2600
2500
(1100) 2400
2300
(1000) 2200
2100
(907) 2000
3300
AFT LIMIT
2430
FORWARD LIMIT
41
42
43
44
45
46
47
48
49
50
51
AIRCRAFT CG LOCATION (L C/G) INCHES AFT OF DATUM (STA.0.0)
105
110
115
120
125
130
AIRCRAFT CG LOCATION (L C/G) CM AFT OF DATUM (STA. 0.0)

FIXED BALLAST

The M20M has provisions for a fixed ballast located in the tailcone at Fuselage Station 209.5. If additional equipment is to be installed, fixed ballast weight adjustment may be required to maintain the center of gravity enevelope.

The aircraft should be weighed and a new center of gravity established as defined in the airplane weighing computation on page 6-4.

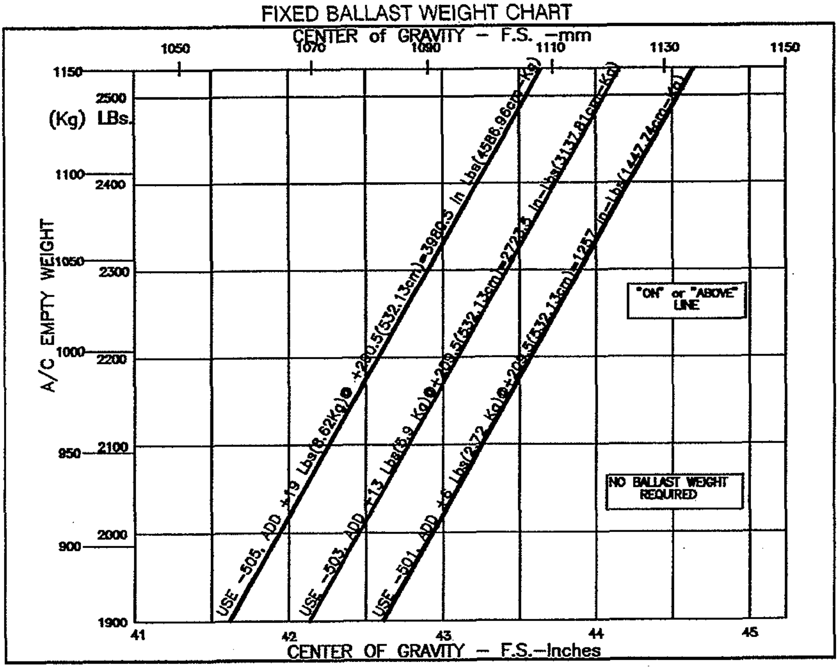
Check the weight and C.G. on the Fixed Ballast Weight Chart below. Install or remove weights as required.

EXAMPLE:Airplane empty weighs 2150 lbs.(975 Kg) with a C.G. at 42.75 inches (108.6cm).

ADD - 503 weights @ 209.5 in., 13 lbs. (5.9 Kg) = + 94636.0 moment.

NEW CG = 94636 ÷ 2163 = 43.75

FIXED BALLAST WEIGHT CHART



PILOT'S LOADING GUIDE

LOADING CALCULATION PROCEDURE

Proper loading of the aircraft is essential for maximum flight performance and safety. This section will assist you in determining whether the aircraft loading schedule is within the approved weight and center-of-gravity limits.
To figure an actual loading problem for your aircraft, proceed as follows:
Step 1. Refer to the latest entry on page 6-5 for the current empty weight and moment.

NOTE

Since the engine oil is normally kept at the full level, the oil weight and moment is included in basic empty weight and is constant in calculating all loading problems.

Step 2: Note the pilot's weight and the position his seat will occupy in flight. Find this weight on the left scale of the Loading Computation Graph (page 6-6) and cross the graph horizontally to the graph for #1 and #2 seats. When this point is located, drop down to the bottom scale to find the value of the moment/1000 due to the pilot's weight and seat position.

Repeat procedure for co-pilot and enter these weights and moment/1000 values in the proper sub-columns in the Problem Form on page 6-6.

Step 3: Proceed as in Step 2 to account for the passengers in seats 3 and 4. Enter the weight and value of moment/1000 in the proper columns.

Step 4: Again proceed as in Step 2 to account for the amount of fuel carried, and enter the weight and moment/1000 values in the proper columns.

Step 5: Once more proceed as in Step 2 to account for the baggage to be carried and enter the figures in the proper columns.

Step 6: Total the weight columns. This total must be 3200 Pounds(1452 Kgs) or less. Total the Moment/1000 column.

DO NOT FORGET TO SUBTRACT NEGATIVE NUMBERS.

Step 7: Refer to the Center-of-Gravity Moment Envelope (page 6-7). Locate the loaded weight of your airplane on the left scale of the graph and trace a line horizontally to the right. Locate the total moment/1000 value for your airplane on the bottom scale of the graph and trace a line vertically above this point until the horizontal line for weight is intersected. If the point of intersection is within the shaded area, your aircraft loading is acceptable. If the point of intersection falls outside the shaded area, you must rearrange the load before takeoff.

EQUIPMENT LIST

The following equipment list is a listing of items approved at the time of publication of this manual for the Mooney M20M.

Only those items having an X in the "Mark If Installed" column and dated were installed at Mooney Aircraft Corporation at the time of manufacture.

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

NOTE

Positive arms are distances aft of the airplane datum. Negative arms are distances forward of the airplane datum.

Asterisks (*) after the item weight and arm indicate complete assembly installations. Some major components of the assembly are listed and indented on the lines following. The summation of the major components will not necessarily equal the complete assembly installation.

EQUIPMENT LIST

MO.

DAY

YEAR

M-EQ-A

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg.)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	A. FIXED BALLAST								
1A	WEIGHT (-501 INSTL)	350203	(2.81)	6.2	(532.1)	209.50			
2A	WEIGHT (-503 INSTL)	350203	(6.08)	13.4	(532.1)	209.50			
3A	WEIGHT (-505 INSTL)	350203	(8.94)	19.7	(532.1)	209.50			

EQUIPMENT LIST

M-EQ-B1

MO. / DAY / YEAR

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	B. POWERPLANT & ACCESSORIES								
1B	ENGINE-LYCOMING TIO-540-AF1A INCLUDES: STARTER, ALTERNATORS(2), OIL FILTER, OIL RADIATOR, PROP GOV, TURBOCHARGER, INTERCOOLER, NO OIL.	600423	(241)	531.80	(-62.87)	-24.75			
2B	PROPELLER-CONSTANT SPEED McCAULEY- HUB, B3D32C417 BLADES (3), 82NRD-7	680035	(34.02)	75.0	(-125.73)	-49.5	X		
3B	SPINNER INSTALLATION	680035	(7.5)	5.6	(-131.06)	-51.6	X		
4B	INDUCTION AIR FILTER	600417	(.27)	.6	(-81.3)	-32.0	X		
5B	ENGINE-LYCOMING TIO-540-AF1B INCLUDES: STARTER, ALTERNATORS(2), OIL FILTER, OIL RADIATOR, PROP GOV, TURBOCHARGER, INTERCOOLER, NO OIL.	600423	(241)	531.80	(-62.87)	-24.75			

EQUIPMENT LIST

M-EQ-C1

MO. / DAY / YEAR

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	C. ELECTRICAL SYSTEM								
1C	BATTERIES 24 VOLTS (2)	800311	(13.4)	29.55	(370.8)	146.0	X		
2C	REGULATOR, VOLTAGE (2)	800311	(.27)	.6 EA	(41.28)	16.25	X		
3C	PITOT, HEATED	820252	(.52)	1.15	(106.3)	41.85	X		
4C	CIGAR LIGHTER	800311	(.08)	.17	(49.53)	19.5	X		
5C	FUEL PUMP, ELECTRIC	610293	(.86)	1.9	(38.1)	15.0	X		
6C	STALL WARNING INDICATOR	800311	(.45)	1.0	(127.0)	50.0	X		
7C	GEAR WARNING INDICATOR	800311	(.45)	1.0	(49.53)	19.5	X		
8C	WING TIP STROBE LIGHT INSTL.	800311	(2.27)	5.0	(134.62)	53.0	X		
9C	TAIL STROBE LIGHT INSTL.	800311	(.68)	1.5	(578.7)	227.82	X		
10C	LANDING/TAXI LIGHTS (2 SETS)	210417	(2.7)	5.88	(105.6)	41.6	X		
11C	ACTUATOR, FLAPS	750110	(2.3)	5.1	(277.1)	109.1	X		
12C	ACTUATOR, LANDING GEAR	560260	(5.08)	11.2	(99.06)	39.0	X		

EQUIPMENT LIST

M-EQ-C2

MO.		
DAY		
YEAR		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	C. ELECTRICAL SYSTEM (CON'T)								
13C	E.L.T. (D & M ELT-8)	810152	(1.63)	3.59	(337.8)	133.0			
14C	HOURMETER INSTALLATION	950241	(.23)	.5	(46.99)	18.5			
15C	E.L.T. (ARNAV ELT-100)	810152	(2.33)	5.13	(337.8)	133.0			
16C									
17C									
18C									
19C									
20C									
21C									

EQUIPMENT LIST

MO.			
DAY			
YEAR			

M-EQ-D1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	D. WHEELS, TIRES & BRAKES								
1D	MAIN WHEEL & BRAKE ASSYS (2) *	520029	(6.22)	13.72	(163.6)	64.4	X		
	WHEEL ASSEMBLY (2)	520029	(4.99)	11.0	(162.5)	63.98	X		
	BRAKE ASSEMBLY (2)	520029	(1.23)	2.72	(167.6)	65.98	X		
2D	TIRES, MAIN (2) (6 PLY RATING) 6.00 X 6 TYPE III W/ TUBES	520029	(7.71)	17.0	(162.5)	63.98	X		
3D	NOSE WHEEL ASSEMBLY (1)	540000	(1.18)	2.6	(-33.8)	-13.3	X		
4D	TIRE, NOSE (1) (6 PLY RATING) 5.00 X 5 TYPE III W/ TUBE	540000	(3.18)	7.0	(-33.8)	-13.3	X		
5D	MASTER CYLINDER, BRAKE (2)	850109	(1.36)	3.0	(21.08)	8.3	X		
6D	VALVE, PARKING BRAKE	850109	(.27)	.6	(44.45)	17.5	X		
7D									
8D									
9D									

EQUIPMENT LIST

M-EQ-E1

MO.			
DAY			
YEAR			

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	E. INSTRUMENTS								
1E	GYRO HORIZON	820336	(1.33)	2.93	(44.3)	17.46			
2E	DIRECTIONAL GYRO		(1.33)	2.93	(42.7)	16.8			
3E	CLOCK, PANEL MOUNTED		(.11)	.25	(49.8)	19.6			
4E	OAT GAUGE		(.25)	.55	(46.9)	18.47	X		
5E	INDICATOR, VERTICAL SPEED		(.23)	.5	(44.9)	17.67	X		
6E	INDICATOR, TURN & SLIP/TURN COORD		(.83)	1.84	(41.9)	16.5	X		
7E	ALTIMETER		(.49)	1.07	(36.0)	14.17			
8E	INDICATOR, AIRSPEED		(.32)	.70	(47.8)	18.80	X		
9E	TACHOMETER		(.36)	.8	(48.1)	18.95	X		
10E	FUEL FLOW		(.63)	1.39	(46.9)	18.48	X		
11E	TIT GAUGE		(.23)	.5	(44.5)	17.5	X		
12E	ENGINE GAUGES (DUAL CLUSTERS)	820336	(1.6)	3.5	(46.9)	18.5	X		

EQUIPMENT LIST

MO.			
DAY			
YEAR			

M-EQ-E2

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	E. INSTRUMENTS (CON'T)								
13E	ANNUNCIATOR PANEL	820336	(.58)	1.3	(44.5)	17.5	X		
14E	MAGNETIC DIRECTION INDICATOR	130323	(.23)	.5	(60.6)	23.87	X		
15E									
16E									
17E									
18E									
19E									
20E									

EQUIPMENT LIST

M-EQ-F1

						MO.			
						DAY			
						YEAR			
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	F. MISCELLANEOUS SYSTEMS								
1F	VACUUM SYSTEM INSTALLATION	860015	(2.58)	5.68	(-2.54)	-1.0	X		
2F	VACUUM PUMP	860015	(1.54)	3.4	(-7.6)	-3.0	X		
3F	STAND BY VACUUM PUMP	860015	(2.45)	5.41	(-6.4)	-2.5	X		
4F	OXYGEN SYSTEM (115.7 cu. ft.)	870029	(14.16)	31.21	(347.9)	137.0	X		
5F	DESCENT RATE CONTROL (SPD'BRKS)	950155	(5.59)	12.32	(177.8)	70.0	X		
6F	PROPELLER DE-ICE	690003	(2.69)	5.93	(-115.6)	-45.5	X		
7F	FLIGHT CALCULATOR	340206	(.25)	.55	(44.1)	17.35			

EQUIPMENT LIST

M-EQ-E1

MO.					
DAY					
YEAR					

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	G. CABIN ACCOMODATIONS								
1G	SUN VISORS (2)	130303	(.32)	1.0	(83.8)	33.0	X		
2G	SHOULDER HARNESS ASSY (4)	140214	(2.27)	8.4	(194.3)	76.48	X		
3G									
4G	SEAT BELT ASSY - REAR (2)	140262	(1.36)	2.0	(180.3)	71.0	X		
5G	ASHTRAY, ARM REST	140295	(.18)	.4	(79)	31.1 *			
6G	ASHTRAY, CABIN DOOR	130331	(.14)	.3	(86.6)	34.1			
7G	ASHTRAY, SEATBACK (2 ea.)	130331	(.18)	.4 ea.	(129.8)	51.1 *			
8G									
9G									
10G									
11G									

* THIS ARM IS AT FWD SEAT POSITION.

EQUIPMENT LIST

MO.			
DAY			
YEAR			

M-EQ-H1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) (POUNDS)	ARM (cm) (INCHES)	MARK IF INSTALLED		
	H. AVIONICS & AUTOPILOTS						
1H							
2H							
3H							
4H							
5H							
6H							
7H							
8H							
9H							
10H							
11H							
12H							

EQUIPMENT LIST

MO.			
DAY			
YEAR			

M-EQ-H2

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) (POUNDS)	ARM (cm) (INCHES)	MARK IF INSTALLED		
	H. AVIONICS & AUTOPILOTS						
13H							
14H							
15H							
16H							
17H							
18H							
19H							
20H							
21H							
22H							
23H							
24H							

EQUIPMENT LIST

M-EQ-H3

						MO.		
						DAY		
						YEAR		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) (POUNDS)	ARM (cm) (INCHES)	MARK IF INSTALLED		
	H. AVIONICS & AUTOPILOTS (CON'T)						
25H							
26H							
27H							
28H							
29H							
30H							
31H							
32H							
33H							
34H							
35H							
36H							

EQUIPMENT LIST

MO.			
DAY			
YEAR			

M-EQ-I1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	I. AUXILIARY EQUIPMENT (FLY AWAY)								
1I	TOW BAR, FOLDING (STOWED)	010036	(1.03)	2.6	(273.1)	107.5	X		
2I	JACK POINTS (2) (STOWED)	↑	(.07)	.1	(332.7)	131.0	X		
3I	EYE BOLT, WING TIE DOWN (2) (STOWED)		(.09)	.1	(332.7)	131.0	X		
4I	FUEL SAMPLER CUP (STOWED)		(.04)	.05	(332.7)	131.0	X		
5I	BAGGAGE TIE DOWNS (2) (STOWED)		(.04)	.16	(332.7)	131.0	X		
6I	CARGO RESTRAINT BELTS (2) (STOWED)		(.27)	1.0	(332.7)	131.0	X		
7I	PITOT COVER (STOWED)		(.03)	.3	(332.7)	131.0	X		
8I	POH/AFM No. - MOONEY		(.84)	1.5	(332.7)	131.0	X		
9I	ENGINE OPERATOR'S MANUAL-LYCOMING		(.35)	.5	(332.7)	131.0	X		
10I	ENGINE LOG BOOK	↓	(.07)	.2	(332.7)	131.0	X		
11I	AIRFRAME LOG BOOK	010036	(.063)	.2	(332.7)	131.0	X		
12I									

EQUIPMENT LIST

MO.			
DAY			
YEAR			

M-EQ-J1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	J. OPTIONAL EQUIPMENT								
1J	ARM REST INSTL, PILOT'S SEAT	140295	(.95)	2.1	(87.6)	34.5	X		
2J	LUMBAR SUPPORT INSTL. (2)	140300	(.99)	2.18	(88.9)	35.0	X		
3J	ACCESS PANEL, FUEL GAUGE (2)	210099	NEGLIGIBLE DIFFERENCE				X		
4J	RECOGNITION LIGHT INSTL (2)	210413	(.60)	1.32	(134.6)	53.0			
5J	RUDDER PEDAL EXTENSION INSTL (1)	720115	(.059)	.13	(38.1)	15.0			
6J	AUX. POWER RECPT. INSTL.	800166	(1.48)	3.27	(332.7)	131.0			
7J	AUX. POWER CABLE ADAPTER	880042	(3.43)	7.57		***			
8J	DUAL BRAKE INSTL	950270	(1.38)	3.05	(38.1)	15.0			
9J	STATIC DISCHARGE INSTL	950253	NEGLIGIBLE DIFFERENCE						
10J	STEP ASSY & INSTL	950256	(1.25)	2.75	(274.3)	108.0			
11J	FIRE EXTINGUISHER INSTL	130328	(1.20)	2.65	(153.7)	60.5			
12J									

*** NORMALLY STOWED IN BAGGAGE COMPARTMENT BETWEEN STA. 110 & 130.

EQUIPMENT LIST

M-EQ-J2

							MO.		
							DAY		
							YEAR		
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	J. OPTIONAL EQUIPMENT (CON'T)								
13J	ANTI-COLLISION BEACON (RED)	800311	(.48)	1.06	(451.2)	180.0			
14J									
15J									
16J									
17J									
18J									
19J									
20J									
21J									
22J									
23J									
24J									

EQUIPMENT LIST

MO.			
DAY			
YEAR			

M-EQ-J3

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED		
	J. OPTIONAL EQUIPMENT (CON'T)								

EQUIPMENT LIST

M-EQ-J3

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED MO.	DAY	YEAR
	J. OPTIONAL EQUIPMENT (CON'T)								

TABLE OF CONTENTS

TABLE OF CONTENTS (con't)

INTRODUCTION

Acquiring a working knowledge of the aircraft's controls and equipment is one of your important first steps in developing a fully efficient operating technique. This Airplane and Systems Section describes location, function, and operation of systems' controls and equipment. It is recommended that you, the pilot, familiarize yourself with all controls and systems while sitting in the pilot's seat and rehearsing the systems operations and flight procedures portions of this manual.

AIRFRAME

The M20M is an all metal, low wing, high performance airplane. The fuselage has a welded, tubular-steel cabin frame covered with non-structural aluminum skins. Access to the cabin is provided by a door located on the right side of the fuselage. A door is provided aft of the rear seat for access to the baggage compartment. The aft fuselage, tailcone, is of semi-monocoque construction.
Seating in the cabin is provided for the pilot and three passengers.
The M20M has a tapered wing that is a full-cantilever-laminar-flow type. The airfoil varies from a NACA 63_2-215 at the wing root to a NACA 64_1-412 at the wing tip, modified by an inboard leading edge cuff.
An aerodynamically designed cover is attached to the wing tip and contains the wing navigation and anti-collision lights. The wing has full wrap- around skins with flush riveting over the forward top and bottom two thirds of the wing chord.
The empennage consists of the vertical and horizontal stabilizers and the rudder and elevator surfaces. The entire empennage pivots around attaching points on the aft fuselage to provide pitch attitude trim. The tricycle landing gear allows maximum vision and ground maneuvering. Hydraulic disc brakes and a steerable nose wheel aid in directional control during taxiing and ground operations.
The landing gear is electrically retracted and extended. A warning horn, a gear position indicator on the floorboard and a green "GEAR DOWN" light help prevent inadvertent gear-up landings. A manual emergency gear extension system is provided in the event of an electrical failure.

FLIGHT CONTROLS DESCRIPTION

The aircraft has dual flight controls and can be flown from either the pilot or co-pilot seat. Dual pairs of foot pedals control the rudder and nose wheel steering mechanisms. Push-pull tubes, rather than conventional cable systems, actuate the all-metal flight control surfaces. Rod-end bearings are used throughout the flight control systems. These bearings are simple and require little maintenance other than occasional lubrication. Specially designed aluminum-alloy extrusions, that permit flush skin attachment, form the leading edges of the rudder and elevators. A spring-loaded interconnect device indirectly joins the aileron and rudder control systems to assist in lateral stability during flight maneuvers. Longitudinal pitch trim is achieved through a trim control system that pivots the entire empennage around the tailcone attachment points. A variable down-spring located in the tailcone and a bobweight located forward of the control column help create desirable stability characteristics.

Aileron System

The ailerons are of all-metal construction with beveled trailing edges. Three hinges of machined, extruded aluminum attach the ailerons to the aft wing spar outboard of the wing flaps. The ailerons link to the control wheel through push-pull tubes and bellcranks. Counterweights balance the system.

Elevator System

Elevator construction is essentially the same as that of the ailerons. Both elevators attach to the stabilizer at four hinge points. Push-pull tubes and bellcranks link the elevators to the control yoke. Counterweights balance the elevators.

Rudder System

The rudder attaches to the aft vertical fin spar at four hinge points. Push-pull tubes and bellcranks link the rudder to the rudder pedals. An electric rudder trim system is incorporated. The rudder trim indicator is located on the lower right side of the Pilot's panel.

Stabilizer Trim System

To provide pitch trim control, the entire empennage pivots around its main hinge points. The system consists of a manually (electrical operation optional) operated actuator that operates a series of torque tubes and universal joints connected to a jack screw on the aft tailcone bulkhead. A trim control wheel, located between the pilot and co-pilot seats, allows the pilot to set stabilizer angle. Trim position is indicated by an electrical gauge located in the center of the instrument panel. This indicates stabilizer position relative to the aircraft thrust line.

Rudder Trim System

The M20M is equipped with an electric rudder trim system which allows the pilot to trim out much of the rudder force required for takeoff, climb, cruise and descent. The system is a "bungee" type spring assembly, attached to the rudder control system and driven by an electric motor. The trim system is operated by a split toggle switch located directly above the throttle on the pilot's panel. The split switch is a safety measure that greatly reduces the possibility of a runaway trim situation. The electronic trim indicator is located adjacent to the toggle switch. The takeoff position is the last 3 lighted segments on the right end of the indicator. Rudder force varies from negligible (with trim to the far right) to mild (with trim set to the third segment from the right). Cruise will result in the trim indicator being slightly left of neutral and even more left of neutral during a high speed descent.

Wing Flaps

The wing flaps are electrically operated and interconnected through push-pull tubes and bellcranks. Total flap area is 17.98 square feet.
Nominal travel is 0 to 33 degrees and limit switches prevent travel above or below these limits. The flap position is controlled by a switch located on the lower control console. The electric flap position indicator which shows full up, takeoff (10 degrees) and full down positions is located on the right side of the center console. A potentiometer controls the flap position indicator. Generally, aircraft trim requirements will change with use of the flaps. Lowering of the flaps will cause a nose down pitching condition which can be easily corrected by application of nose up trim. Conversely, retraction of the flaps from a trimmed flight condition will cause a nose up pitching condition.

Use of the flaps should always be within the operational limits established in Section II. The flaps are very effective in lowering landing speed and can be used to slow the aircraft to approach speeds.

INSTRUMENT PANEL

The instrument panel is designed to provide functional grouping of all flight, radio, engine instruments, switches and controls required to operate various systems. All flight instruments are grouped on the shock-mounted panel directly in front of the pilot. Power plant instruments are grouped into two clusters and located to the right of the flight instruments. The radio panel is in two sections directly in front of the co-pilot's seat. The annunciator panel and optional radio console are at the top left of the radio panel. The circuit breaker panel is located at the far right, in front of the co-pilot's seat.

FLIGHT PANEL & INSTRUMENTS

Flight instruments operate: (1) by barometric pressure or barometric-impact air pressure differences, (2) by variations in electric current due to mechanically varied resistance, (3) by air drawn into an evacuated case or (4) by reference to the earth's magnetic field.

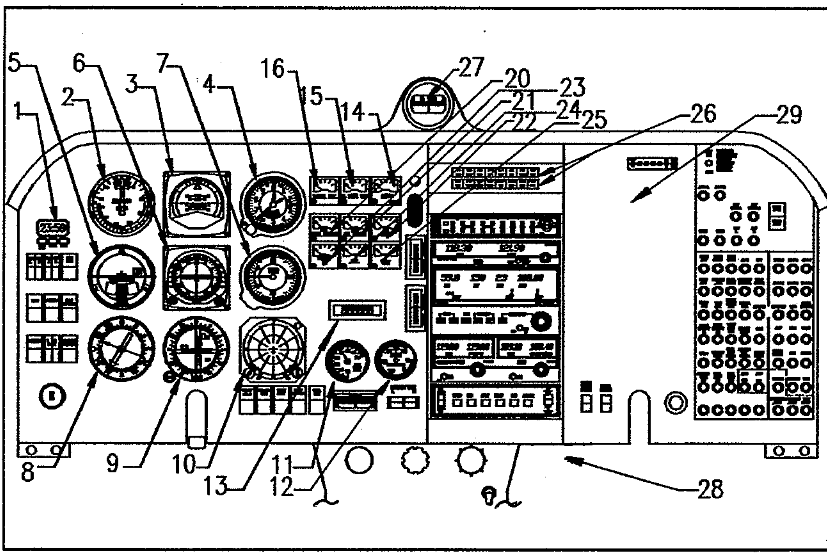


FIGURE 7-1

1. Clock
The electric, digital, panel mounted clock, may be used and set by the following procedures:
Three buttons are located below the digital face of the clock and identified as START/STOP, CLEAR & MODE .
Normal or Elapsed time.
MODE - Push to switch from normal time to elapsed time.
START/STOP - Push to start or stop seconds when in elapsed time mode.
CLEAR - Push to reset elapsed time to Zero.
Set Hours, Minutes or 24 vs 12 hour time.
Push and Hold both START/STOP and CLEAR buttons for 4 - 5 seconds to enter clock set mode; 12 H or 24 H will flash.
- Push both START/STOP & CLEAR buttons three (3) times more to select either 12 or 24 hour mode.
- Push CLEAR to select hours (hours flashing/minutes blank) or minutes (hour steady/minutes flashing) for setting.
- Push START/STOP to increase either hours or minutes until desired time is set. In 12 H mode set PM (P) if necessary.
- Push MODE to return to normal time.

2. Airspeed Indicator
The airspeed indicator registers airspeed in knots. The air pressure difference between the pitot tube and static ports on each side of the tailcone operates the airspeed indicator.

3. Artificial Horizon
Varies with installed equipment.

4. Altimeter
The altimeter operates by absolute pressure and converts barometric pressure to altitude reading in feet above mean sea level. The altimeter has a fixed dial with three pointers to indicate hundreds, thousands and tens-of- thousands of feet. Barometric pressure is sensed through the static ports. A knob adjusts a movable dial, a small window on the face of the main dial, to indicate local barometric pressure and to correct the altimeter reading for prevailing conditions.

5. Turn Coordinator
The turn coordinator operates from an electric power source. The turn coordinator is independent of the flight reference gyros. The turn coordinator displays variation in roll and yaw to the pilot by means of a damped miniature aircraft silhouette display - this provides the pilot with essential information to execute a "proper turn".

6. Gyroscopic Heading Indicator (DG)
The vacuum operated directional gyro displays airplane heading on a compass card in relation to a fixed simulated airplane image and index. The directional indicator may precess slightly over a period of time. Therefore, the compass card should be be set in acordance with the magnetic compass just prior to takeoff and occcasionally checked and readjusted on extended flights. A knob on the lower left edge of the instrument is used to adjust the compass card to correct for any precession. A slaved flux gate compass is optional; if installed and ON will keep the DG corrected during the flight.

7. Vertical Speed Indicator
The vertical speed indicator converts barometric pressure changes in the static lines to aircraft ascent or descent rate readings in feet per minute. This indicator has a single needle and two adjoining scales that read from 0 to 2000 feet per minute.

8. Automatic Direction Finder (Indicator) (ADF)

9. Navigation Instrument No. 2.

10. (Optional) Stormscope, Second Altimeter, etc.

11. Manifold Pressure
The manifold pressure gauge is of the direct reading type. The gauge is calibrated in inches of mercury (Hg) and indicates the pressure in the induction air manifold.

12. Tachometer
The tachometer is an electronic meter which counts ignition pulses. The instrument is calibrated in engine revolutions per minute (RPM).

13. Fuel Flow
The fuel flow gauge is an electric instrument operating from information provided by a fuel flow transducer. The gauge indicates fuel flow being used by the engine. The unit incorporates a self test feature which shows "8's" in all four segments, then the "K" factor and then the total fuel used since last "RESET". The FT-101A system will also depict the quantity of fuel used when the "USED" button is pushed.

14. Ammeter
The ammeter indicates battery charge or discharge. A PUSH for VOLTS button is available to show buss voltage if desired. The voltage is read on a separate scale using the same needle.

15 & 16. Fuel Quantity Indicators
The fuel quantity indicators are used in conjunction with float-operated variable-resistance transmitters in each fuel tank. The tank-full position of the transmitter floats produces a maximum resistance through the transmitters, permitting minimum current flow through the fuel quantity indicator and maximum pointer deflection. The instruments are calibrated in fractions of tank volume. (1/4, 1/2, etc.)

17, 18 & 19. NOT USED

20. Fuel Pressure
The fuel pressure gauge is of the electric type utilizing a transducer as a reference. It is calibrated in pounds per square inch (PSI).

21. Oil Pressure
This is an electrical instrument using a transducer as a reference. It is calibrated in pounds per square inch (PSI).

22. OAT (Outside Air Temperature)
The outside air temperature gauge provides the pilot with the free stream outside air temperature in ° C.

23. Turbine Inlet Temperature (TIT) (° F)
The TIT gauge incorporates a thermocouple probe in the turbocharger turbine inlet to transmit temperature variations to the indicator mounted in the engine cluster. The TIT indicator serves as a visual aid to the pilot when adjusting mixture for optimum power. TIT varies with fuel-air ratio,power and RPM.

24. Oil Temperature
The oil temperature gauge is an electric instrument connected to an electrical resistancea bulb in the engine. Temperature changes of the engine oil change the electrical resistance thereby allowing more or less current to flow through the indicating gauge. The instrument is calibrated in ° F.

25. Cylinder Head Temperature
The cylinder head temperature indication is controlled by an electrical resistance type temperature probe installed in cylinder number 5. The indicator receives power from the aircraft electrical system. The instrument is calibrated in ° F.
A 6 position switch, with probes installed in all cylinders, is optional.

26. Annunciator Panel
See description in this Section, Page 7-15.

27. Magnetic Compass
The magnetic compass dial is graduated in five-degree increments and is encased in a liquid-filled glass and metal case. It is equipped with compensating magnets adjustable from the front of the case. Access to the compass light and the compensating magnets is provided by pivoted covers. No maintenance is required on the magnetic compass except an occasional check on a compass rose, adjustment of the compensation screws (if necessary) and replacement of the lamp.

28. Hour Meter
The hour meter is located on the co-pilot's side, forward of the console and indicates elapsed time while the engine is running. Location may vary.

29. Radio Instruments
Refer to Section IX for the description of the radio/navigation configuration installed in this aircraft.

SWITCHES & CONTROLS

1. Magneto/Starter Switch
The Magneto/Starter switch combines both ignition and starting functions. Turning the ignition key clockwise through R, L, and BOTH to the START position and then pushing forward on the key and receptacle engages the starter. Releasing the key when the engine starts allows the switch to return, by spring action, to the BOTH position.

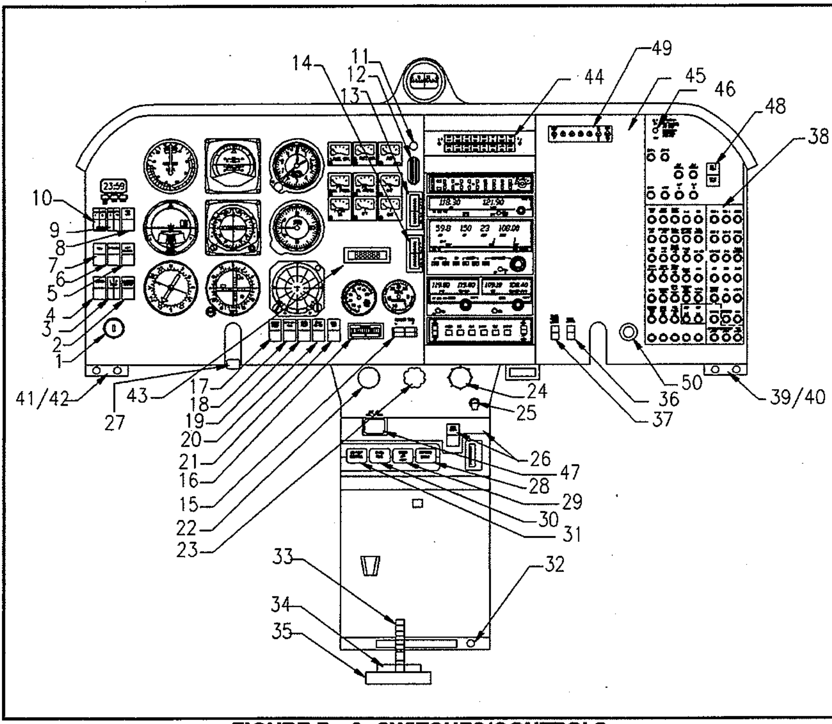


FIGURE 7 - 2 SWITCHES/CONTROLS

2. RADIO MASTER SWITCH
Switch operates a relay supplying power to the avionics buss. Since relay is energized to turn avionics buss OFF, failure of relay coil will still allow electrical power to avionics buss. Energizing starter automatically energizes relay and disconnects all avionics from buss. Electric trim switch, on control wheel, is tied to avionics buss and will not operate unless RADIO MASTER and TRIM switch on pilot's panel are - ON.

3. ALTERNATOR FIELD SWITCH (SPLIT) (L OR R ALT FLD)
These switches cut alternator field power from main buss to either Left (L) or Right (R) alternators

4. MASTER SWITCH
Master switch operates battery relay which controls battery power (selected battery) to main buss. This switch cuts ALL ship power OFF except forward and aft cabin overhead lights and the electric clock.

5. **OPTIONAL** - Rotating/Flashing Beacon, etc.

6. STROBE LIGHT (STROBE LITE)SWITCH/CIRCUIT BREAKER
Strobe light combination switch/circuit breaker turns wing tip and tail strobe lights on. Should a short occur, the combination switch/circuit breaker will automatically trip to the OFF position.

7. NAVIGATION LIGHT (NAV LITE) SWITCH/CIRCUIT BREAKER
Navigation light combination switch/circuit breaker turns wing tip and tail navigation lights on. Should a short occur, the combination switch/circuit breaker will automatically trip to the OFF position. The glareshield and panel lights are also turned on when this switch is ON. Control dimming of either glareshield or panel lights with rotating switches on lower console. See No. 36 & 37.

8. RECOGNITION LIGHT (RECOG LITE) (If installed)
Pushing the recognition light combination switch/circuit breaker turns recogntion light ON. Should a short occur, combination switch/circuit breaker will automatically trip to OFF position.

9. TAXI LIGHT (TAXI LITE) SWITCHES (L & R)
10. LANDING LIGHT (LDG LITE) SWITCHES (L & R)
Select and push split switches to turn desired set of lights ON. Push switches OFF to turn desired set of lights off. Lights should be operated only for short time periods while not in flight to preclude overheating of lamps. Over load protection is achieved by circuit breakers in panel.

11. GEAR SAFETY BY PASS SWITCH (Gear Retraction Override)
Gear safety override switch is a manual means of electrically by-passing the Airspeed Safety Switch. In the event the landing gear switch is placed in gear-up position, a properly operating Airspeed Safety Switch prevents gear from being retracted before takeoff speed of approximately 60 + /-5 KTS is reached. To retract landing gear at a lower airspeed, the GR SAFETY BY PASS switch may be held de-pressed until landing gear is completely retracted.

~ CAUTION ~

Activation of landing gear safety override switch overrides the safety features of airspeed safety switch and CAN cause landing gear to start retracting while aircraft is on ground.

12. LANDING GEAR SWITCH
Electric gear switch, identified by its wheel shaped knob, is a two-position switch. Pulling aft and lowering knob lowers landing gear while pulling aft and raising knob raises landing gear.

| NOTE |

Failure to "Pull" knob out prior to movement may result in a broken switch.

13. STABILIZER TRIM POSITION INDICATOR
Stabilizer trim position indicator (LED) is electrically activated by a potentiometer attached to trim wheel mechanism. The position signal is transmitted to indicator by resistance readings.

14. FLAP POSITION INDICATOR
Wing flap position is electrically indicated by the (LED) flap indicator, located on flight panel. The intermediate mark on lens is the flap TAKEOFF setting. Signal is transmitted to indicator thru a potentiometer attached to flap mechanism. Position signal is transmitted to indicator by resistance readings..

15. RUDDER TRIM SWITCH
Push split toggle switch to position rudder into trimmed condition to reduce rudder pedal forces during takeoff, climbs or descents. Right - takeoff and climbs; Left - descents. Pushing left side of spring loaded switch trims rudder left, pushing right side of switch trims rudder right.

16. RUDDER TRIM POSITION INDICATOR
Rudder trim position is electrically indicated on an (LED) indicator located adjacent to switch. Signal is transmitted to indicator thru a potentiometer attached to trim mechanism. Position signal is transmitted to indicator by resistance readings.

17. FUEL BOOST PUMP (BOOST PUMP) SWITCH
An electric fuel boost pump is installed to supplement engine driven fuel pump on takeoff and landing or if engine driven fuel pump fails. Fuel boost pump is turned ON automaticlally when throttle is in full OPEN position or manually, with switch. Boost pump is required to be ON during takeoff and landing.

18. STAND-BY VAC UUM (STBY VAC) SWITCH.
When HI/LO VAC annunciator light illuminates (steady or flashing), the vacuum operated gyro instruments are considered to be unreliable. STBY VAC switch should be turned ON. Refer to Airborne Service Letter No. 31 in Section X.

19. PITOT HT Switch/Circuit Breaker
Pushing the pitot heat combination switch/circuit breaker ON turns heating elements within the pitot tube on. Should a short occur the combination switch/circuit breaker will automatically trip to the OFF position. The "PITOT HEAT" annunciator light will illuminate "BLUE"when this switch is ON.
On some export aircraft the annunciator will illuminate "RED" when the switch is OFF and will not be illuminated when ON and drawing current.

20. PROPeller DE ICE Switch (If installed).
See Section IX for operating procedures.

21. ELEVator TRIM Switch
This switch is normally left in the ON position and serves as both a circuit protector and as a master disconnect for the electric trim system in the event of a malfunction. The Radio Master Switch must be ON before power is available to the elevator trim system.

22. Throttle Control
Pushing the throttle control forward increases engine power. Pulling the throttle aft decreases engine power. Full throttle automatically activates the boost pump.

23. Propeller Control
Pushing the propeller control forward increases engine RPM; pulling the control aft decreases engine RPM. The control is a vernier type and fine adjustments of RPM can be obtained by turning the knob clockwise to increase RPM and counter clockwise to decrease RPM. The knob should not be turned IN any closer than 1/8" to the panel nut face.

24. Mixture Control
The mixture control allows the pilot to adjust the fuel-air ratio (mixture) of the engine. Pushing the control forward enrichens the mixture. Pulling the control full aft closes the idle cutoff shutting down the engine. The control is of the vernier type and fine adjustments of the mixture can be obtained by turning the knob clockwise to enrichen the mixture and counterclockwise to lean. The knob should not be turned IN any closer than 1/8" to the panel nut face.

25. FLAP Switch
The flap switch, on the console, operates the electrically-actuated wide span wing flaps. Holding the springloaded switch in the FLAP DOWN position lowers the flaps to the desired angle of deflection. Simply releasing downward pressure on the switch allows it to return to the OFF position stopping the flaps at any desired intermediate position during extension. When FLAP UP position is selected, flaps will retract to full up position unless the switch is returned to the neutral position for a desired intermediate setting.

~~~~~~~
~ CAUTION ~
~~~~~~~

Positioning the Flap Switch to the UP position retracts the flaps completely.

26. COWL FLAP Switch & Cowl Flap Position Indicator.
The rocker type cowl flap switch activates the electric cowl flap actuator to open and close the cowl flaps. Placing the switch in the lower position opens the cowl flaps. This allows additional airflow to properly cool the engine on the ground and during lowspeed, high power climbs. During cruise, placing the switch in the upper position closes the cowl flaps reducing the airflow through the engine. When full open or closed is selected the actuator will automatically shut off when the cowl flaps have reached that position. The switch will remain in that selected position. To keep oil and cylinder head temperatures within the normal operating ranges (green arc of the temperature gauges) the cowl flaps may be positioned at any angle from closed to full open. This may be accomplished by momentarily positioning the switch in either the upper or lower position. When the cowl flaps have reached a desired intermediate position, as shown on the indicator, place the switch to the center (OFF) position.

The cowl flaps position indicator is electrically activated by a potentiometer mounted on the mechanism and transmits resistance variations to the LED indicator

27. Alternate Static Source Valve
Pulling the alternate static source valve to the full aft position changes the source of static air for the altimeter, airspeed and vertical speed indicator from the outside of the aircraft to the cabin interior. Airspeed and altimeter readings are affected slightly when alternate static source is used (See Charts in Section V).

28. Parking Brake Control
Depressing the brake pedals and pulling the parking brake control sets the parking brake. Pushing in the parking brake control releases the parking brake.

29. Cabin Vent Control (Fresh Air)
Pulling the cabin vent control aft opens the mixing box connected to the cabin air inlet NACA vent located on the right side of the airplane. Optimum use of the cabin vent control is described in the Cabin Environment Section.

30. Cabin Heat Control
Pulling the cabin heat control turns on cabin heat. To lower cabin temperature the cabin heat control is pushed forward toward the OFF position. Optimum use of the cabin heat control is described in the Cabin Environment Section.

31. Defrost Control
Pulling the defrost control decreases air flow to the lower cabin and increases air flow to the windshield in the front of the glareshield area. Optimum use of the defrost control is described in the Cabin Environment Section.

32. Mike Jack
Plug the hand held microphone into this plug and place in mike holder located on storage compartment door on front of lower console.

33. Trim Control Wheel
Manually rotating the trim control wheel forward lowers the aircraft nose during flight; rearward rotation raises the nose of the aircraft during flight. If the optional electric trim system is installed, pushing both sides of the trim switch located on the left hand portion of the pilots control wheel will electrically trim the aircraft..

34. Fuel Selector Valve
The fuel selector valve located on the floorboard is a three position valve which allows the pilot to select either the left or right fuel tank. Turning the valve to OFF shuts off ALL fuel to the engine. At full throttle the engine will stop from fuel starvation in 2 to 3 seconds.

35. Gear Down Position Indicator (Floorboard)
The illuminated gear-down position indicator near the back of the fuel selector valve pan, aft of the center console, has two marks that align when the gear is down-and is illuminated when the green GEAR DOWN light is on. A red-white striped decal shows when landing gear is NOT in the down position.

36. PNL LTS Switch (Panel Light Dimmer)
When the NAV light rocker switch is turned ON, the instrument lights are switched on also, at the last intensity setting. Push and hold dimmer switch until panel lights are at the intensity desired. Upper portion to intensify; lower portion to dim.

37. GLR SHLD LTS Switch (Glareshield Light Dimmer)
When the NAV light rocker switch is turned ON, the glareshield lights are switched on also, at the last intensity setting. Push and hold switch until the glareshield lights are at the intensity desired. Upper portion to intensify; lower portion to dim.

38. Circuit Breaker Panel
See details elsewhere in this Section.

39 & 40. Co-pilot's Headset Jacks.
41. & 42. Pilot's Headset Jacks.

43. Fuel Flow Totalizer indicator & FUEL MEMory Switch.
The "Fuel Totalizer" memory is connected to the aircraft battery through the "FUEL MEMory" switch. Indicates fuel flow being used at any given power setting and provides fuel used since last fuel filling if memory switch has been left ON and the RESET button has not been pushed.
(Some optional "Fuel Totalizer" systems do not contain a memory switch.).

44. Annunciator Panel
See description elsewhere in this section.

45. Optional Directional Gyroscopic Indicator Remote SLAVE and/or Compensation Switch.

46. Emergency Locator Transmitter (ELT) Switch (ARM/ON)
Place in ARM position for routine operation. Refer to ELT description elsewhere in this section on proper and lawful usage.

47. Alternate Air
Automatically opens when Induction air becomes blocked for any reason. May be opened manually by pulling this knob. The AMBER ALT AIR light on annunciator will illuminate when open.

48. Battery Select Switch - BAT 1/BAT 2
This switch allows pilot to select the battery desired as primary for any flight. Battery #1 is normally used for operations. The battery not being used is recharged through a trickle charge system. It is recommended to switch batteries occasionally

49. Fuel Flow Memory Switch
This is normally left in the "ON" position at all times so that "Fuel Used" information is retained from one flight to the next, until reset. The memory switch may be turned OFF to prevent battery drain if the aircraft is to be stored for extended periods of time.

50. Cigar Lighter

ANNUNCIATOR & SWITCH PANEL

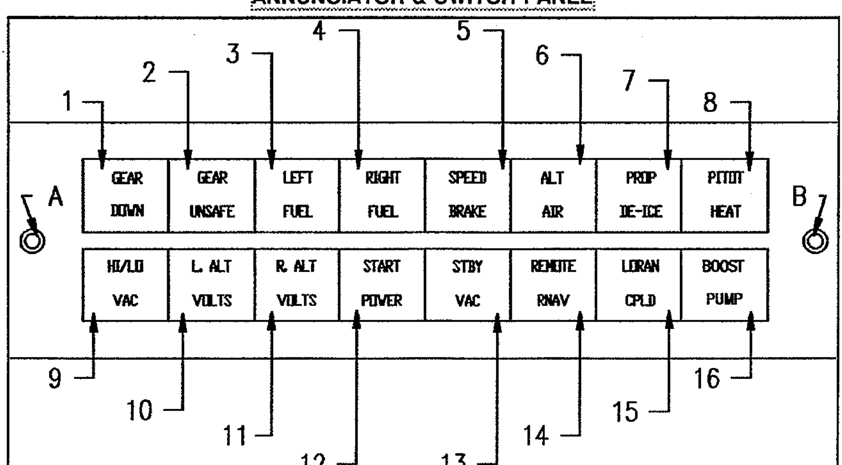


FIGURE 7 - 3 ANNUNCIATOR PANEL

A. PRESS-to-TEST Switch
Pressing the RED press-to-test switch with the Master Switch ON will illuminate all light bulbs. Defective bulbs must be replaced prior to the next flight.

B. DIM Switch
The DIM switch may be activated when the low fuel lights come on bright. The switch will dim both low fuel lights but will not turn them off. To restore the display to bright, press the TEST switch

1. Gear Safety Indicator (GEAR DOWN)
2. Gear Safety Indicator (GEAR UNSFE)

The GEAR DOWN light (GREEN), a GEAR UNSFE light (RED), and a warning horn provide visual and audible gear position signals. The green (GEAR DOWN) light shows continuously when the gear is fully extended. With the navigation lights ON, the GEAR DOWN light is dimmed for night operation. All gear lights are OUT when the gear is fully retracted. Additional verification is accomplished by checking the floorboard indicator window.

3. LEFT FUEL (Left Tank)
4. RIGHT FUEL (Right Tank)

Left and/or right, fuel annunciator light (RED) comes on when there is 2-1/2 to 3 gallons (9.5 to 11.4 liters) of usable fuel remaining in the respective tank.

5. SPEED BRAKE

Illuminates AMBER when speed brakes are extended.

6. ALT AIR

Illuminates AMBER when the spring loaded alternate air door is opened, either manually or automatically. In this situation, induction air for the engine is drawn from inside the cowling rather than through the NACA air intake vent. Normal induction air system MUST be checked for proper operation prior to next flight.

| NOTE |

Use of alternate air will result in loss of power and will reduce the service ceiling.

7. PROP DE-ICE

Illuminates BLUE when Propeller De-Ice has been selected ON.

8. PITOT HEAT

Illuminates BLUE when pilot has selected the PITOT HEAT rocker switch ON.
Some exported aircraft will Illuminate AMBER when the switch is OFF or when there is any type of electrical failure in the pitot heat system and WILL NOT BE illuminated when the switch is ON.

9. HI/LO VAC

A RED light indicates a malfunction or improper adjustment of air suction system. Air suction is available for operation of the attitude gyro and also the directional gyro. The designated suction range is 4.25 +/- .25 to 5.5 +.2/-0.0 inches of mercury (Hg). The HI/LO VAC light will BLINK WHEN SUCTION IS BELOW 4.25 in. Hg. and illuminate STEADY WHEN SUCTION IS ABOVE 5.5 in. Hg. In either case the gyros should not be considered reliable during this warning time.

10. L. ALT VOLTS

A RED light illuminates designating improper voltage supply. A flashing RED light indicates alternator voltage below load requirements or no voltage from alternator; a steady RED light indicates overvoltage or tripped voltage relay.

11. R. ALT VOLTS

A RED light illuminates designating improper voltage supply. A flashing RED light indicates alternator voltage below load requirements or no voltage from alternator; a steady RED light indicates overvoltage or tripped voltage relay.

12. START POWER
Illuminates RED when the starter switch or relay has malfunctioned and the starter is engaged while the engine is running. Shut the engine off as soon as practicable.

13. STBY VAC
Illuminates AMBER when the Stand by Vacuum Switch has been selected to ON.

14. REMOTE RNAV
Illuminates AMBER anytime the DME is not slaved to the RNAV unit.

15. LORAN CPLD
Illuminates BLUE when the loran is coupled to the # 1 NAV CDI or HSI.

16. BOOST PUMP
Illuminates BLUE when the Electric Auxiliary Boost Pump is selected ON.

GROUND CONTROL

NOSE GEAR STEERING

The nose gear steering system consists of steering horn on the gear leg linked to the rudder pedals by push-pull tubes and bellcranks. Gear retraction automatically disengages the steering mechanism from the nose wheel and centers the nose wheel for entry into the wheelwell.

TAXIING AND GROUND HANDLING

The aircraft can be easily taxied with minimum use of brakes. Minimum turning radius is 40 ft.(12.0 m) right & 48 ft.(14.4 m) left without use of brakes. A manual tow bar can be used to ground handle the aircraft. Care must be used to not swivel the nose wheel beyond 13° right or 11° left from center. Adjustable steering stops are incorporated on nose gear leg assembly.

LANDING GEAR

CONSTRUCTION

The landing gear legs are constructed of chrome-molybdenum tubular steel, heat-treated for greater strength and wear resistance. Main gear attaching points have metal backings imbedded in the gear mounting box attached to the wing spar. The nose gear mounts on the cabin tubular steel frame and engine mount. Rubber discs in all gear leg assemblies absorb the shock of taxiing and landing.

RETRACTION SYSTEM

The landing gear is electrically retracted and extended. The gear switch operates the landing gear actuator relay. Pulling the wheel-shaped knob out and moving it to the upper detent raises the gear. However, an Airspeed Safety Switch, located on the left fuselage side adjacent to the pilot's left knee and connected to the airspeed indicator, is incorporated in the electrical system to prevent landing gear retraction while on the ground and until a safe takeoff speed is reached, (approximately 60 +/-5 KTS). The up limit switch will stop the gear in its retracted position. Moving the control knob to its lower detent lowers the gear. The properly rigged down limit switch will stop the gear actuating motor when proper force has been exerted to hold the landing gear in the down-and-locked position. Bungee springs preload the retraction mechanism in an overcenter position to hold the gear down. A landing gear safety by-pass switch override is provided next to the gear switch should the gear fail to retract. Depressing and holding this switch manually bypasses the airspeed safety switch and allows the gear to retract.

~ CAUTION ~

Never rely on the safety switch to keep the gear down during taxi, takeoff or landing. Always make certain that the landing gear switch is in the down position during these operations.

WHEEL BRAKES

The main gear wheels incorporate self-adjusting disc-type hydraulic brakes. The pilot's rudder pedals have individual toe-actuated brake cylinders linked to the rudder pedals. Depressing the toe pedals and pulling the parking brake control on the console sets the brakes. Pushing the parking brake control forward releases the brakes.
It is not advisable to set the parking brake when the brakes are overheated, after heavy braking or when outside temperatures are unusually high. Trapped hydraulic fluid may expand with heat and damage the system. Wheel chocks and tiedowns should be used for long-term parking.

EMERGENCY EXTENSION SYSTEM

An emergency gear extension mechanism is provided to allow manual lowering of the landing gear. The control mechanism is located between and aft of the pilot and co-pilot seats. The red lever must be released and pulled up (aft) to disengage the gear from the electric drive and engage the manual extension mechanism. The mechanism has a spring retracted pull cable which manually drives the electric gear actuator to extend the gear. 12-20 pulls are required to fully extend and lock the gear down. The electrical extension or retracting system will not operate if the manual extension lever is not properly positioned.

WARNING SYSTEM

The landing gear warning system consists of: 1) the landing gear condition lights, GREEN for "GEAR DOWN" and RED for "GEAR UNSFE", and 2) a warning horn activated when the gear is not down-and-locked and the throttle is set at approximately 1/4 inch from idle position. The green light shows continuously when the gear is fully extended. The red light shows whenever the gear is in transit or not locked down but is OFF when the gear is fully retracted. A visual gear-position indicator, located on floorboard aft of the fuel selector, shows when the gear is down when the indicator marks align. The gear down light is dimmed when navigation lights are turned on.

STEERING

Rudder pedal action steers the nose wheel. Gear retraction relieves the rudder control system of its nose wheel steering and centers the wheel to permit retraction into the nose wheel well. The minimum turning radius on the ground is 40 feet (12.0 m) to the right and 48 feet (14.4 m) to the left. Adjustable steering stops have been incorporated on nose gear leg assembly.

~ CAUTION ~

The nose wheel must not be swiveled beyond 11° left or 13° right of center. To exceed these limits may cause structural damage.

CABIN

BAGGAGE COMPARTMENT

The baggage compartment is located aft of the rear passenger seat. The standard compartment has 20.9 cubic feet (.59 cu.m.) of baggage or cargo space. A maximum of 120 pounds (54 Kg) may be loaded in this area. There are two pairs of floor tiedown straps provided. Passengers should not be allowed to occupy this space.

Additional cargo space is available by removing rear seat, bottom cushion and seat back cushion/cover (fold seat back forward and slide seat cover UP and OFF frame. Store cushions as desired).
To fold rear seat back down, pull lock pin (left side frame). Pull seat frame from pivot rods. Place pivot rods into portion of seat frame that carpet is attached to. Slide frame down until approximately bottomed out. Pull seat back release handle UP to move catch down. Pivot seat back forward & down into seat cushion cavity.
Both rear seats can be folded down together or independent of each other.
The storage area located behind the door at the top of the aft baggage compartment bulkhead is restricted to 10 pounds (4.5 Kg).

CARGO RESTRAINT

Cargo tiedown rings/clevis pins are to be inserted into holes provided in web of front seat rails. The cargo belts attach to these rings and to standard seat belt harness to retain cargo. Refer to Figure 7-4 for typical restraint.

~ ~ ~ ~ ~ ~
~ CAUTION ~
~ ~ ~ ~ ~ ~

Proper loading and retention of cargo is mandatory. See Loading Computation Graph, SECTION VI.

SEATS

The front seats are individually mounted and may be adjusted fore and aft to fit individual comfort preferences. The front seat back may be adjusted by turning hand crank until seat back is in desired position.
Both optional front seat configurations allow vertical seat height adjustment by turning a hand crank to raise or lower the entire seat assembly.
The rear seat backs have four (4) adjustment positions. Each seat can be adjusted independent of the other by pulling up on respective release handles located on left or right of aircraft center line on forward spar. This allows adjustments from approximately 10° to 40° recline position.

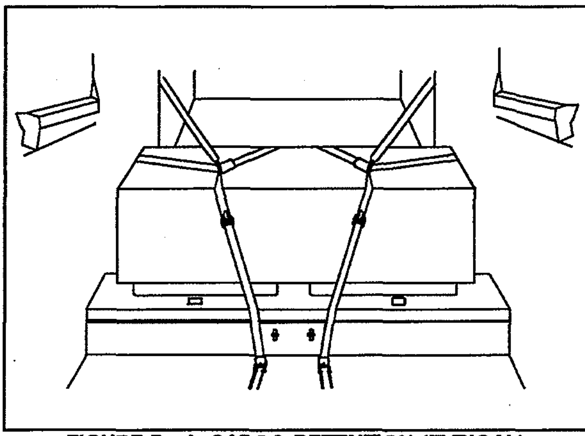
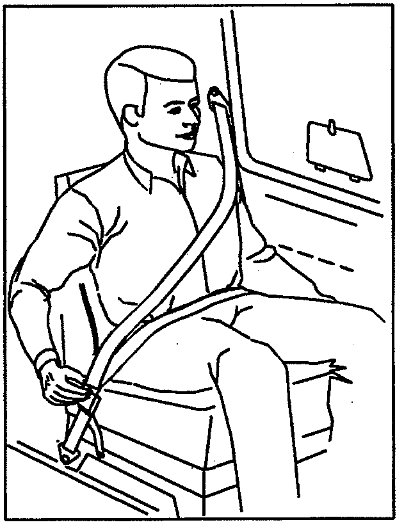


FIGURE 7 - 4 CARGO RETENTION (TYPICAL)

SEAT BELTS/SAFETY HARNESS

Safety restraints, if worn properly, one occupant per restraint, keep occupants firmly in their seats during T/O, landing, turbulent air and during maneuvers. The belts/harnesses are mechanically simple and comfortable to wear. The front seat inertia belts/harnesses are attached to hardpoints on side structure and seats. The rear seat belts are attached to brackets firmly mounted to structural hardpoints. Shoulder harnesses are provided for rear seat occupants. Safety belts/harnesses MUST be fastened for take-off and landing operations. It is recommended that all infants and small children below 40 lbs. weight and/or under 40 in. height be restrained in an approved child restraint system appropriate to their height and weight.



The single diagonal type safety harness is designed so the chest strap crosses diagonally from the outboard shoulder to an attachment point as low on the inboard hip as possible. Rear seat occupants should take care to conform with this procedure in adjusting chest strap and inboard belt length. This diagonal configuration places body center-of-gravity inside the triangle formed by chest strap and lap belt. The lap belt should be adjusted comfortably tight. As a result, the body is restricted from rolling out toward the unrestricted shoulder or "open" side of the harness, upon forward impact. Refer to Figure 7-5 for proper seat belt/harness adjustment.

DOORS, WINDOWS & EXITS

CABIN DOOR

Access into cabin is provided by a door located on right side of fuselage. This door has inside and outside operating handles. Outside door handle can be locked with a key specifically provided for it. The door has two latching mechanisms, one located at the top of door and one at the aft, center of door.
Should the door come open in flight, flying qualities of the aircraft will not be affected. Procedures for closing door in flight are contained in SECTION III.

PILOT'S WINDOW

A pilot's storm window is located in the left main cabin window. This window is generally used for fresh air for prolonged ground operations or as required during adverse weather conditions. The window should not be opened in flight above 132 KIAS.

EMERGENCY EXITS

The CABIN DOOR is the primary emergency exit from the cabin. If a situation exists where a probable off airport landing will occur, the door should be unlatched to prevent jamming during landing.

The BAGGAGE compartment access DOOR can be used as an **auxiliary** exit. The door can be opened from the inside even though locked. To open, **pull** off small ABS cover, **pull** out latch pin and **lift Red Handle**.
To verify re-engagement of latching mechanism; open outside handle fully, close inside handle to engage pin in cam slide of latch mechanism; insert locking pin into hole to hold Red Handle down. Replace ABS cover. Operate outside handle in normal method.

ENGINE

GENERAL

…ngine installed is a TEXTRON-Lycoming TIO 540-AF1A, or -AF1B, turbocharged, …automatic waste gate control system. The following designation describes engine :

T	Denotes "TURBOSUPERCHARGED"
I	Denotes "FUEL INJECTED"
O	Denotes "OPPOSED" (refers to the horizontally opposed cylinders)
540	Denotes piston displacement in "CUBIC INCHES"
AF1A or -AF1B	Denotes a specific equipment configuration

The engine operates with three, standard engine controls. The propeller turns clockwise as viewed from the cockpit.

ENGINE CONTROLS

The engine controls are centrally located between the pilot and co-pilot on the engine control console. The BLACK throttle knob regulates manifold pressure; push the knob forward to increase the setting; pull the knob aft to decrease the setting. A vernier throttle control is optional.

The propeller control, with its crowned BLUE knob, controls engine RPM through the propeller governor. Push the knob forward to increase engine RPM; pull the knob aft to decrease RPM.

The mixture control, with its RED fluted knob, establishes the fuel-air ratio (mixture). Push the knob full forward to set the mixture to full-rich, pull the knob gradually aft to lean the mixture. Pull the knob to its maximum aft travel position to close the idle cut-off valve to …mpletely shut down the engine. Precise mixture settings can be established by observ…g the TIT gauge on the pilot's instrument panel while adjusting the mixture control.

The optional throttle, propeller and mixture controls are vernier type and fine adjustment can be made by turning knobs clockwise or counter-clockwise. The vernier controls should be rigged within .030 to .060 in. from panel nut face. Rapid movement or large adjustments can be made by pushing button on end of control and positioning control where desired. The non-vernier throttle has an intergral friction device.

Engine cooling is controlled by cowl flaps. The switch is located beneath and right of engine controls. Push switch DOWN to open cowl flaps.

ENGINE INSTRUMENTS

Engine instruments operate electrically, except manifold pressure, through variations in resistance caused by pressure or temperature changes or by variations in current output caused by varying engine RPM or alternator output. The tachometer receives its signal from the Hall effect sensor in magneto.

Engine operating instruments are located in the center of the instrument panel. Colored arcs on instrument faces mark operating ranges. Proper interpretation of engine instrument readings is essential for selecting optimum control settings and for maintaining maximum cruise fuel economy. (Refer to SECTION II for Limitations).

ENGINE OPERATION AND CARE

Life of an engine is determined by the care it receives. Maximum efficiency and engine service life can be expected when a good maintenance program is followed. Poor maintenance results in faulty engine performance and reduced service life. Efficient engine operation demands careful attention to cleanliness of air, fuel, oil and maintaining operating temperatures within required limits. Servicing of the engine should be accomplished only by qualified personnel. The minimum grade of fuel for this engine is 100 LL or 100 octane aviation gasoline. If the grade required is not available, use a higher rated fuel; never use a lower rated fuel. Operational procedures for adverse environmental conditions can be found in engine operator's manual.

OIL SYSTEM

The engine has a full-pressure, wet sump oil system with an 10 quart (9.46 liters) capacity. A conventional dip stick is provided for detemining oil quantity. The oil system is depicted in Figure 7-6. The propeller governor boosts engine oil pressure for operation of the propeller. It controls oil pressure going to the propeller hub to maintain or change propeller blade angles. This oil flows through propeller shaft to reach the propeller.

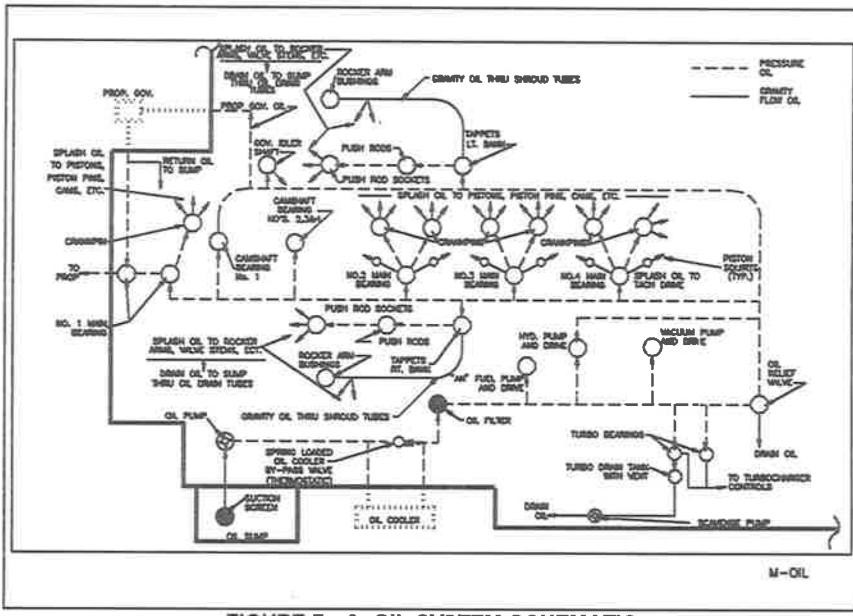


FIGURE 7 - 6 OIL SYSTEM SCHEMATIC

LUBRICATION SYSTEM

Oil Filter - Full flow oil filter is a throw away filter element with a bypass valve incorporated.

BREATHER FOR CRANKCASE

The crankcase is vented overboard to a near static location.

AIR INDUCTION SYSTEM (See Figure 7-7)

The engine air induction system consists of a NACA, flush-type air inlet duct located on front of lower cowling. The air inlet duct incorporates the air filter housing. This housing covers a throw-away, paper canister type air filter element.

A secondary or alternate air source for combustion air is provided. This air inlet has a spring loaded door which normally remains closed. If the air filter or induction air inlet should become restricted, the alternate air door will automatically open. Warmer air will then be drawn from the engine compartment. There will be a reduction of engine power when the alternate air door is open due to lower inlet air pressure and higher air temperature. Whenever the alternate air door is **open**, a switch will activate the "ALT AIR" annunciator light on the panel to alert the pilot.

ICING PROTECTION

Continued operation of the induction system in the event of intake air being obstructed is provided by activation of the alternate air system. The alternate air is automatically or manually controlled. When the door is opened, unfiltered, relatively warm air, from engine compartment, is admitted into the induction system.

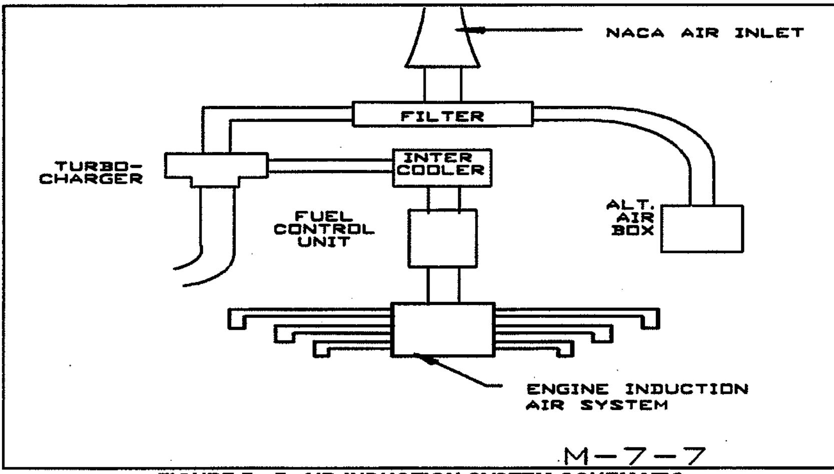


FIGURE 7 - 7 AIR INDUCTION SYSTEM SCHEMATIC

TURBOCHARGER SYSTEM

The turbocharger system consists of a turbine and compressor assembly, intercooler, density/differential pressure controller, variable wastegate assembly and necessary hoses and ducting.

TURBOCHARGER OPERATIONAL CHARACTERISTICS

When operating at less than full throttle, or above approximately 20,000 ft. with full throttle, any change in **engine speed** will cause a change in manifold pressure, ie. a decrease in engine speed may produce an increase in manifold pressure. Any change in **airspeed** will also result in a change in manifold pressure, ie. an increase in airspeed will produce a slight increase in manifold pressure due to ram air effects.

EXHAUST SYSTEM

The exhaust system consists of tubes from each cylinder mating into a common collector pipe under the left & right bank of cylinders. The right collector pipe crosses over and intersects with the left collector, then this exhaust manifold joins to the turbocharger crossover. A short tailpipe is attached to the end of the turbocharger and exits through the left cowl flap.

The crossover pipe has a heat shroud around it which serves as a cabin air heater. Outside ambient air is forced into the cabin heater by forward velocity. Air flows around the pipe picking up heat and is then carried to a cabin heat box mounted on the firewall. When cabin heat is not required, the air continues to flow around the crossover pipe for cooling and is dumped overboard through the cabin heat box outlet duct.

FUEL INJECTION

The injector system is based on the principle of measuring engine air consumption by use of a venturi tube and using airflow forces to control fuel flow to the engine. Fuel distribution, to individual cylinders, is obtained by use of a fuel flow divider and air bleed nozzles.

ENGINE COOLING AIR

Ram air is drawn into the forward part of upper cowl and flows down, around the cylinders using several baffles to control air direction. Hot air, off the cylinders, exits the cowl thru louvers in lower cowl and moveable cowl flaps, located on either side of engine lower cowl, immediately forward of the firewall.

ENGINE STARTING SYSTEM

Engine starting is provided by a 24 volt starter. A starter engaged warning light (START POWER) is incorporated as standard equipment in annuciator panel. Ignition is provided by an impulse coupled magneto.

IGNITION SYSTEM

Power from the engine crankshaft is transmitted through camshaft gear to the magneto drive gears, which in turn drives the magneto drive couplings. The left magneto incorporates an impluse coupling. As the rubber bushings in the drive gear turns the coupling drive lugs, counterweighted latch pawls inside the coupling cover, engage pins on the magneto case and hold back the latch plate until forced inward by the coupling cover. When the latch plate is released, the coupling spring spins the magneto shaft through its neutral position and the breaker opens to produce a high voltage surge in the secondary coil. The spring action permits the latch plate, magnet and breaker to be delayed through a lag angle of 30 degrees of drive gear rotation during the engine cranking period. Two lobes on the breaker cam produce two sparks per revolution of the drive shaft. After engine is running, counter-weights hold the latch pawls away from the stop pins and the magneto shaft is driven at full advance.

The engine firing order is 1-4-5-2-3-6. Ignition harnesses are connected to the magnetos so right magneto fires the upper plugs on the right side and lower plugs on the left. The left magneto fires the upper plugs on the left and lower plugs on the right. The magneto cases, spark plugs, harnesses and connections are shielded to prevent radio interference. The magnetos are pressurized from turbocharged induction system bleed air.

ACCESSORIES

ALTERNATOR

Electrical power is supplied by two, belt driven, 28 Volt, 70 ampere alternators.

VACUUM PUMP

A full time, engine driven vacuum pump supplies suction for the vacuum-operated gyroscopic flight instruments. Air entering vacuum-powered instruments is filtered: hence, sluggish or erratic operation of vacuum driven instruments may indicate that a clogged vacuum filter is preventing adedquate air intake. A vacuum annunciator light is provided to monitor system operation. Refer to Airborne Service Letter No. 31, located in Section X.
The Stand-by Vacuum pump is also driven from the engine accessory case, but is coupled through an electrically actuated clutch. The pilot must PUSH a panel mounted rocker switch ON for the Stand-by Vacuum to be operable.

TURBINE INLET TEMPERATURE PROBE

The turbine inlet temperature (TIT) probe measures exhaust gas temperature as it enters the turbocharger turbine inlet. The TIT probe varies electrical current (milliamps), based on exhaust gas temperature, and supplies this to TIT gauge located on instrument panel. The TIT gauge is used as the primary source to lean fuel mixture.

PROPELLER

The propeller is a three blade, metal, constant speed unit. Propeller rotational speed (RPM) is maintained by a balance of air load, oil pressure and engine rotational forces. The propeller governor regulates flow of high pressure engine oil to a piston in the propeller dome. The piston is linked by a sliding rod and fork arrangement to propeller blades. Governor oil pressure acting on a piston and spring increase propeller blade pitch, thus decreasing propeller and engine RPM. As oil pressure is reduced centrifugal twisting moments on the propeller blades decrease propeller blade pitch and increase RPM.

In cruise, always use the power setting charts provided in SECTION V.

FUEL SYSTEM

Fuel is carried in two integrally sealed sections of the forward, inboard area of wing. Total usable fuel capacity is 89 U.S. gallons (337 liters). There are sump drains at the lowest point in each tank for taking fuel samples to check for sediment contamination or condensed water accumulation.

The recessed three position fuel selector,aft of console, on the floor, allows the pilot to set selector valve to LEFT tank, RIGHT tank or OFF position.

The gascolator, located at right of selector valve, in the floorboard, is for draining condensed water and sediment from lowest point in fuel system before first flight of the day and after each refueling.
The gascolator sump can be used to drain the fuel tank selected by fuel selector valve.

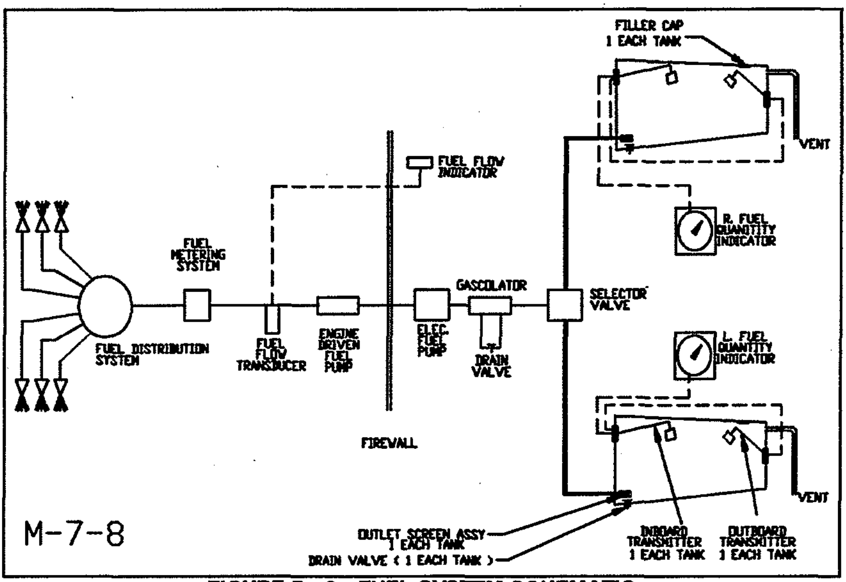


FIGURE 7 - 8 FUEL SYSTEM SCHEMATIC

FUEL FEED

Fuel is delivered, by the engine driven pump, to a Bendix fuel injector where pressure is regulated and the correct volume of fuel is metered to each cylinder of the engine.
The electric boost pump, located under the floor board, below the passenger's feet is cable of supplying sufficient pressure and fuel flow to the engine for rated engine performance should the engine driven fuel pump fail.

Two electric fuel-level transmitters, working in series, in each wing tank operate the appropriate, left or right, fuel quantity gauges. The master switch actuates the fuel quantity indicator system to depict an indication of fuel remaining in each tank.
Vents in each fuel tank allow for overflow and pressure equalization.

The optional, visual fuel quantity indicators, in each wing, are to be use for PARTIAL FUEL LOADING only and NOT for preflight inspection purpose.

Fuel Flow (if installed) indicates the volume of fuel being used, total fuel used or fuel remaining or time remaining. Optional fuel flow systems are available and each do not indicate the same type data. The fuel flow memory switch can be shut off if aircraft is to be stored for long periods of time.

ELECTRICAL SYSTEM

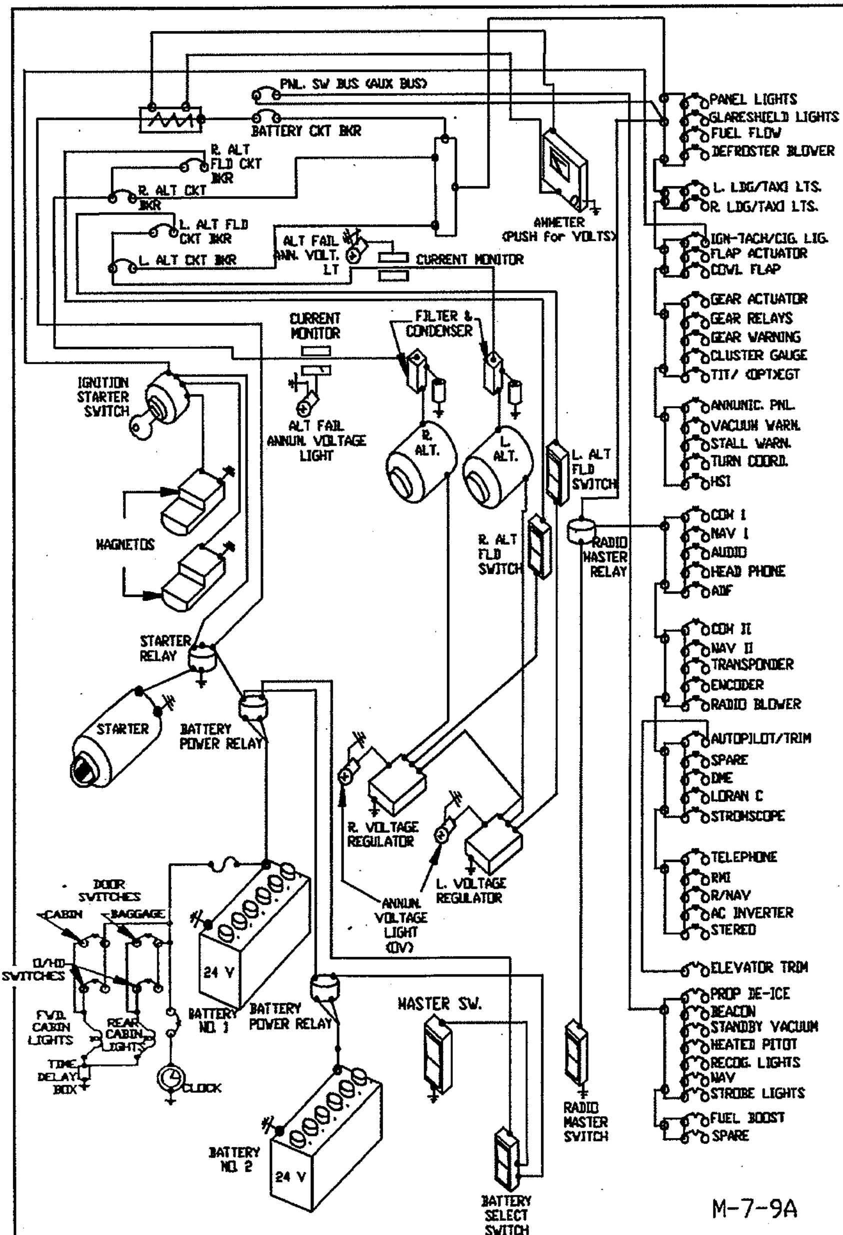


FIGURE 7 - 9 ELECTRICAL SCHEMATIC

ALTERNATOR & BATTERY

Two 24-volt, 10-ampere-hour storage batteries (in the tailcone) and two 70 ampere self-rectifying alternators supply electrical power for equipment operation. The No. 1 battery ,left side of tailcone, is normally used to sustain the electrical system and to start the aircraft. The No. 2 battery, right side of tailcone, is not normally used but is kept in a fully charged condition by trickle charge, through a diode system.

Should the No. 1 battery be depleted to the point of being unable to supply adequate power for system needs, it may be de-selected from the system and No. 2 selected on line by pushing the rocker switch marked BAT-1/BAT-2, on the circuit breaker panel, from the BAT-1 to BAT-2 position. The MASTER switch still controls battery power to the buss from either position. With the BAT-1/BAT-2 switch in the No. 2 position the No. 1 battery will be recharged (trickle charged) through the diode system. Alternate between #1 & #2 batteries as desired to keep both active.

A standard Ammeter which has a PUSH for Volts button depicts battery charge or discharge.

SCHEMATIC (See FIGURE 7-9)

The voltage regulator adjusts alternator output to current load while maintaining a constant voltage level. A voltage warning light illuminates steadily when voltage limits are exceeded (ie. voltage spikes) and flashes when the voltage is low.

CIRCUIT BREAKER PANEL (See FIGURE 7-10)
(Illustration depicts typical C/B panel; may vary from your aircraft)

Push-pull or rocker switch-circuit breakers automatically break the electrical current flow if the system or unit receives an overload to prevent damage to electrical wiring.
The main circuit breaker panel is in the extreme right panel. Figure 7-10 illustrates the main circuit breaker panel with its push-pull circuit breakers. Rocker switch-circuit breakers are at the bottom and left of the pilot's flight panel.

The alternators push-pull circuit breakers on the main breaker panel furnish an emergency overload break between the alternators and the power buss. Since the alternators are incapable of output in excess of circuit breaker capacity, a tripped breaker normally indicates a fault within that alternator.

The alternator field (L & R alternators) has a push-pull circuit breaker to furnish an emergency break in the alternator field excitation circuit in the event of alternator or voltage regulator malfunction. If either regulator output voltage exceeds limits, the corresponding overvoltage warning light illuminates steadily and the alternator field circuit breaker pops.

Resetting the affected alternator field circuit breaker should reset the alternator. If the circuit breaker will not reset, continue flight on the remaining alternator. Monitor the buss voltage and the output load of the remaining alternator. Reduce electrical load, if needed, to maintain a buss voltage of 28 VDC and to operate within the load capacity of the remaining alternator. Land when practical to correct the malfuction.

| NOTE |

The circuit breakers installed in the panel may vary depending on installed equipment.

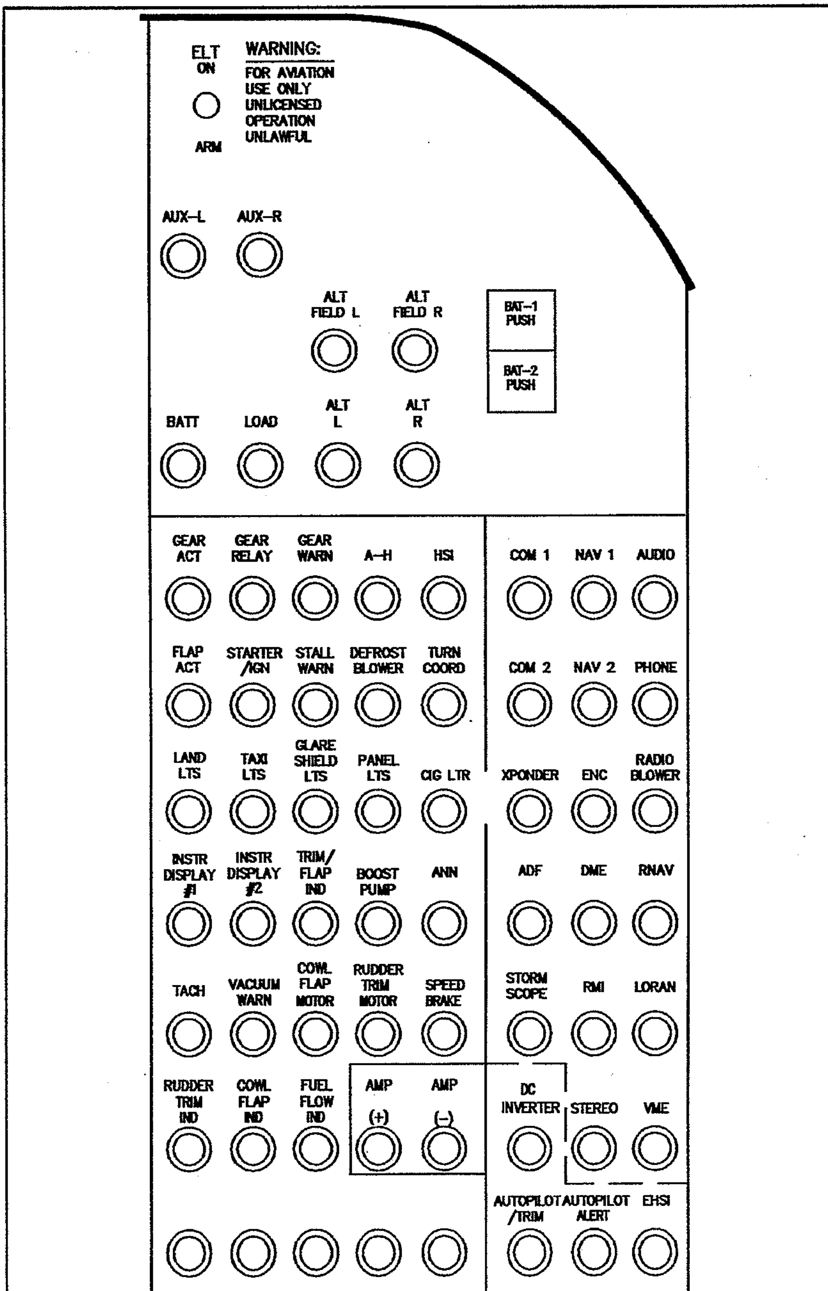


FIGURE 7-10 CIRCUIT BREAKER PANEL (TYPICAL)

ANNUNCIATOR PANEL

The landing gear, low fuel, speed brakes, alternate air, propeller de-ice and pitot heat lights are grouped in the upper annunciator panel. The vacuum malfunction, alternator fail, start power, stand-by vacuum, remote RNAV and loran coupled lights are grouped in the lower annunciator panel.

A test switch and dim switch are also found in the panel; each of the lights and switches are discussed elsewhere in this section.

ELT PANEL

The ELT Panel houses the remote ELT Switch and provides room for other switches as required for optional avionics installations. (See Section IX for Avionics Systems installed in this aircraft).

LIGHTING SYSTEM

INSTRUMENT & PLACARD LIGHTS

All placards are floodlighted by lights from the glareshield when the NAV light switch is selected ON. Two switches on the radio panel control the intensity of these lights. The left switch regulates the intensity of the placard lighting. The right switch regulates avionics and instrument lighting intensity. Pushing the top of the switch increases light intensity; pushing the bottom decreases light intensity.

MAP LIGHT

The map light switch is located on the center of the pilot's and co-pilot's control wheel.

CABIN LIGHTING

Two sets of overhead lights illuminate the cabin.

The forward lights are controlled by a BRIGHT-OFF-DIM switch located in headliner between pilot and co-pilot and a switch in the cabin door frame. The rear cabin lights are controlled by another BRIGHT-OFF-DIM switch located overhead between pilot and co-pilot and a switch in the baggage door frame. The door switch(es) allow the appropriate lights to come ON any time the door(s) are open. A timer mechanism is included in the circuit to allow either set of lights to remain ON for approximately 2 minutes after the door(s) are closed if the overhead rocker switches are left ON. The rocker switches are connected through the Master Switch and will go OFF when Master Switch is OFF and the door(s) are closed.

~ CAUTION ~

The door switches are connected directly to the battery and will remain ON as long as the door(s) are open.

EXTERIOR LIGHTING

Conventional navigation and high intensity strobe lights are installed on the wing tips and on the rudder trailing edge(strobe light only). Landing and Taxi lights are installed in the right and left wing leading edge. Split switches are used to control either the left or right taxi or landing lights. All exterior lights are controlled by rocker type switches on the middle left hand portion of the pilot's panel.

The high intensity wing tip and tail strobe lights are required for night operation but should be turned OFF when taxiing near other aircraft or flying in fog or clouds. The conventional position lights must be used for all night operations.

CABIN ENVIRONMENT

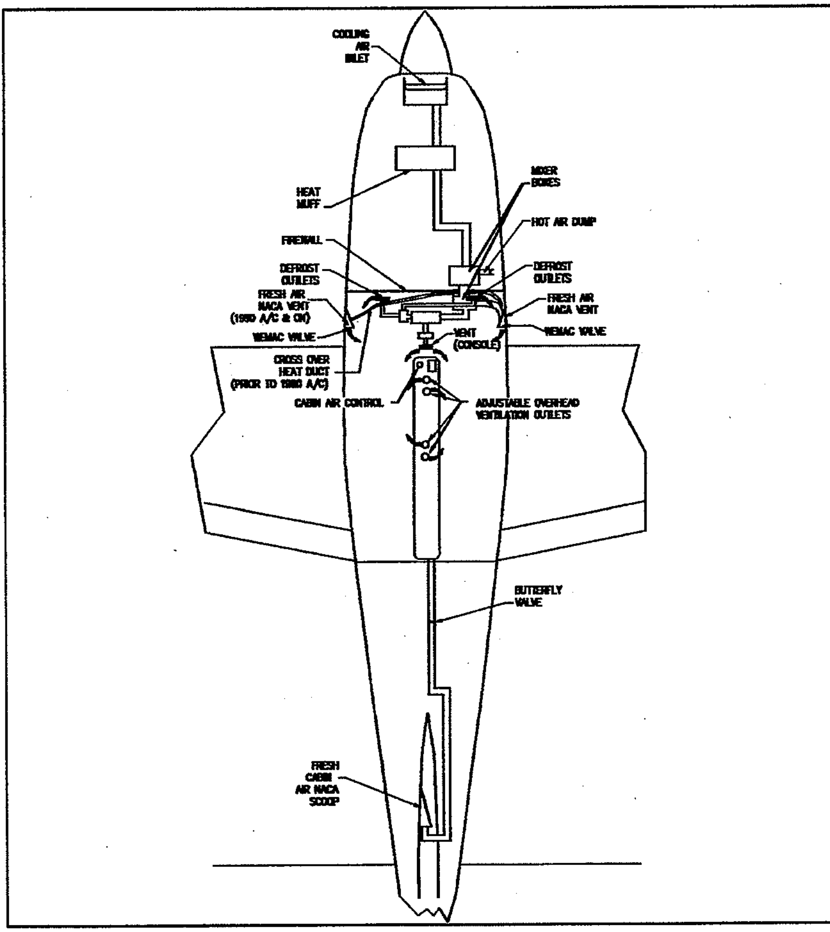


FIGURE 7-11 CABIN AIR FLOW SCHEMATIC

HEATING & VENTILATION SYSTEMS

Three ventilating systems provide cabin environmental conditions which can be controlled to pilot and passenger individual preferences:

FRESH AIR - One source of outside air enters the cabin through airscoops on the both sides of the fuselage. This outside air is always available through the adjustable outlets (Wemacs) near the pilot's and co-pilot's knees.

CABIN VENT - When the CABIN VENT control is pulled AFT, fresh air from the NACA duct on the right side is supplied to the cabin (through the mixer box and the lower console duct) and/or to the defrost system.

CABIN HEAT - Fresh air heated by the engine exhaust muff and cool air from the airscoop on the co-pilot side can be individually controlled and mixed to the desired temperature by use of the Cabin Vent and Cabin Heat controls. Pulling the cabin heat control aft supplies heat to the cabin and defroster system. Hot and cold air may be mixed by adjusting both heat and vent controls. These controls may be adjusted anywhere between full open and full closed.

OVERHEAD VENTILATION - The cabin overhead ventilating system works independently of the cabin heating and ventilating system. Fresh air enters an intake on the dorsal fin and is controlled by individual outlets above and between each seat. A master air vent control regulates flow of air through the individual overhead outlets. This control is located between the pilots & co-pilots seat on the overhead panel.

WINDSHIELD DEFROSTING SYSTEM

The windshield defrost system takes air from the cabin air distribution system and distributes this over the windshield interior surface any time the heat and/or fresh air valves are opened. Pulling the defrost control full aft decreases flow to the cabin and forces maximum air to flow through the defrost ducts.

PITOT PRESSURE & STATIC SYSTEM

A pitot tube, mounted on the lower surface of the left wing, picks up airspeed indicator ram air. A heated pitot prevents pitot tube icing when flying in moisture-laden air. A pitot system drain valve is located on the forward bottom skin of the left wing to fuselage fillet. Static ports on each side of the tailcone supply static air pressure for the altimeter, the airspeed indicator, and vertical speed indicator. A static system drain valve is located on the fuselage bottom skin below the left side tailcone access door and is used to drain moisture that might collect in the lines.
An alternate static pressure source valve handle is installed in the console below the engine power controls. Alternate static air is taken from the cockpit and will affect flight instrument readings. Performance variation charts in Section V depict the difference between primary and alternate static indications.

STALL WARNING SYSTEM

The electrical stall warning system uses a vane-actuated switch, installed in the left wing leading edge, to energize stall warning horn located in the cabin. The stall warning switch is adjusted to provide aural warning at 5 to 10 KIAS before the actual stall is reached and will remain on until the aircraft flight attitude is changed toward a non-stalled condition.

| NOTE |

Do not attempt to adjust prestall warning speed by bending the vane. This part has been heat treated and cannot be bent without damaging or breaking the vane.

OXYGEN SYSTEM

A four-place oxygen system provides supplementary oxygen necessary for continuous flight at high altitude. An oxygen cylinder is located in the equipment bay, accessible through a removable panel on the aft wall of the baggage compartment, or through the standard external panel in the tailcone. A combined pressure regulator/shutoff valve, attached to the cylinder, automatically reduces cylinder pressure to the delivery pressure required for operating altitude. The oxygen cylinder filler valve is located under a springloaded door aft of the baggage door.
A pilot's oxygen panel on the side wall near the pilot's arm rest contains a cylinder pressure gauge, effectively a quantity gauge, and a control knob which is mechanically connected to the shutoff valve at the cylinder. The supply of oxygen can thus

be shut off from the cockpit when not required. When the control is in the "ON" position sufficient oxygen flow is available at the maximum airplane operating altitude (see Section II Limitations) while at lower altitudes the reducing valve automatically economizes the flow to conserve oxygen for longer duration or for future availability, without requiring any action by the pilot. (See Fig. 7-13).
Four oxygen outlets are provided in the overhead panel between the pilot's and co-pilot's seat for the convenience of all occupants. Oxygen flows from the outlets only when a mask hose is connected. Four partial re- breathing type masks are provided, each with vinyl plastic hoses and flow indicators. The three passenger masks are of the disposable type. The pilot's mask is a permanent type with a built-in microphone for ease of radio communication while using oxygen. To use the mask-microphone, connect its lead to the microphone jack located left of the instrument panel, in place of the aircraft microphone lead, and key the switch on the control yoke.
The oxygen cylinder, when fully charged, contains 115.7 $ft.^3$ (composite) of aviator's breathing oxygen (Spec No. MIL-0-27210) under a pressure of 1850 PSI at 21° C (70° F).
Filling pressures will vary, however, due to ambient temperature in the filling area, and the rise of temperature resulting from compression of the oxygen. Because of this, merely filling to 1850 PSI will not result in a properly filled cylinder. Fill to pressures indicated on Fig. 7-12 for ambient temperatures.

WARNING
Oil, grease or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided when handling oxygen equipment.

Ambient Temperature °F	Filling Pressure PSIG	Ambient Temperature °F	Filling Pressure PSIG
0	1650	50	1875
10	1700	60	1925
20	1725	70	1975
30	1775	80	2000
40	1825	90	2050

FIGURE 7-12 - OXYGEN FILLING PRESSURES

NOTE
The oxygen cylinder should not be run down to less than 100 PSI. Below this pressure atmospheric contamination of the cylinder may occur, requiring valve removal and cylinder cleaning and inspection at an FAA approved repair station.

For FAA requirements concerning supplemental oxygen, refer to FAR 91.32. Supplemental oxygen should be used by all occupants when cruising above 12,500 feet. It is often advisable to use oxygen at altitudes lower than 12,500 feet under conditions of night flying, fatigue, or periods of physiological or emotional disturbances. Also the habitual and excessive use of tobacco or alcohol will usually necessitate the use of oxygen at less than 10,000 feet.

The oxygen duration chart (Fig. 7-13) should be used in determining the usable duration (in hours) of the oxygen supply in the airplane for the chosen cruising altitude. The following procedure outlines the method of finding the duration from the chart:

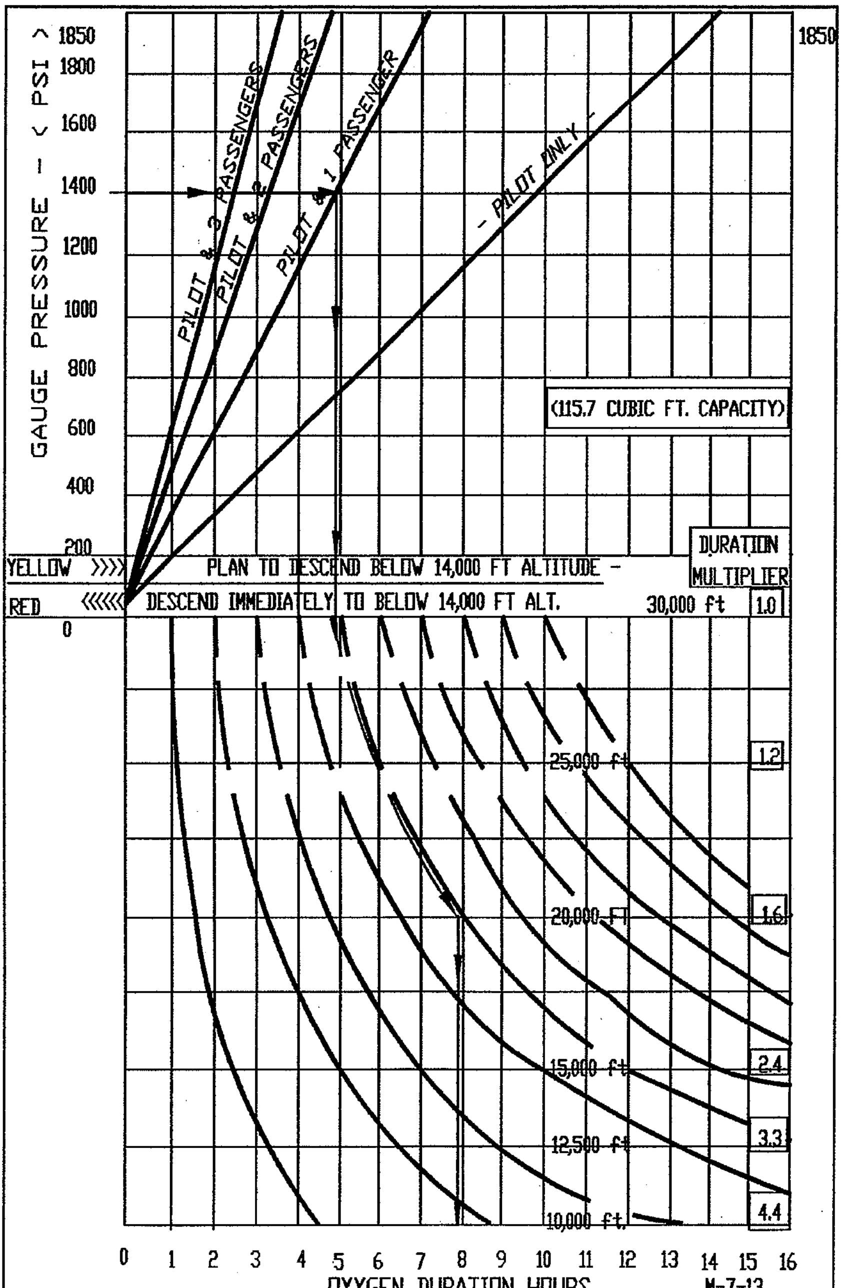


FIGURE 7-13 OXYGEN DURATION CHART (115.7 Cu.Ft. CAPACITY)

1. Note the available oxygen pressure shown on the pressure gage.

2. Locate this pressure on the scale on the left side of the chart. Then go across the chart horizontally to the right until intersecting the diagonal line which represents the number of persons on board. From that intersection drop vertically down to the heavy line, marked 30,000 ft..

3. From this point on the heavy line, follow the trend of the curved lines, down to the horizontal line representing cruise altitude. Then drop vertically down to the bottom of the chart and read the duration in hours given on the scale.

4. As an example of the above procedure, 1400 PSI of pressure will safely sustain the pilot and one passenger for 4 hours and 55 minutes (Fig. 7-13) at 28,000 ft.; however, cruising at 20,000 ft. would permit an oxygen duration of 7 hours and 55 minutes (Fig. 7-13).

Light crew loads and relatively low altitudes will permit oxygen durations off the chart. Such durations can be calculated by determining the duration at 30,000 feet (by steps 1 and 2 above) and multiplying by the "duration multiplier" shown on the right of the appropriate cruising altitude. Example, Pilot only at 1600 PSI has 11.25 hours duration at 30,000 ft., times 2.4 duration multiplier for 20,000 ft., gives 26 hours and 54 minutes duration at 20,000 ft. Oxygen durations off the chart obviously exceed the airplanes duration. However, judicious choices of altitude for the number of persons on board can permit flight planning for several fuel stops, without need for recharging the oxygen system at each stop.

VACUUM SYSTEM

The standard vacuum sysem on the M20M consist of the main vacuum pump, regulator, filters and a clutch activated, engine driven, stand-by vacuum pump. The main vacuum pump operates when the engine is running. The stand-by vacuum pump is coupled to the engine accessory drive but the electrically activated clutch must be turned ON, by pushing the STBY VAC switch, before the pump is on line.

A vacuum system malfunction is shown to the pilot by a RED, HI/LO VAC, annunciator light. A flashing annunciator light indicates low vacuum and a steady light indicates high vacuum. In either case the vacuum operated instruments are to be considered UNRELIABLE and use of the stand-by vacuum pump is recommended. The STBY VAC legend on the annunciator will be illuminated when the STBY VAC switch is ON.

EMERGENCY LOCATOR TRANSMITTER

The Emergency Locator Transmitter (ELT) is located in the tailcone and is accessible from the battery access door on the right side of the tailcone. The emergency locator transmitter meets the requirements of FAR 91.52 and is automatically activated by a longitudinal force of 5 to 7 g's. The ELT transmits a distress signal on both 121.5 MHz and 243.0 MHz for a period of from 48 hours in low temperature areas and up to 100 hours in high temperature areas. The unit operates on a self-contained battery. The battery should be checked at each annual inspection.

The battery has a useful life of four years. However, to comply with FAA regulations it must be replaced after two years of shelf life. The battery should also be replaced if the transmitter has been used in an emergency situation or if accumulated test time exceeds one hour. The battery replacement date is marked on the transmitter label.

On the unit itself is a three position selector switch placarded "ARM", "OFF", "ON". The "ARM" position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until the battery is drained to depletion or until the switch is manually moved to the "OFF" position. The "ARM" position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane.

The "ON" position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter.

Select the "OFF" position when changing the battery, when rearming the unit if it has been activated for any reason, or to discontinue transmission.

| NOTE |

If the switch has been placed in the "ON" position for any reason, the "OFF" position has to be selected before selecting "ARM". If "ARM" is selected directly from the "ON" position the unit will continue to transmit in the "ARM" position.

E.L.T. REMOTE SWITCH OPERATION

A pilot's remote switch, located above the RH radio panel, is provided to allow the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON", "ARM". The unit will start transmitting with switch in "ON" position and will stop when remote switch is returned to "ARM" position during cockpit checkout.

| NOTE |

If for any reason a test transmission is necessary, the operator must first obtain permission from a local FAA or FCC representative (or other applicable Authority) or in accordance with current regulations. Test transmission should be kept to a minimal duration. Testing of ELT should be conducted only during the first five (5) minutes after any hour and no longer than three (3) audible sweeps.

The ELT should be checked during the ground check to make certain the unit has not been accidentally activated. Check by tuning a radio receiver to 121.5 MHz. If there is an oscillating/warbling sound, the locator may have been activated and should be turned off immediately. Reset to the "ARM" position and check again to insure against outside interference.

TABLE OF CONTENTS

INTRODUCTION

This section contains factory recommended procedures for proper ground handling, routine care and servicing of your Mooney.

It is recommended that all aircraft undergo a complete inspection (ANNUAL) each twelve calendar months. In addition to the recommended ANNUAL inspection aircraft operated commercially (for hire) should have a complete inspection every 100 hours of operation. All inspections must be performed by a designated representative of the FAA or the Aviation Authority of the country in which the aircraft is licensed.
The FAA may require other inspections by the issuance of airworthiness directives applicable to the airplane, engine, propeller and other components. It is the responsibility of the owner/operator to ensure compliance with all applicable Airworthiness Directives and recommended "MANDATORY" Mooney Aircraft Service Bulletins/Instructions; when inspections are repetitive the owner/operator should take appropriate steps to prevent inadvertent non-compliance.

Scheduling of ALL maintenance is the responsibility of the aircraft operator. A general knowledge of the aircraft is necessary to perform day-to-day service procedures and to determine when non-routine or unusual service or shop maintenance is needed.

Service information in this section of the manual is limited to service procedures which the operator will normally perform or supervise. Reference should be made to FAR Part 43 for information regarding preventive maintenance which may be performed by a U.S. licensed pilot.

It is wise to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered in your locality.

Keep in touch with your Mooney Service Center and take advantage of his knowledge and experience. He knows your airplane and how to maintain it. Should an extraordinary or difficult problem arise concerning the repair or upkeep of your Mooney, consult the Customer Service Department, Mooney Aircraft Corporation, P.O. Box 72, Kerrville, TX. 78029-0072. Telephone: Area Code (512)-896-6000.

All correspondence regarding your airplane should include the aircraft MODEL and SERIAL NUMBER. These numbers can be found on an identification plate located on the lower aft portion of the left side of the tailcone. The aircraft Model and Serial Number must also be used when consulting either the Service & Maintenance Manual or Illustrated Parts Catalog.

Service & Maintenance, Illustrated Parts and Service Bulletin/Service Instruction Manuals for your airframe and systems (excluding Avionics & Navigation) may be obtained from your Mooney Service Center.

Avionics and Navigation Systems information should be obtained from the applicable manufacturer.

Engine information should be obtained from TEXTRON - Lycoming, 652 Oliver Street, Williamsport, PA, 17701, telephone (717) 323-6181.

GROUND HANDLING

TOWING

For maneuvering the aircraft in close quarters, in the hangar, or on the ramp, use the tow bar furnished with the aircraft loose equipment. The towbar attaches to the nose gear crossbar. One man can move the aircraft providing the ground surface is relatively smooth and the tires are properly inflated.
When no towbar is available, or when assistance in moving the aircraft is required, push by hand on the wing leading edges.

Towing by tractor or other powered equipment is NOT RECOMMENDED.

~ CAUTION ~

Exercise care not to turn the nose wheel past its normal swivel angle of 11° Left or 13° Right of center. Exceeding the turn limits shown on the turn indicator may cause structural damage to the Nose Gear Assembly.

TIEDOWN

As a precaution against wind damage, always tie down the aircraft when parked outside. Removable wing tiedown eye-bolts, supplied with the loose equipment, screw into wing receptacles marked HOIST POINT just outboard of each main gear.
Replace these eyebolts with jack point fixtures when it is necessary to lift the aircraft with jacks. The tail tiedown point is part of the tail skid.

TO TIE DOWN THE AIRCRAFT:
a. Park the airplane facing the wind.
b. Fasten the co-pilot seat belt through the flight control wheel. Pull seat belt snug so flight controls are immobilized.
c. Fasten strong ground-anchored chain or rope to the installed wing tiedown eyebolts, and place wheel chocks fore and aft of each wheel.
d. Fasten a strong ground-anchored chain or rope through the tail skid.

JACKING

When it is necessary to raise the aircraft off the ground:
a. Install jack points in tiedown mounting holes outboard of each main gear.
b. Use standard aircraft jacks at both wing hoist points (wing tiedown eyebolt receptacles) outboard of the main gears. While holding jack point in place, raise jack to firmly contact jack point.
c. Raise aircraft, keeping wings as nearly level as possible.
d. Place a jack under front jack point (Sta. – 5.51) to lift the nose.
e. Secure safety locks on each jack.

~ CAUTION ~

Do not raise the aircraft on jacks out of doors when wind velocity is over 8 KTS. When lowering aircraft on jacks, bleed off pressure on all jacks simultaneously and evenly to keep aircraft level as it is lowered.

| NOTE |

Individual wheels may be raised without raising the entire aircraft. Wheels not being raised should be chocked fore and aft.

SERVICING

REFUELING

Integrally sealed tanks, in the forward inboard sections of the wings, carry the standard fuel quantity. With the aircraft standing on level ground, service each fuel tank after flight with Grade 100 or 100LL octane, AVGAS. **The fuel tank is considered full when fuel completely covers the bottom of the standpipe.**

The optional visual fuel quantity indicators on top of each wing tank should be used as a reference for partial refueling only. These gauges will not indicate the tank's total capacity above 30 gallons of fuel.

Before filling the fuel tanks when planning a maximum weight flight configuration, consult the Weight & Balance Record for loading data.

~ ~ ~ ~ ~ ~ ~
~ **CAUTION** ~
~ ~ ~ ~ ~ ~ ~

Never use fuel of a lower grade than 100 octane or 100 LL avgas.

Fuel samples from the sump drain of each tank should be taken before the first flight of the day to check for water, sediment or other contamination. Fuel samples taken immediately after refueling may not show water or sediment due to mixing action of refueling process.

////////////////////
///**WARNING**///
////////////////////

Allow five minutes after refueling for water and sediment to settle in the tank and fuel drain valve before taking fuel samples or draining the gascolator.

Tank sump drains are near each wing root forward of the wheel wells. A small plastic cup is supplied in the loose equipment kit for obtaining fuel samples. To collect a fuel sample, insert the cup actuator prong into the sump drain receptacle and push upward to open the valve momentarily and drain fuel into the cup. If water is in the fuel, a distinct line separating the water from the gasoline will be seen through the transparent cup wall. Water, being heavier, will settle to the bottom of the cup, while the colored fuel (green or blue) will remain on top. Continue taking fuel samples until all water is purged from the tank.

The fuel system gascolator is inboard of the right wing tank sump drain on the edge of the fiberglass belly skin. To flush the system and the lines leading from the wing tanks to the selector valve, turn the selector handle to the left tank position and pull fuel drain valve for about five seconds. Repeat the procedure for the right tank position. Be sure that the fuel drain valve is returned to the closed position and that the drain valve is not leaking.

ENGINE LUBRICATION

Operate the new engine within the limitations given in Section II.

| **NOTE** |

Use recommended engine break-in procedures as published by engine manufacturer.

OIL LEVEL CHECK:
Check engine oil level before first engine start of the day.
The oil filler cap access door is located in the top cowling. Any lubricating oil must conform with Specification MIL-L-2851 to be acceptable for use in the engine.

New or newly overhauled engines should be operated on aviation grade straight mineral oil during the first 25 HOURS of operation or until oil consumption has stabilized. The aircraft is delivered from Mooney with multi-viscosity straight mineral oil. Single viscosity mineral oil may be added to multi-viscosity straight mineral oil if necessary.

The engine is equipped with an external oil filter and the engine oil change intervals may be extended from 50 HOUR to 100 HOUR INTERVALS providing the external filter element is changed at 50-HOUR INTERVALS.

~ ~ ~ ~ ~ ~ ~
~ CAUTION ~
~ ~ ~ ~ ~ ~ ~

If an engine has been operating on straight mineral oil for several hundred hours, a change to additive oil should be undertaken with caution.

If the engine is in an extremely dirty condition, the switch to additive oil should be deferred until after engine has been overhauled. When changing from straight mineral oil to additive or compounded oil, after several hundred hours of operation on straight mineral oil, take the following precautionary steps:

a. DO NOT MIX additive oil and straight mineral oil. Drain straight mineral oil from engine, change filter and fill with additive oil.

b. DO NOT operate engine longer than FIVE HOURS before again changing oil.

c. Check oil filter for evidence of sludge or plugging. CHANGE oil and REPLACE oil filter element every 10 HOURS if sludge is evident. Resume normal oil drain periods after sludge conditions improve.

Your Mooney Service Center will change the engine oil in addition to performing all other service and inspection procedures needed when you bring your airplane in for its 50-hour; 100-hour, or annual inspections.

~ ~ ~ ~ ~ ~ ~
~ CAUTION ~
~ ~ ~ ~ ~ ~ ~

Excessive oil sludge buildup indicates that the oil system needs servicing at less than 50-hour intervals.

When changing or adding oil, the following grades of oil are recommended:

Multi-Viscosity . . . 15W-50 or 20W-50 *

* Refer to the latest edition of TEXTRON-Lycoming service data for approved brands of oil.

Mooney Service Center's stock approved brands of lubricating oil and all consumable materials necessary to service your airplane.

INDUCTION AIR FILTER SERVICING

The importance of keeping the induction air filter clean cannot be over-emphasized. A clean filter promotes fuel economy and longer engine life. The dry-type filter can usually be washed six to eight times before replacement is necessary. Replace the paper induction air filter every **500 HOURS** or at **ONE YEAR** intervals, whichever occurs first.

1. To clean the dry-type induction air filter:

a. Remove the engine cowling.
b. Remove filter element.

c. Direct a jet of air from inside of filter out (opposite normal airflow). Cover entire filter area with air jet.

~ CAUTION ~

Do not use a compressor unit with a nozzle pressure greater than 100 PSI.

d. After cleaning, inspect filter for damage. Discard if filter or gasket is damaged.

| NOTE |

If filter shows an accumulation of carbon, soot, or oil, continue with cleaning steps e through h.

e. Soak filter in nonsudsing detergent for 15 minutes; then agitate filter back and forth for two to five minutes to free filter element of deposits.

| NOTE |

A Donaldson D-1400 Filter Cleaner is also recommended. Do not use solvents.

f. Rinse filter element with a stream of clear water until rinse water is clear.

g. Dry filter thoroughly. Do not use a light bulb or air heated above 180 degrees F. for filter drying.

h. Inspect for damage and ruptures by holding light bulb inside filter. If damage is evident, replace filter with a new one.

GEAR & TIRE SERVICING

The aircraft is equipped with 6-ply Type III standard-brand tires and tubes. Keep the main gear tires inflated at 42 PSI and the nose tire at 49 PSI for maximum service life. Proper inflation will minimize tire wear and impact damage. Visually inspect the tires at preflight for cracks and ruptures, and avoid taxi speeds that require heavy braking or fast turns. Keep the gear and exposed gear retraction system components free of mud and ice to avert retraction interference and binding. It is recommended that retraction/extension cycles (5 minimum) be done any time any tire is replaced to assure that no interference exists during the cycle.

~ CAUTION ~

After any landing, other than a smooth touchdown and rollout, when aircraft is above 3200 Lbs (1452 Kg), the aircraft should undergo the Gear System Operational Inspection as outlined in M20M Service and Maintenance Manual, No. 150, Chapter 32-30-01.

The gear warning horn may be checked in flight by retarding the throttle with the gear up. The gear horn should sound with an intermittent note when throttle is positioned 1/4 to 3/8 inch from idle, while the gear is up.

BATTERY SERVICE

The 24-volt, 10 ampere-hour electrical storage batteries are located in the tailcone, aft of baggage compartment bulkhead, accessible through left and right side tailcone access panels. Check battery fluid level every 25 FLIGHT HOURS or each 30 DAYS whichever comes first.

To service the batteries, remove access cover and battery cover; check terminals and connectors for corrosion. Add distilled water to each battery cell as necessary; keep the fluid at one-quarter inch over the separator tops.
Check the fluid specific gravity for a reading of 1.265 to 1.275. A recharge is necessary when the specific gravity is 1.240 or lower. Start charging at four amperes and finish at two amperes; do not allow battery temperature to rise above 120° F. during recharging. Keep the battery at full charge to prevent freezing in cold weather and to prolong service life.

~ CAUTION ~

The alternator and voltage regulator operate only as a one-polarity system. Be sure the polarity is correct when connecting a charger or booster battery.

If corrosion is present, flush the battery, shelf and mounting area with a solution of baking soda and water. Do not allow soda to enter the battery cells. Keep cable connections clean and tightly fastened, and keep overflow line free of obstruction.

HYDRAULIC BRAKE RESERVOIR SYSTEM

The brake system hydraulic reservoir is located on the tailcone bulkhead, forward of the avionics. To service, remove the left side tailcone access panel and check fluid level every 50 HOURS of operation. Fluid level should be no higher than two (2) inches(5 cm) below the filler cap. Use only hydraulic fluid (Red) conforming to specification MIL-H-5606. DO NOT FILL reservoir while parking brake is set.

MAINTENANCE

ENGINE PERFORMANCE CHECKS

When the aircraft leaves the factory the TEXTRON-Lycoming TIO-540-AF1A engine has been properly tuned and will perform at optimum efficiency. To insure that the engine is continuing to perform properly certain maintenance action should be performed during the 100 HOUR or ANNUAL inspection or whenever it is suspected that engine performance is not correct.

Refer to SERVICE AND MAINTENANCE MANUAL for specific maintenance actions to adjust engine if necessary.

PROPELLER CARE

The high stresses to which propeller blades are subjected makes their careful inspection and maintenance vitally important. Check the blades for nicks, cracks, or indications of other damage before each flight. Nicks tend to cause high stress concentrations in the blades which, if ignored, may result in cracks. It is very important that all nicks and scratches be repaired prior to next flight. It is not unusual for the propeller blades to have some end play or fore and aft movement as a result of manufacturing tolerances in the parts. This has no adverse effect on propeller performance or operation. With the first turn, centrifugal force firmly seats the blades, rigidly and positively against the retention bearing in the propeller hub.

Preflight inspection of the propeller blades should include, in addition to the foregoing, an occasional wiping with an cloth soaked in kerosene. NEVER USE AN ALKALINE CLEANER ON THE BLADES.

Your Mooney Service Center will answer any questions you may have concerning blade repair and inspection.

EXTERIOR CARE

As with any paint applied to a metal surface, an initial curing period is necessary for developing the desired qualities of durability and appearance. Therefore, DO NOT APPLY WAX TO THE NEW AIRCRAFT EXTERIOR UNTIL TWO OR THREE MONTHS AFTER DELIVERY. Wax substances will seal paint from the air and prevent curing. Wash the exterior to prevent dirt from working into the curing paint. Hold buffing to a minimum until curing is complete and there is no danger of disturbing the undercoat.

~ ~ ~ ~ ~ ~ ~ ~
~ **CAUTION** ~
~ ~ ~ ~ ~ ~ ~ ~

Before washing the exterior, be certain the brake discs are covered, a pitot cover is in place, and all static-air buttons are masked off.

Remove grease or oil from the exterior by wiping with a cotton cloth saturated in kerosene. Flush away loose dirt and mud deposits before washing the exterior with an aircraft-type washing compound mixed in warm water. Use soft cleaning cloths or a chamois, and USE ONLY MILD LIQUID TYPE DETERGENTS, avoid harsh or abrasive detergents that might scratch or corrode the surface. It is essential that ALL CLEANING COMPOUNDS AND APPLICATION CLOTHS BE FREE OF ABRASIVES, GRIT, OR OTHER FOREIGN MATTER. Use a prewax cleaner to remove a heavy oxidation film. For nonoxidized or precleaned surfaces, apply a good exterior finish wax recommended for protection of urethane enamel finishes. Carefully follow the manufacturer's instructions. A heavier coating of wax on the leading edge of the wings, empennage, and nose section will help reduce drag and abrasion in these areas.

If fuel, hydraulic fluid, or any other dye-containing substance is found on the exterior paint, wash the area at once to prevent staining. Immediately flush away spilled battery acid, and treat the area with a baking soda-and-water solution, followed by a thorough washing with a mild aircraft detergent and warm water.

Before wiping the windows or windshield, flush the exterior with clear water to remove particles of dirt. Household window cleaning compounds should NOT be used as some contain abrasives or solvents which could harm plexiglas. An commercial anti-static plexiglass cleaner is recommended for cleaning and polishing the windshield and windows.

INTERIOR CARE

Normal household cleaning practices are recommended for routine interior care. Frequently vacuum clean the seats, carpets, side panels, and headliner to remove as much surface dust and dirt as possible. Occasionally wash any leather, vinyl & side panels with a mild soap solution. Wipe clean with a slightly damp cloth and dry with a soft cloth. NEVER APPLY FURNITURE POLISHES. Foam-type shampoos and cleaners for upholstery materials are good for removing stains and reconditioning the interior. Spray dry cleaners are also recommended. Use Woolite on Nova-Suede panels. Grease spots on fabric should be removed with a jelly-type spot lifter.

~ ~ ~ ~ ~ ~ ~ ~ ~
~ **CAUTION** ~
~ ~ ~ ~ ~ ~ ~ ~ ~

Never use benzene, carbon tetrachloride, acetone, or gasoline for cleaning plexiglas or interior panels. Carefully follow the manufacturer's instructions when using commercial cleaning and finishing compounds.

Do not saturate fabrics with a solvent which could damage the backing and padding materials. To minimize carpet wetting, keep foam type cleaners as dry as possible and gently rub in circles. Use a vacuum cleaner to remove foam and to dry the materials.

Use a damp cloth or a mild soap solution to clean interior plastic, vinyl trim and metal surfaces.

AIRPLANE FILE

Certain miscellaneous data, information and licenses are a part of the airplane file. The following is a checklist of documents that must either be carried in the airplane or available on request of the proper authority.

1. To be displayed in the airplane at all times:
   a. Aircraft Airworthiness Certificate (FAA Form 8100-2).
   b. Aircraft Registration Certificate (FAA Form 8050-3).
   c. Aircraft Radio Station License, if transmitter installed (FCC Form 556).

2. To be carried in the airplane during all flight operations:
   a. Pilot's Operating Handbook (including FAA Approved Flight Manual).
   b. Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
   c. Equipment List.

NOTE

The original weight and balance data and Equipment List are contained in Section VI of this manual. This manual is supplied with each new airplane purchased from Mooney Aircraft Corporation. It is recommended that copies of Section VI be made and stored in a safe place.

3. To be made available upon request:
   a. Airplane Log Book.
   b. Engine Log Book.

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.

BLANK

TABLE OF CONTENTS

THE SUPPLEMENTS INSERTED INTO THIS SECTION ARE FAA APPROVED

SUPPLEMENT INSERTED . . . . DATE

INTRODUCTION

FAA approved data pertaining to Limitations, Normal Procedures, Emergency Procedures, and effects on performance for certain optional equipment installed in the airplane are contained in this section. Commonly installed items of optional equipment whose function and operation do not require detailed instructions are described by Section VII.

The Supplements are Approved by the FAA prior to incorporation into the Airplane Flight Manual.

BLANK

TABLE OF CONTENTS

TABLE OF CONTENTS

THE SUPPLEMENTS INSERTED INTO THIS SECTION ARE FAA APPROVED

INTRODUCTION

FAA approved data pertaining to Limitations, Normal Procedures, Emergency Procedures, and effects on performance for certain optional equipment installed in the airplane are contained in this section. Commonly installed items of optional equipment whose function and operation do not require detailed instructions are described by Section VII.

The Supplements are Approved by the FAA prior to incorporation into the Airplane Flight Manual.

MOONEY AIRCRAFT CORPORATION
P. O. Box 72
Kerrville, TX 78029-0072

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

MOONEY MODEL M20B, M20C, M20E, M20F,
M20G, M20J, M20K, & M20M

WITH

PRECISE SPEEDBRAKE SYSTEM (SBS)
(WITH CONTROL HORN SWITCH OPERATION)

REG. NO. N1091A

SER. NO. 27-0062

This Supplement must be attached to the applicable FAA Approved Airplane Flight Manual when the Precise Speedbrake System (SBS), with control horn switch operation, is installed in accordance with Mooney Aircraft Corporation Drawing Number 950155. The information contained herein supplements or supersedes the basic manual only in those areas listed. For limitation, procedures and performance information not contained in this Supplement, consult the Basic Airplane Flight Manual.

FAA Approved: A L Stone

Don P. Watson, Manger
Aircraft Certification Division
FEDERAL AVIATION ADMINISTRATION
Southwest Region
Ft. Worth, Texas 76101

Revision D: 8-16-89

Original Issue Date: 1 - 28 - 85

SECTION I - GENERAL

A Speedbrake System (SBS) may be installed to provide expedited descents at low cruise power, glide path control on final approach, "lift dumping" in the landing roll and a measure of protection against excessive speed buildup in an inadvertent spiral dive.

This kit consists of wing mounted speedbrakes with dual closure springs in each wing, a suction bellows below rear seat (belly area), a push button switch on pilot's control yoke, an amber light on pilot's panel (annunciator panel light on M20M) and a cable activation system.

The SBS push button switch located on the left horn of pilot's control wheel features a push (ON) retained position to deploy the speedbrakes. To retract, push one additional time and release to (OFF) position.

Activating this switch closes an electrical circuit to a solenoid valve which, in turn, permits suction from the vacuum system to reach the SBS suction bellows. In the event of an electrical malfunction, the SBS circuit breaker may be pulled to remove electrical power from the heavily spring-loaded solenoid.

SECTION II - OPERATING LIMITATIONS

1. Airspeeds - Same limitations as basic airplane.
2. Descent in icing conditions - SBS OFF.
3. PLACARDS:

Placard to be located at the circuit breaker panel: . . SPEEDBRAKE
Placard to be near Speedbrake switch on Control wheel: . SPEEDBRAKE
Placard to be placed in front and in full view of the pilot:
SPEEDBRAKE EQUIPPED: FOR OPERATING INSTRUCTION AND LIMITATIONS SEE FAA APPROVED AFM SUPPLEMENT OR PILOT'S . . . . OPERATING HANDBOOK.

SECTION III - EMERGENCY PROCEDURES

1. Forced landing after engine failure . . . . . . SBS OFF
   . or as required to modulate glide path with use of Speedbrakes.
   . . . . (amber light/annunciator-not illuminated)
2. Spins . . . . SBS OFF
3. Ditching . . . . SBS OFF
4. Disabled elevator system . . . . SBS OFF
5. Electrical Failure . . . . SBS OFF

SECTION IV - NORMAL OPERATING PROCEDURES

Before Takeoff

1. Speedbrake Push Button Switch . . . . . . IN-OUT (ON)
   Check Speedbrakes DEPLOYED (amber light/annunciator- illuminated)
2. Speedbrake Push Button Switch . . . . . IN-OUT-(OFF)
   Check Speedbrakes Down (amber light/annunciator-not illuminated)

During Takeoff

1. SBS . . . . . OFF (amber light/annunciator-not illuminated)

SECTION IV (Cont'd.)

Enroute

1. SBS . . . . OFF

Expedited descents

1. Select 2200 RPM and approximately 22 inches manifold pressure to keep the engine warm.
Push Switch . . . . (ON) to deploy speedbrakes
Push Switch . . . . (OFF) to retract speedbrakes
. . . . (amber light/annunciator light OFF)

Final Approach

Fly a high base leg and final approach, extend wing flaps as desired and actuate the SBS Switch "ON" to deploy the Speedbrakes. The speedbrakes may be operated intermittently - as required - to modulate the glide path. Maintain an 85 knot approach speed by establishing a moderately steep, nose down attitude.

NOTE
Lower the nose in anticipation of increased drag as the SBS is actuated.

Landing

Initiate the landing flare at a slightly higher altitude above the runway and rotate the aircraft more rapidly than usual to perform a tail low touchdown.

//////////////////////
// CAUTION //
//////////////////////
If rate of descent is excessive, place SBS switch (OFF) to retract speedbrakes; add power as required to reduce the rate of descent.

Balked Landing (GO-AROUND)

Advance throttle and place SBS Switch (OFF); retract wing flaps per basic Airplane Flight Manual instructions.

Securing Aircraft

Perform a normal shutdown sequence . . . . SBS Switch (OFF).

Section V thru X

No change with SBS system retracted.

MOONEY AIRCRAFT CORPORATION
P.O. BOX 72
KERRVILLE, TEXAS 78029-0072

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

Mooney Aircraft Model

M20M

WITH

PROPELLER DE-ICE SYSTEM

REG. NO. N1091A

SERIAL NO. 27-0062

This Supplement must be attached to the applicable FAA Approved Pilot's Operating Handbook and Airplane Flight Manual (POH/AFM) when the B. F. Goodrich, Propeller De-Ice System, is installed in accordance with Mooney Drawing 690003. The information contained herein supplements or supersedes the basic manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Airplane Flight Manual.

FAA APPROVED: Henry A. Armstrong

Henry A. Armstrong, Manager
Aircraft Certification Service
FEDERAL AVIATION ADMINISTRATION
Fort Worth, Texas.
76193-0150

MOONEY AIRCRAFT CORPORATION

P. O. BOX 72

Kerrville, Texas 78029-0072

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date
A	Title Page, 3 of 3	Added REV.A to page Revised Data	M. McAuley	4/5/90

The revised portions of affected pages are indicated by vertical black lines in the margin.

SECTION I - GENERAL

The propeller de-ice system is intended for use if unexpected icing conditions are encountered. The system is operated by a rocker switch/circuit breaker located in the pilot's panel.
When the switch is placed in the "ON" position, current flows to a timing device which supplies power to the heating elements in the propeller boots. Each propeller blade boot contains heating elements which are cycled ON and OFF every 90 seconds by the timer. An annunciator light is illuminated whenever the de-ice rocker switch is turned on and will cycle ON & OFF with timer, indicating when current is being applied to heating elements.

SECTION II - LIMITATIONS

There is no change to the airplane limitations when the propeller de-ice system in installed.

Flight into known icing conditions is prohibited.

SECTION III - EMERGENCY PROCEDURES

No change

SECTION IV - NORMAL PROCEDURES

If unexpected icing conditions are encountered, the following procedure is recommended:

1. "PROP DE-ICE" switch - ON.
2. Verify "PROP DE-ICE" light (BLUE) is illuminated on the annunciator panel.

NOTE
The airplane ammeter should fluctuate slightly as the timer cycles ON and OFF every 90 seconds.

SECTION V - PERFORMANCE

Sea level rate of climb will be reduced approximately 50 FPM, with no reduction in cruise true airspeed.

SECTION VI THROUGH X

No Change

MOONEY AIRCRAFT CORPORATION
P.O. BOX 72
KERRVILLE, TEXAS 78029-0072

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

Mooney Aircraft Models

M20J, M20K, M20L, M20M

WITH

AA80 "InterVOX" Intercom System

REG. NO. N1091A

SERIAL NO. 27-0062

This Supplement must be attached to the applicable FAA Approved Pilot's Operating Handbook and Airplane Flight Manual (POH/AFM) when the AA80 InterVOX Intercom System, is installed in accordance with Mooney Drawing number 810417 (M20J & M20K), 810202 (M20L & M20M). The information contained herein supplements or supersedes the basic manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Airplane Flight Manual.

FAA APPROVED: Henry A Armstrong

Henry A. Armstrong, Manager
Aircraft Certification Service
FEDERAL AVIATION ADMINISTRATION
Fort Worth, Texas.
76193-0150

Date: 1-8-90

MOONEY AIRCRAFT CORPORATION

P. O. BOX 72

Kerrville, Texas 78029-0072

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date

The revised portions of affected pages are indicated by vertical black lines in the margin.

SECTION I - GENERAL

The AA80 intercom system provides one central control for all aircraft audio, allowing existing radio and entertainment audio to be mixed with live or voice activated intercom audio. Boom microphone control is also provided for two places (pilot & co-pilot), with pilot's control having priority. Muting of the entertainment audio is provided during ICS or TX operation. An emergency/isolation mode is also provided for the pilot.

Control over radio receive level (internal), transmit sidetone level (internal), music level (internal), intercom level (front panel), and VOX threshold (front panel) is provided. The vox threshold or squelch also allow for a "live" mode, by defeating the squelch, and allowing continuous ICS operation.

Operation of the ICS is transparent, allowing transmit during any ICS mode simply by use of the TX PTT switch.

SECTION II - LIMITATIONS

The AA80 intercom system imposes no limitations on the original airframe or other systems.

SECTION III - EMERGENCY PROCEDURES

The AA80 intercom system does not affect the emergency procedures of the aircraft.

Refer to the following for emergency procedures for the AA80 intercom system.

EMERGENCY OPERATION

If power is lost to the AA80 for any reason, it will drop into the power-fail mode and the pilot will be connected directly to the radios for emergency operation. The external PTT switch will still function. This mode is similar to the "PILOT ISOLATE" mode, except that all co-pilot & passenger functions are lost since they depend on external power. A power failure has occurred when the panel indicator fails to light under any condition.

If a catastrophic relay failure of the AA80 should occur or the rear connector becomes loose or disengaged, the designated emergency hand microphone and headset jacks will allow operation to continue, as they have no connection directly through the AA80.

The "PILOT ISOLATION" mode requires no power and will operate even if other circuitry should fail in the AA80.

NOTE

During this mode the co-pilot's microphone IS NOT locked out and he could transmit if necessary; however he will NOT BE ABLE TO RECEIVE the incoming audio.

All aspects of emergency operation should be confirmed to be working by the pilot before accepting the aircraft into service. This can be accomplished by pulling the intercom circuit breaker during the pre-takeoff ground check to turn all power OFF from the AA80 and checking operation per procedures above.

SECTION IV - NORMAL PROCEDURES

SELECTION OF TRANSMIT FUNCTIONS

Keying the external TX PTT switch activates the AA80 for transmit with the pilot's switch having priority in normal or "INTERVOX" mode. Proper TX operation is annunciated by a green light on the front of the AA80.

Sidetone is normally heard from the radio(s) connected to the AA80, but if not available, an internal potentiometer will adjust the level of artificial sidetone generated within the AA80 system for the pilot's convenience.

NOTE

This artificial sidetone is only available through the amplifier in the AA80 and will be lost to the pilot in the "PILOT ISOLATION" mode, but will be heard by the passenger(s).

SELECTION OF RECEIVE FUNCTIONS

Receive audio is always enabled through the AA80 and has a separate internal adjustment to allow balancing of this level to suit the pilot"s preference and equalize iso/normal operation.

An additional input is provided for entertainment audio (tapes,etc.) with a separate level adjustment. This line is muted during transmit functions and when the intercom is active.

If the "ISO" function is selected, the pilot will be connected directly to the radios, while the co-pilot and rear seat passenger(s) remain on the ICS bus with the entertainment audio. In the "INTERVOX" mode all stations hear the same audio.

ICS FUNCTION

Intercom audio may be generated in two modes between users, "live" (on constantly) or "VOX" (voice activated). This is selected, along with the squelch threshold of the VOX circuit, by the "VOX SQUELCH" control on the front of the AA80. When the VOX trigger is activated, the front panel indicator will light up amber, indicating that the ICS system is ON.

Intercom level or volume is set by the "ICS VOLUME" control on the front of the AA80. It does not affect the level of other audio within the system.

ICS functions are available to all users when the system switch is in the "INTERVOX" mode. When switch is in the "PILOT ISOLATION" mode, only the co-pilot and the passenger(s) have ICS capability.

SECTION V thru X

No change to these Sections when the AA80 intercom system is installed except that the weight and balance information will require updating.

JOSE J. MONROY
P.O. BOX 8217
CORAL SPRINGS, FLORIDA 33075 USA

F A A APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

MOONEY MODEL M20M (S/N 27-0001 and after)

REG. NO. N1091A

SER. NO. 27-0062

This Airplane Flight Manual Supplement (AFMS) must be attached to the appropriate FAA Approved Airplane Flight Manual (AFM) or Pilot's Operating Handbook (POH) when Long Range Fuel Tanks are installed in accordance with Supplemental Type Certificate (STC) No. SA1913SO. The information contained herein supplements or supersedes the information presented in the basic Airplane Flight manual or Pilot's Operating Handbook only in those areas listed herein. For limitations, procedures and performance information not contained in this AFM Supplement, consult the basic FAA Approved Airplane Flight Manual or Pilot's Operating Handbook.

FAA APPROVED: Paul Sconyers
Manager
Atlanta Aircraft Certification Office, Central Region, FAA

DATE: DEC 1? 1990

JOSE J. MONROY
P.O. BOX 8217
CORAL SPRINGS, FLORIDA 33075 USA

Airplane Flight Manual Supplement for Mooney
Model M20M

1. GENERAL

This aircraft is equipped with auxiliary fuel tanks behind the main tanks for extended flight range. The tanks feed by gravity into the main tanks with no pilot intervention. The auxiliary fuel tank refueling is done thru the existing filler hole at the same time as the main tanks with no additional procedure. The additional fuel capacity is 29 gallons total, for a total capacity of 118 gallons.

2. LIMITATIONS - No change except

PLACARDS

On the fuel tank filler cap:

FUEL CAPACITY 59 GAL.
OCTANE 100/130
FILL BOTH WINGS EVENLY

3. PROCEDURES

PREFLIGHT

1. Check the left and right tank for fuel level and drain the inboard drain sump for clear fuel (the original drain) on each tank.

2. Drain the outboard sump located just outboard of the main landing gear door for left and right aux. tank.

3. Note the instrument panel fuel gauge reading and compute fuel amount for each side using the table below:

S/N 27-0001 thru 27-0052	S/N 27-0053 and after
1/4 mark = 11 gallons	11 gal mark = 11 gallons
1/2 mark = 22 gallons	22 gal mark = 22 gallons
3/4 mark = 44 gallons	33 gal mark = 44 gallons
F mark = 59 gallons	F mark = 59 gallons

4. Set the fuel flow meter for the total fuel onboard.

5. C.G. arm for the aux. tanks is 71.0 inches and maximum total fuel weight for both sides is 180 pounds.

FAA APPROVED

DATE: DEC 18 1990

SERVICING

1. Fill one tank.

2. Fill the opposite one

5. Ensure that both wings are filled to the same level.

NOTE

Fuel level may drop approximately 1.0 inch after refueling (five minutes) due to fuel level equalization in the aux. tank. Just fill in the extra fuel if desired.

6. Drain the sump for each tank until clear fuel is visible.

4. PERFORMANCE - No change

GARMIN Ltd. or its subsidiaries
c/o Garmin International
1200 E. 151st Street, Olathe, KS 66062 USA

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for
GARMIN 500W SERIES GPS-WAAS NAVIGATION SYSTEM
as installed in

MOONEY M20M
Make and Model Airplane

Reg. No. N1091A S/N 27-0062

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped with the Garmin 500W Series unit. This document must be carried in the airplane at all times when the Garmin 500W Series unit is installed in accordance with STC SA01933LA.

The information contained herein supplements or supersedes the information made available to the operator by the manufacturer in the form of clearly stated placards, markings, or manuals 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, markings, or manuals or the basic FAA approved Airplane Flight Manual.

FAA APPROVED
Patrick Power
Manager, Flight Test Branch, ANM-160L
Federal Aviation Administration
Los Angeles Aircraft Certification Office
Transport Airplane Directorate

DATE: December 21, 2006

GARMIN Ltd. or its subsidiaries
c/o Garmin International
1200 E. 151st Street, Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for a Garmin 500W Series Navigation System

LOG OF REVISIONS				
	Page			
Rev. No.	No.	Date	Description	FAA Approved
A Original	All	11/06/06	Complete Supplement	Patrick Power Mgr. Flt. Test Br., ANM-160L FAA, Los Angeles ACO Transport Airplane Directorate Date November 6, 2006
B	All	12-21-06	Added GA 35 antenna selection to Limitations section.	Patrick Power Mgr. Flt. Test Br., ANM-160L FAA, Los Angeles ACO Transport Airplane Directorate Date December 21, 2006

GARMIN Ltd. or its subsidiaries
c/o Garmin International
1200 E. 151st Street, Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or SUPPLEMENTAL AIRPLANE FLIGHT MANUAL for a Garmin 500W Series Navigation System

Table of Contents

FAA APPROVED

DATE: DEC 21 2006

Section 1. GENERAL

1.1 Garmin 500W Series GPS/WAAS Nav Com

The Garmin 500W Series GPS/WAAS Navigator is a panel-mounted product that contains a GPS/WAAS receiver for GPS approved primary navigation, (plus optional VHF Com and VHF Nav radios) in an integrated unit with a moving map and color display. The 500W Series unit features a graphical display which may also be used to depict traffic, weather, or terrain data. Optional TAWS annunciation and audio is available in some installations.

The navigation functions are operated by dedicated keys and graphical menus which are controlled by the buttons and the dual concentric rotary knob along the bottom and right side of the display.

Optional VHF Com and VHF Nav radio functions are controlled via dedicated buttons and knobs on the left side of the display and adjacent to frequencies they are controlling.

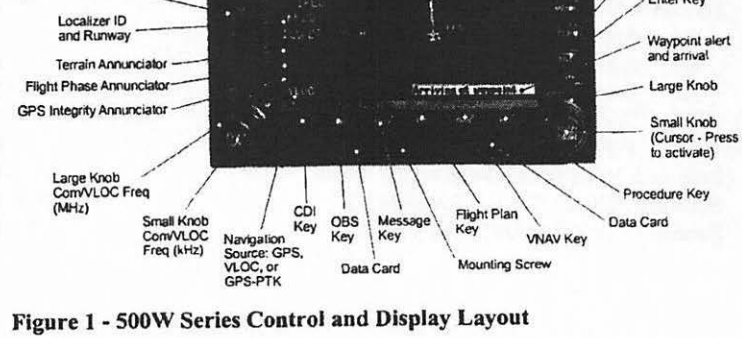


Figure 1 - 500W Series Control and Display Layout

FAA APPROVED

DATE: DEC 2 2006

1.2 Operation

GPS/WAAS TSO-C146a Class 3 Operation: The Garmin 500W Series unit, when installed in accordance with STC SA01933LA, uses GPS and WAAS (within the coverage of a Space-Based Augmentation System complying with ICAO Annex 10) for enroute, terminal area, non-precision approach operations (including "GPS", "or GPS", and "RNAV" approaches), and approach procedures with vertical guidance (including "LNAV/VNAV" and "LPV").

Navigation is accomplished using the WGS-84 (NAD-83) coordinate reference datum. GPS navigation data is based upon use of only the Global Positioning System (GPS) operated by the United States of America.

1.3 Class II Oceanic, Remote, and other Operations:

The Garmin 500W Series, as installed, has been found to comply with the requirements for GPS primary means of Class II navigation in oceanic and remote airspace, when used in conjunction with Garmin Prediction Program part number 006-A0154-03. Oceanic operations are supported when the 500W Series unit annunciates OCN. This provides an alarm limit of four nmi and a mask angle of five degrees. The 500W series unit also has the ability to predict RAIM availability at any waypoint in the database if WAAS corrections are expected to be absent or disabled. This does not constitute an operational approval for Oceanic or Remote area operations. Additional equipment installations or operational approvals may be required.

a) Oceanic navigation requires an additional approved long range oceanic and/or remote area navigation system with independent display, sensors, antenna, and power source. (It may be a second 400W/500W Series unit.)
b) Redundant VHF Com and VHF Nav systems may be required for other than U.S. 14 CFR Part 91 operations. Check foreign regulation requirements as applicable. (It may be a second 400W/500W Series unit.)
c) Operations approval *may* be granted for the use of the 500W Series unit RAIM prediction function in lieu of the Prediction Program for operators requiring this capability. Refer to your appropriate civil aviation authorities for these authorizations.

Section 2. LIMITATIONS

2.1 Pilot's Guide

The GARMIN 500W Series Pilot's Guide, part number and revision listed below (or later revisions), must be immediately available for the flight crew whenever navigation is predicated on the use of the 500W Series unit.

- 500W Series Pilot's Guide & Reference P/N 190-00357-00 Rev A
- 400W/500W Series Optional Displays P/N 190-00356-30 Rev A
- 400W/500W Series Display Interfaces P/N 190-00356-31 Rev A

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations. Additional aircraft systems may be required for IFR operational approval. Systems limited to VFR shall be placarded in close proximity to the 500W Series unit "**GPS LIMITED TO VFR USE ONLY**".

2.2 System Software:

The system must utilize the Main and GPS software versions listed below (or later FAA approved versions). The software versions are displayed on the self-test page immediately after turn-on for approximately 5 seconds or they can be accessed in the AUX pages.

Subsequent software versions may support different functions. Check the 500W Series Pilot's Guide for further information.

Table 1 - Approved Software Versions

Software Item	**Approved Software Version** *(or later FAA approved versions)*	
	SW version	As displayed on unit
Main SW Version	2.00	2.00
GPS SW Version	2.4	2.4

2.3 Navigation Database

The 500W Series unit database cards listed in the following table (or later FAA approved versions) must be installed.

a) IFR enroute and terminal navigation is prohibited unless the pilot verifies the currency of the database or verifies each selected waypoint for accuracy by reference to current approved data.

b) GPS instrument approaches using the 500W Series units are prohibited, unless the 500W Series unit's approach data is verified by the pilot or crew to be current. Instrument approaches must be accomplished in accordance with an approved instrument approach procedure that is loaded from the 500W Series unit database.

Table 2 – Approved Navigation Database Cards

Part Number	Revision	Description
010-10546-00	B or later	Data Card, WAAS, IFR, World Wide
010-10546-01	B or later	Data Card, WAAS, IFR, Americas
010-10546-02	B or later	Data Card, WAAS, IFR, International

2.4 Terrain Database

The 500W Series unit supports Terrain or TAWS (optional) and requires a Terrain database card to be installed in order for either feature to operate. The table below lists compatible database cards for the 500W series. Each of the data base cards contains the following data:

a) The Terrain Database has an area of coverage from North 75° Latitude to South 60° Latitude in all longitudes.
b) The Airport Terrain Database has an area of coverage that includes the United States, Canada, Mexico, Latin America, and South America.
c) The Obstacle Database has an area of coverage that includes the United States, and is updated as frequently as every 56 days.

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

Table 3 – Approved Terrain Database Cards

Part Number	Revision	Description
010-10201-20	C or later	Data Card, TAWS / Terrain, 128MB
010-10201-21	A or later	Data Card, TAWS / Terrain, 256MB

2.5 Navigation

No navigation is authorized north of 89° (degrees) north latitude or south of 89° (degrees) south latitude.

2.6 IFR Operational Limitation

This system does not currently comply with US 14 CFR part 91, SFAR 97 requirements for TSO-C146a equipment. Until complete compliance is demonstrated and approved by the FAA, authorization to conduct any GPS or WAAS operation under Instrument Flight Rules (IFR) requires that:

a) Aircraft using the GPS or WAAS capability of the 500W series navigation equipment under IFR must be equipped with an approved and operational alternate means of navigation appropriate to the flight with the exception of oceanic and remote operations.
b) For flight planning purposes, if an alternate airport is required it must have an approved instrument approach procedure other than GPS or RNAV that is anticipated to be operational and available at the estimated time of arrival. All equipment required for this procedure must be installed and operational.
c) For flight planning purposes, Garmin Prediction Program part number 006-A0154-03 (with the installed antenna part number selected) should be used to confirm the availability of RAIM for the intended flight in accordance with the local aviation authority guidelines for TSO-C129a equipment. WAAS NOTAMs (or their absence) and generic prediction tools do not provide an acceptable indication of availability.
d) When flight planning an LNAV/VNAV or LPV approach, operators should use the Garmin Prediction Program part number 006-A0154-03 (with the installed antenna part number selected) in addition to any NOTAMs issued for the approach.

The installed antenna must be specified for the Garmin Prediction Program to compute the overall system performance. The antenna installed in this installation is (one antenna to be checked by installer):

☐ A-33 (575-9 / 590-1104) ☐ A-34 (575-93 / 590-1112)

☐ GA 56A (011-01154-00) ☐ GA 56W (011-01111-00)

☐ GA 57 (011-01032-00) ☐ GA 35 (013-00235-00)

2.7 Approaches

a) During GPS approaches, the pilot must verify the 500W Series unit is operating in the approach mode. (LNAV, LNAV+V, L/VNAV, or LPV)

b) When conducting approaches referenced to true North, the heading selection on the AUX pages must be adjusted to TRUE.

c) Accomplishment of an ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR approach, or any other type of approach not approved for GPS overlay, is not authorized with GPS navigation guidance.

d) Use of the GNS 530W VOR/LOC/GS receiver to fly approaches not approved for GPS requires VOR/LOC/GS navigation data to be present on the external indicator (i.e. proper CDI source selection).

e) For aircraft with remote source selection annunciation or remote GPS navigation annunciations installed, conducting IFR approaches is prohibited if the remote annunciation is found to be inoperative during pre-flight. (This limitation does not prohibit the conduct of an IFR approach if the required remote annunciation fails during flight. The indications provided on the 500W Series unit display may be used as a backup).

f) Except in emergency conditions, IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the 500W Series unit or the affected CDI.

2.8 Autopilot Coupling

IFR installations of a Garmin 500W Series unit allow the operator to fly all phases of flight based on the navigation information presented to the pilot; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes; however, the FAA requires that vertical coupling of an autopilot for approaches be demonstrated to meet their intended function and provide safe and proper operation. This installation is limited to:

☐ No limitations for autopilot coupling.

☐ Lateral GPS coupling (LNAV only). For 530W units: The GS of an ILS (VLOC) may be coupled to the autopilot without any limitations.

This limitation may be removed after an FAA Flight Test demonstration. Contact Garmin International, Tech Support for additional information.

2.9 Terrain Display [Units without TAWS]

Terrain refers to the display of terrain information. Pilots are NOT authorized to deviate from their current ATC clearance to comply with terrain/obstacle alerts. Terrain unit alerts are advisory only and are not equivalent to warnings provided by TAWS. Navigation must not be predicated upon the use of the terrain display.

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.

2.10 TAWS Function [Units with TAWS]

TAWS is an optional extension of Terrain. Pilots 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.

To avoid unwanted alerts, TAWS should be inhibited when landing at an airport that is not included in the airport database.

TAWS must be inhibited prior to the Final Approach Fix (FAF) when conducting and instrument approach that terminates in a circling to land or side step maneuver.

2.11 Weather Display

If an optional weather receiver is interfaced to the 500W Series unit, the weather information displayed is limited to supplemental use only and may not be used in lieu of an official weather data source.

2.12 Traffic Display

Traffic may be displayed on the 500W Series unit when connected to an approved optional TCAS, TAS, or TIS traffic device. These systems are capable of providing traffic monitoring and alerting to the pilot. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering. Display of this traffic data and related operations are described in the 500W Series unit Pilot's Guide.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures
No change.

3.2 Abnormal Procedures
a) If the Garmin 500W Series unit GPS navigation information is not available, or is invalid, utilize other remaining operational navigation equipment installed in the airplane as appropriate. If the 500W Series unit loses GPS position and reverts to Dead Reckoning mode (indicated by the annunciation of "DR" in the lower left of the display), the moving map will continue to be displayed. Aircraft position will be based upon the last valid GPS position and estimated by Dead Reckoning methods. Changes in airspeed or winds aloft can affect the estimated position substantially. Dead Reckoning is only available in Enroute mode; Terminal and Approach modes do not support DR.

b) If a "Loss of Integrity" (INTEG) message is displayed during:
   - Enroute/Terminal: continue to navigate using GPS equipment and periodically cross-check the GPS guidance to other approved means of navigation.
   - GPS Approach: GPS approaches are not authorized under INTEG - Execute missed approach or revert to alternate navigation.

c) During a GPS LPV precision approach or GPS LNAV/VNAV approach, the 500W Series unit will downgrade the approach if the Horizontal or Vertical alarm limits are exceeded. This will cause the vertical guidance to flag as unavailable. The procedure may be continued using the LNAV only minimums.

d) During any GPS approach in which precision and non-precision alarm limits are exceeded, the 500W Series unit will flag the lateral guidance and generate a system message "ABORT APPROACH loss of navigation". Immediately upon viewing the message the unit will revert to Terminal 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 should be utilized.

Section 4. NORMAL PROCEDURES

Refer to the 500W Series unit Pilot's Guide defined in paragraph 2.1 on page 6 of this document for normal operating procedures. This includes all GPS operations, VHF COM and NAV, and Multi-Function Display information. For information on TIS traffic, data linked weather, or TAWS see the Pilot's Guide addendum for optional displays. For information on active traffic sensor or Stormscope operation and displays see the Pilot's Guide addendum for display interfaces.

Although intuitive and user friendly the 500W Series unit requires a reasonable degree of familiarity to prevent operations without becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid 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 excellent training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization. Use of an autopilot is strongly encouraged when using the 500W Series unit in IMC conditions.

4.1 Approaches with Vertical Guidance

The 500W Series unit supports three types of GPS approaches with vertical guidance: LPV approaches, LNAV/VNAV (annunciated as L/VNAV) approaches, and LNAV approaches with advisory vertical guidance (annunciated as LNAV+V). For LNAV approaches with advisory vertical guidance, the 500W Series will annunciate LNAV+V indicating vertical guidance is available. LNAV minimums will be controlling in this case.

NOTE:

> If flying an LPV or LNAV/VNAV approach, be prepared to fly the LNAV only approach prior to reaching the final approach fix (FAF). If the GPS integrity is not within vertical approach limits, the system will flag the vertical guidance. This may be annunciated by a downgrade to LNAV message.

For additional information on approaches with vertical guidance refer to the 500W Series unit Pilot's Guide.

4.2 Autopilot Operation

The Garmin 500W Series may be coupled to an optional autopilot if installed in the aircraft when operating as prescribed in the LIMITATIONS section of this manual. For lateral guidance, some installations may utilize GPSS or GPS Roll Steering in lieu of the analog deviation information. If an HSI is used with GPSS engaged, the pilot should rotate the course pointer as prompted on the 500W Series unit to prevent any spatial disorientation and to prevent the aircraft from turning inappropriately if the autopilot is switched from digital (GPSS) to analog mode. For autopilot operational instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.3 Coupling the Autopilot during approaches

The Garmin 500W Series supports analog and digital (GPSS) control interfaces to an optionally installed autopilot. Some autopilots revert to ROLL mode (wings level) and/or flag a NAV failure if the digital data becomes unavailable or is inhibited. The CDI selection of VLOC should inhibit the digital control interface. When switching between GPS and VLOC the pilot should be aware that the autopilot may need to be re-engaged into APR or NAV mode after changing the CDI source.

Autopilot coupling to GPS vertical guidance requires that the autopilot be engaged in an analog APR mode identical to coupling to an ILS. Some autopilots may revert to ROLL mode when the navigation outputs of the 500W Series unit sequence to the final approach fix. In these installations the unit will be configured to PROMPT the pilot to "Enable the autopilot approach outputs" in order to prevent the autopilot from entering ROLL mode without the pilot being aware of the transition.

- ☐ This installation prompts the pilot and requires the pilot to enable the A/P outputs just prior to engaging the autopilot in APR mode.
- ☐ This installation supports a seamless transition from digital (GPSS) to analog guidance for the autopilot. To capture the vertical guidance, the pilot may engage the autopilot in APR mode at any time when the GPS Glide Slope (VDI) becomes valid (displayed without a FLAG).
- ☐ This installation interfaces to the autopilot in analog mode only. To capture the vertical guidance, the pilot may engage the autopilot in APR mode at any time when the GPS Glide Slope (VDI) becomes valid.

☐ The autopilot does not support any vertical capture or tracking in this installation.

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.

4.4 TAWS Cautions and Warning [If installed]

Should a terrain awareness Caution occur, take positive corrective action based on analysis of all the available information. If this elevates to a terrain awareness Warning, immediately initiate and continue a maximum rate climb until the alert ceases. Only vertical maneuvers are recommended, unless visual meteorological conditions (VMC) exist or the pilot can determine that turning in addition to the climbing maneuver is the safest course of action.

4.5 WFDE Prediction Program

The Garmin WAAS Fault Detection and Exclusion (WFDE) Prediction Program is required for Remote/Oceanic operations and may be required for IFR Enroute/Terminal and Approach operations; reference the Limitations section of this manual.

The Prediction Program should be used in conjunction with the Garmin 400W/500W Simulator. After entering the intended route of flight in the Simulator flight plan the pilot selects the FDE Prediction Program under the Options menu of the Simulator program.

For detailed information refer to the WFDE prediction program instructions (190-00643-01). The availability of FDE is only required for Oceanic or Remote operations; RAIM is required for IFR Enroute/Terminal operations; and Approach availability should be validated whenever conducting RNAV(GPS) approaches.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

See Garmin 500W Series unit Pilot's Guide for a complete description of the 500W Series unit.

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GTX 33X and GTX 3X5 Transponders with ADS-B
as installed in

MOONEY M20M
Make and Model Airplane

Registration Number: N1091A Serial Number: 27-0062

This document serves as an FAA Approved Airplane Flight Manual Supplement or Supplemental Airplane Flight Manual when the GTX 33X or GTX 3X5 with ADS-B is installed in accordance with Supplemental Type Certificate SA01714WI. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the FAA approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA approved Airplane Flight Manual, markings, or placards.

FAA Approved By: JR Brownell

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

Date: 9-9-2019

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
1	05/01/2013	All	Complete Supplement	*Robert Murray* Robert Murray ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *05/01/2013*
2	03/08/2016	All	New supplement format with GTX 3X5 added.	*Michael Warren* Michael Warren ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *03/08/2016*
3	12/07/2017	All	Updated SW versions and removed section 3.2.3. Updated section 2.2 Corrected PED FAR reference and additional minor corrections.	*Erik Frisk* Erik Frisk ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *12/21/2017*
4	09/09/2019	4, 6, 7, 9, 11, 13, 14, 18	Added GTX diversity units, updated SW versions, expanded allowed remote control panels, and incorporated other minor changes	See cover page 1

Table of Contents

Section 1. GENERAL

1.1 GTX 33X

The Garmin GTX 33X family consists of the GTX 330 ES and GTX 33 ES (Non-Diversity Mode S Transponders) and the GTX 330D ES and GTX 33D ES (Diversity Mode S Transponders). The ES option of any of the transponders provides ADS-B extended squitter functionality.

All Garmin GTX 33X transponders are a radio transmitter/receiver that operates on radar frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses to ground-based radar on a frequency of 1090 MHz. Each unit is equipped with IDENT capability to initiate the SPI (special position identification) pulse for 18 seconds and will reply to ATCRBS Mode A, Mode C and Mode S All-Call interrogation. Interfaces to the GTX 33X are shown in the following block diagrams.

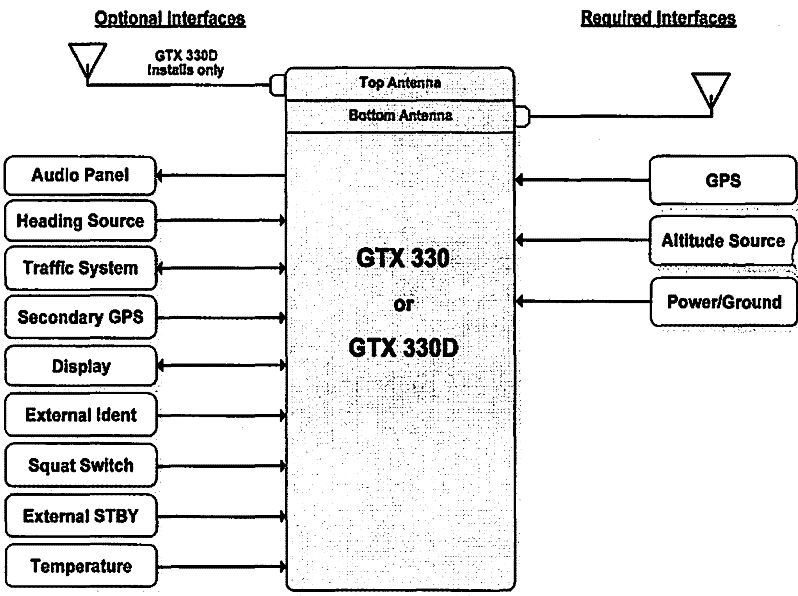


Figure 1 – GTX 330 or GTX 330D Interface Summary

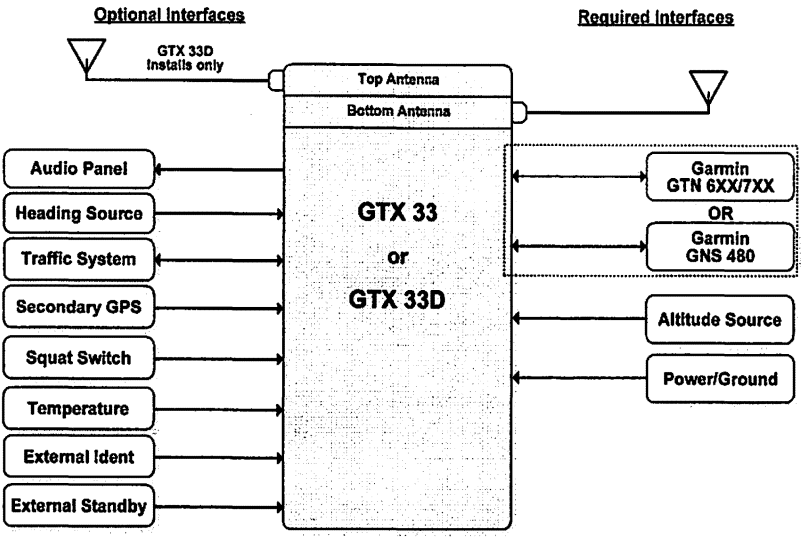


Figure 2 – GTX 33 or GTX 33D Interface Summary

The GTX 33X performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090 MHz)
  - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
    - GPS Position, Altitude, and Position Integrity
    - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
    - Air Ground Status
    - Flight ID, Call Sign, ICAO Registration Number
    - Capability and Status Information
    - Transponder Squawk Codes between 0000-7777.
    - Emergency Status
    - IDENT - initiates SPI (special position identification) pulse for 18 seconds
  - Pressure Altitude Broadcast Inhibit
- Reception of TIS-A traffic data from a ground station
- Provides TIS-A traffic alerting to the pilot via interfaced display and audio output

1.2 GTX 3X5

The Garmin GTX 3X5 family consists of the GTX 335, 335D, 335R, 335DR, 345, 345D, 345R, and 345DR transponders. The functional differences between each of these transponders are described in Table 1. Transponder models with a "D" designation are diversity capable and support both a top fuselage and bottom fuselage antenna.

Function	GTX 335/ 335D	GTX 335 w/GPS	GTX 335R/ 335DR	GTX 335R w/GPS	GTX 345/ 345D	GTX 345 w/GPS	GTX 345R/ 345DR	GTX 345R w/GPS
Panel mount	x	x			x	x		
Remote mount			x	x			x	x
Mode S	x	x	x	x	x	x	x	x
ADS-B (out)	x	x	x	x	x	x	x	x
ADS-B Traffic					x	x	x	x
FIS-B					x	x	x	x
Internal GPS		x		x		x		x
Bluetooth					x	x	x	x
Optional Garmin Altitude Encoder	x	x	x	x	x	x	x	x

Table 1 – GTX 3X5 Unit Configurations

Interfaces to the GTX 3X5 are shown in Figure 3.

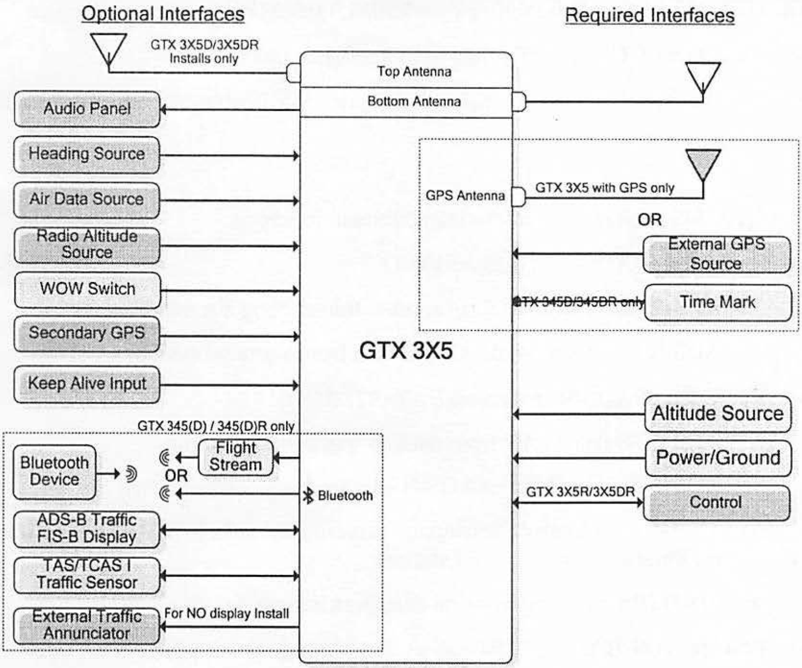


Figure 3 – GTX 3X5 Interface Summary

The GTX 3X5 performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090 MHz)
    - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
        - GPS Position, Altitude, and Position Integrity
        - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
        - Air Ground Status
        - Flight ID, Call Sign, ICAO Registration Number
        - Capability and Status Information
        - Transponder Squawk Codes between 0000-7777.
        - Emergency Status
        - IDENT - initiates SPI (special position identification) pulse for 18 seconds
    - Pressure Altitude Broadcast Inhibit

The GTX 335 performs the following additional functions:

- Reception of TIS-A traffic data from a ground station
- Provide TIS-A traffic alerting to the pilot via interfaced display and audio output.

The GTX 345 performs the following additional functions:

- Reception of ADS-B In data on 1090 MHz
  - ADS-B (Data directly from another transmitting aircraft)
  - ADS-R (Rebroadcast of ADS-B data from a ground station)
- Reception of ADS-B In data on UAT (978 MHz)
  - ADS-B (Data directly from another transmitting aircraft)
  - ADS-R (Rebroadcast of ADS-B data from a ground station)
  - TIS-B (Broadcast of secondary surveillance radar) (SSR) derived traffic information from a ground station.
  - FIS-B (Broadcast of aviation data from a ground station)
- Provide ADS-B traffic information and alerting to the pilot via an interfaced display
  - Correlation and consolidation of traffic data from multiple traffic sources
  - Aural and visual traffic alerting
- Provide FIS-B data to the pilot via an interfaced display
  - Graphical and textual weather products
    - NEXRAD
    - PIREPs
    - AIRMET/SIGMETs
    - METARs
    - TAFs
    - Winds Aloft
  - Aviation Data
    - TFRs
    - NOTAMs

1.3 Capabilities

The Garmin GTX 33X and GTX 3X5 as installed in this aircraft have been shown to meet the equipment requirements of 14 CFR § 91.227 when operating in accordance with sections 2.1 and 2.2 of this supplement.

1.4 Installation Configuration

This aircraft is equipped with a GTX 33X and/or GTX 3X5 with the following interfaces/ features:

Equipment Installed:

Transponder #1	Transponder #2 (if installed)
☐ GTX 330	☐ GTX 330
☐ GTX 330D	☐ GTX 330D
☐ GTX 33	☐ GTX 33
☐ GTX 33D	☐ GTX 33D
☑ GTX 335	☐ GTX 335
☐ GTX 335D	☐ GTX 335D
☐ GTX 335R	☐ GTX 335R
☐ GTX 335DR	☐ GTX 335DR
☐ GTX 345	☐ GTX 345
☐ GTX 345D	☐ GTX 345D
☐ GTX 345R	☐ GTX 345R
☐ GTX 345DR	☐ GTX 345DR

Interfaced GPS/SBAS Position Source(s):

GPS #1	GPS #2 (if installed)
☐ Internal	☐ Internal
☐ GTN 6XX/7XX Series	☐ GTN 6XX/7XX Series
☑ GNS 400W/500W Series	☐ GNS 400W/500W Series
☐ GNS 480	☐ GNS 480
☐ GIA 63W	☐ GIA 63W
☐ GDL 88 (GTX 330 only)	☐ GDL 88 (GTX 330 only)

Interfaced Pressure Altitude Source:

Pressure Altitude Source #1

☑ GREY

☐ Garmin Altitude Encoder

Pressure Altitude Source #2 (if installed)

☐ ____________________

☐ Garmin Altitude Encoder

Interfaced Remote Control Display (Required for remotely mounted GTX variants):

Transponder #1 Remote Control Display

☐ GTN 6XX/7XX

☐ GNS 480

☐ G950/1000 Display

☐ Gables 7534 Controller

☐ Gables 7614 Controller

☐ CTL-92 Controller

☐ CTL-92E Controller

Transponder #2 Remote Control Display (if installed)

☐ GTN 6XX/7XX

☐ GNS 480

☐ G950/1000 Display

☐ Gables 7534 Controller

☐ Gables 7614 Controller

☐ CTL-92 Controller

☐ CTL-92E Controller

Interfaced Active Traffic System:

☑ None

☐ TCAD

☐ TAS/TCAS

NOTE

If the system includes all of the following components:

- GTX 345R or GTX 345DR,
- G950/1000 Display, and
- TCAD or TAS/TCAS

Then the aircraft is no longer equipped with a TSO compliant active TCAD, TAS or TCAS system. Any operational requirement to be equipped with such system is no longer met.

1.5 Definitions

The following terminology is used within this document:

ADS-B: Automatic Dependent Surveillance-Broadcast

AFM: Airplane Flight Manual

AFMS: Airplane Flight Manual Supplement

ATCRBS: Air Traffic Control Radar Beacon System

CFR: Code of Federal Regulations

ES: Extended Squitter

GNSS: Global Navigation Satellite System

GNS: Garmin Navigation System

GPS: Global Positioning System

GTX: Garmin Transponder

GTN: Garmin Touchscreen Navigator

ICAO: International Civil Aviation Organization

LRU: Line Replaceable Unit

PABI: Pressure Altitude Broadcast Inhibit

POH: Pilot Operating Handbook

SBAS: Satellite-Based Augmentation System

SW: Software

TCAS: Traffic Collision Avoidance System

TIS: Traffic Information Service

TX: Transmit

Section 2. LIMITATIONS

2.1 Minimum Equipment

The GTX 33X and GTX 3X5 must have the following system interfaces fully functional in order to be compliant with the requirements for 14 CFR 91.227 ADS-B Out operations:

Interfaced Equipment	Number Installed	Number Required
Uncorrected Pressure Altitude Source	1	1
GPS SBAS Position Source	1 or more	1
Remote Control Display (for remotely mounted transponders)	1 or more	1

Table 2 – Required Equipment

2.2 ADS-B Out

The GTX 33X and GTX 3X5 only comply with 14 CFR 91.227 for ADS-B Out when all required functions are operational. When the system is not operational, ADS-B Out transmit failure messages will be present on the remote control display interface, or the GTX 330 or GTX 3X5 panel display. If a Gables 7534 controller or Collins CTL-92/92E controller is being used the ADS-B equipment failure condition will be annunciated on the Gables or Collins display "Transponder Fail" while the ADS-B Out Position failure will be annunciated by the remotely installed "ADS-B POSN FAIL" Annunciator.

2.3 TIS Traffic Display with User Navigation Angle

Display of TIS traffic from a GTX 33/330 or GTX 335 is not permitted with an interfacing display configured for a navigation angle of "user".

2.4 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main GTX software version is displayed on the splash screen during start up for the GTX 330 and GTX 3X5 panel mounted units, and the External LRU or System page on the interfaced remote control display for remotely mounted GTX transponders.

Software Item	Software Version *(or later FAA Approved versions for this STC)*
GTX 33X Main SW Version	8.04
GTX 3X5 Main SW Version	2.54

Table 3 - Software Versions

2.5 Pressure Altitude Broadcast Inhibit (PABI)

Pressure Altitude Broadcast Inhibit shall only be enabled when requested by Air Traffic Control while operating within airspace requiring an ADS-B Out compliant transmitter. PABI is enabled by selecting the GTX to ON mode.

2.6 Datalinked Weather Display (GTX 345 Only)

Do not use datalink weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by datalink weather products may not accurately depict current weather conditions.

Do not use the indicated datalink weather product age to determine the age of the weather information shown by the datalink weather product. Due to time delays inherent in gathering and processing weather data for datalink transmission, the weather information shown by the datalink weather product may be significantly older than the indicated weather product age.

Do not rely solely upon datalink services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information.

2.7 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

No Change.

3.2 Abnormal Procedures

3.2.1 LOSS OF AIRCRAFT ELECTRICAL POWER GENERATION

XPDR Circuit Breaker... **PULL**

Transponder and ADS-B Out functions will no longer be available.

NOTE

This guidance is supplementary to any guidance provided in the POH or AFM for the installed aircraft for loss of power generation.

3.2.2 LOSS OF GPS/SBAS POSITION DATA

When the GPS/SBAS receiver is inoperative or GPS position information is not available or invalid, the GTX will no longer be transmitting ADS-B Out data.

For GTX 330 installations:

NO ADSB annunciator illuminated:

Interfaced GPS position sources........................... **VERIFY VALID POSITION**

For GTX 3X5 installations:

NO 1090ES TX annunciator illuminated:

Interfaced GPS position sources........................... **VERIFY VALID POSITION**

For GTX 33 and GTX 3X5R installations:

Reference Display Device documentation for applicable annunciation:

Interfaced GPS position sources........................... **VERIFY VALID POSITION**

Section 4. NORMAL PROCEDURES

The procedures described below are specific only to the panel mounted GTX 330 or GTX 3X5 transponders. Cockpit Reference Guides and Pilot Guides for interfaced remote control displays will provide additional operating information specific to the displays or other traffic systems.

ADS-B Out functionality resides within the GTX transponders thereby providing a single point of entry for Mode 3/A code, Flight ID, IDENT functionality and activating or deactivating emergency status for both transponder and ADS-B Out functions. Details on performing these procedures are located in the GTX 330/330D Pilot's Guide and GTX 3X5 Series Transponder Pilot's Guide.

4.1 Unit Power On

<u>For GTX 330 installations:</u>

GTX Mode... **VERIFY ALT**
NO ADSB... **CONSIDERED**

<u>For GTX 3X5 installations:</u>

GTX Mode... **VERIFY ALT**
NO 1090ES TX.. **CONSIDERED**

<u>NOTE</u>

The NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) may illuminate as the unit powers on and begins to receive input from external systems, to include the SBAS position source.

4.2 Before Takeoff

For GTX 330 installations:

ADS-B TX..VERIFY ON
NO ADSB ....EXTINGUISHED

For GTX 3X5 installations:

1090ES TX CTL ....VERIFY ON
NO 1090ES TX ....EXTINGUISHED

NOTE

The ADS-B TX or 1090ES TX CTL must be turned on and the NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) must be **EXTINGUISHED** for the system to meet the requirements specified in 14 CFR 91.227. This system must be operational in certain airspaces after January 1, 2020 as specified by 14 CFR 91.225.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTION

The Garmin GTX 330 and GTX 3X5 Pilot's Guides, part numbers, and revisions listed below contain additional information regarding GTX system description, control, and function.

Title	Part Number	Revision
GTX 330 Pilot's Guide	190-00207-00	Rev. G (or later)
GTX 3X5 Pilot's Guide	190-01499-00	Rev. A (or later)

Pilot's Guides for interfaced displays, part numbers and revisions listed below, provide additional operating information for the Garmin GTX 33 and GTX 3X5R.

Title	Part Number	Revision
Garmin GTN 725/750 Pilot's Guide	190-01007-03	Rev. E (or later)
Garmin GTN 625/635/650 Pilot's Guide	190-01004-03	Rev. E (or later)
GNS 480 Pilot's Guide	190-00502-00	Rev. D (or later)
GTX 3X5 Series Transponder G1000 Pilot's Guide	190-01499-01	Rev. A (or later)

7.1 GTX TIS Behavior

The TIS Standby/Operate controls for GTX 33/330 and GTX 335/335D units only function when the aircraft is airborne.

7.2 GTX 345R/345DR and G950/1000 No Bearing Traffic Alerts

No visual indication is provided for no bearing traffic alerts. Only an aural indication of the no bearing traffic alert is provided. If an aural alert for no bearing traffic has been previously issued, a "no bearing traffic clear" aural indication will be provided once all traffic alerts are resolved.

All aural alerts are inhibited below 500' AGL, therefore a "no bearing traffic clear" aural may not be heard in a landing or touch and go flight scenario.

TABLE OF CONTENTS

INTRODUCTION

The best of engineering know-how and manufacturing craftsmanship have gone into the design and building of your Mooney Aircraft. Like any high performance airplane, it operates most efficiently and safely in the hands of a skilled pilot.

We urge you to be thoroughly familiar with the contents of your operating manuals, placards, and check list to insure maximum utilization of your airplane. When the airplane has changed ownership, some of these may have been misplaced. If any are missing, replacements should be obtained from any Mooney Marketing or Service Center as soon as possible.

For your added protection and safety, we have added this special section to the Pilot's Operating Handbook to refresh your knowledge of a number of safety subjects. You should review these subjects periodically.

Topics in this section are mostly excerpts from FAA Documents and other articles pertaining to the subject of safe flying. They are not limited to any particular make or model airplane and do not replace instructions for particular types of airplanes.

Your Mooney Aircraft was designed and built to provide you with many years of safe and efficient transportation. By maintaining it properly and flying it prudently, you should realize its full potential.

GENERAL

Flying is one of the safest modes of travel. Remarkable safety records are being established each year. As a pilot you are responsible to yourself, your relatives, to those who travel with you, to other pilots and to ground personnel to fly wisely and safely.

The following materials in this Safety section covers several subjects in limited detail. Here are some condensed DO's and DON'Ts.

---------------------------- DO'S ----------------------------

1. Be thoroughly familiar with your airplane and be current in it, or get a check ride.
2. Pre-plan all aspects of your flight-including weather.

----- **FLY YOUR PLAN** -----.

3. Use services available-FSS, Weather Bureau, etc.
4. Pre-flight you airplane thoroughly.
5. Use your check lists.
6. Have more than enough fuel for takeoff, the planned trip, and adequate reserve.
7. Be sure your weight loading and C.G. are within limits.
8. Be sure articles and baggage are secured.
9. Check freedom of all controls.
10. Maintain appropriate airspeed in takeoff, climb, descent and landing.
11. Avoid other aircraft wake turbulence.
12. Switch fuel tanks before engine starvation occurs.
13. Practice engine out, emergency landing gear extension and other emergency procedures at safe altitude; preferably with a check pilot.
14. Use caution in mountainous terrain.
15. Keep your airplane in good mechanical condition.
16. Stay informed and alert, fly in a sensible manner.

---------------------------- DON'TS ----------------------------

1. Don't take off with frost, ice or snow on the aircraft surfaces.
2. Don't take off with less than minimum recommended fuel, plus reserves.
3. Don't fly in a reckless, show off, careless manner.
4. Don't fly in thunderstorms or severe weather.
5. Don't fly in possible icing conditions. If you encounter icing conditions, alter altitude or course to minimize exposure.
6. Don't apply controls abruptly or with high forces that could exceed design loads of the airplane.
7. Don't fly when physically or mentally exhausted.
8. **DON'T TRUST TO LUCK.**

GENERAL SOURCES OF INFORMATION

There is a wealth of information available to the pilot created for the sole purpose of making your flying easier, faster, and safer. Take advantage of this knowledge and be prepared for an emergency in the remote event that one should occur. You as a pilot also have certain responsibilities under government regulations. These are designed for your own protection. Compliance is not only beneficial but mandatory.

RULES AND REGULATIONS

Federal Aviation regulations, Part 91, General Operating and Flight Rules, is a document of law governing operation of aircraft and the owner's and pilot's responsibilities.

This document covers such subjects as:

Responsibilities and authority of the pilot in command
Certificates required
Liquor and drugs
Flight plans
Pre-flight action
Fuel requirements
Flight rules
Maintenance, preventative maintenance, alterations, inspections and maintenance records

These are only some of the topics covered. It is the owner's and pilot's responsibility to be thoroughly familiar with all items in FAR Part 91 and to follow them.

FEDERAL AVIATION REGULATIONS, PART 39 -AIRWORTHINESS DIRECTIVES

This document specifies that no person may operate a product to which an airworthiness directive issued by the FAA applies, except in accordance with the requirements of that airworthiness directive.

AIRMAN INFORMATION, ADVISORIES, AND NOTICES, FAA AIRMAN'S INFORMATION MANUAL

This document contains a wealth of pilot information for nearly all realms of flight, navigation, ground procedures and medical information. Among the subjects are:

Controlled Air Space
Services Available to Pilots
Radio Phraseology and Technique
Airport Operations
Clearances and Separations
Pre-flight
Departures - IFR
Enroute - IFR
Arrival - IFR
Emergency Procedures
Weather
Wake Turbulence
Medical Facts for Pilots
Bird Hazards
Good Operating Practices
Airport Location Directory

We urge all pilots to be thoroughly familiar with and use the information in this manual.

ADVISORY INFORMATION

Airmen can subscribe to services to obtain FAA NOTAMS and Airman Advisories, and these are also available at FAA Flight Service Stations. NOTAMS are documents that have information of a time-critical nature that would affect a pilot's decision to make a flight; for example, an airport closed, terminal radar out of service, enroute navigational aids out of service, etc.

GENERAL INFORMATION ON SPECIFIC TOPICS

FLIGHT PLANNING

FAR Part 91 requires that each pilot in command, before beginning a flight, familiarize himself with all available information concerning that flight.

All pilots are urged to obtain a complete preflight briefing. This would consist of weather; local, enroute and destination, plus alternates, enroute navaid information. Also airport runways active, length of runways, take off and landing distances for the airplane for conditions expected should be known.

The prudent pilot will review his planned enroute track and stations and make a list for quick reference. It is strongly recommended a flight plan be filed with Flight Service Stations even though the flight may be VFR. Also, advise Flight Service Stations of changes or delays of one hour or more and remember to close the flight plan at destination.

The pilot must be completely familiar with the performance of the airplane and performance data in the airplane manuals and placards. The resultant effect of temperature and pressure altitude must be taken into account in determining performance if not accounted for on the charts. Applicable FAA manuals must be aboard the airplane at all times including the weight and balance forms and equipment lists.

The airplane must be loaded so as not to exceed the weight and the weight and balance loading center of gravity (c.g.) limitations. Also, that at least minimum fuel for takeoff is aboard and sufficient for the trip, plus reserves. Oil in the engines should be checked and filled as required.

INSPECTIONS - MAINTENANCE

In addition to maintenance inspections and preflight information required by FAR Part 91, a complete pre-flight inspection is imperative. It is the responsibility of the owner and operator to assure that the airplane is maintained in an airworthy condition and proper maintenance records are kept.

While the following items cannot substitute for the pre-flight specified for each type of airplane, they will serve as reminders of general items that should be checked.

SPECIAL CONDITIONS CAUTIONARY NOTICE

Airplanes operated for Air Taxi or other than normal operation and airplanes operated in humid tropics or cold and damp climates, etc., may need more frequent inspections for wear, corrosion and or lack of lubrication. In these areas periodic inspections should be performed until the operator can set his own inspection periods based on experience.

| NOTE |

The required periods do not constitute a guarantee that the item will reach the period without malfunction, as the aforementioned factors cannot be controlled by the manufacturer.

Corrosion, and its effects, must be treated at the earliest possible opportunity. A clean dry surface is virtually immune to corrosion. Make sure that all drain holes remain unobstructed. Protective films and sealants help to keep corrosive agents from contacting metallic surfaces. Corrosion inspections should be made most frequently under high-corrosion-risk operating conditions, such as in regions of heavy airborne salt concentrations (e.g., near the sea) and high-humidity areas (e.g., tropical regions).

WALK AROUND INSPECTIONS

All airplane surfaces free of ice, frost or snow.
Tires properly inflated.
All external locks, covers and tie downs removed.
Fuel sumps drained.
Fuel quantity, adequate for trip, plus reserve,(visually checked) and access doors secured.
Oil quantity checked and access doors secured.
Check general condition of airplane, engine, propeller, exhaust stacks, etc.
All external doors secured.

COCKPIT CHECKS

Flashlight available.
Required documents on board.
Use the check list.
All internal control locks removed (If installed).
Check freedom of controls.
Cabin and baggage door properly closed.
Seat belts and shoulder harnesses fastened.
Passengers briefed.
Engine and propeller operating satisfactorily.
All engine gauges checked for proper readings.
Fuel selector in proper position.
Fuel quantity checked by gauges.
Altimeter setting checked.

FLIGHT OPERATIONS

GENERAL

The pilot should be thoroughly familiar with all information published by the manufacturer concerning the airplane. The pilot is required by FAA to operate in accordance with the FAR's and the FAA Approved Airplane Flight Manual and/or placards installed.

TURBULENT WEATHER

A complete weather briefing prior to beginning a flight is the start of assurance of a safe trip. Updating of weather information enroute is another assurance. However, the wise pilot also knows weather conditions change quickly at times and treats weather forcasting as professional advice rather than as absolute fact. He obtains all the advice he can, but still stays alert through knowledge of weather changes, observations, and conditions.

Plan the flight to avoid areas of severe turbulence and thunderstorms. It is not always possible to detect individual storm areas or find the in between clear areas.

Thunderstorms, squall lines and violent turbulence should be regarded as extremely dangerous and MUST be avoided. Hail and tornadic wind velocities can be encountered in thunderstorms that can destroy any airplane, just as tornados destroy nearly everything in their path on the ground.

A roll cloud ahead of a squall line or thunderstorm is visible evidence of violent turbulence, however, the absence of a roll cloud should not be interpreted as denoting the lack of turbulence.

FLIGHT IN TURBULENT AIR

Even though flight in severe turbulence is to be avoided, flight in turbulent air may be encountered under certain conditions. Flying through turbulent air presents two basic problems, to both of which the answer is PROPER AIRSPEED. On the one hand, if you maintain an excessive airspeed, you run the risk of structural damage or failure; on the other hand, if your airspeed is too low, you may stall. If turbulence encountered in cruise or descent becomes uncomfortable to the pilot or passengers, the best procedure is to reduce speed to the maneuvering speed, which is listed in the Limitations Section of the FAA Approved Airplane Flight Manual and Pilots Operating Handbook. This speed gives the best assurance of avoiding excessive stress loads, and at the same time providing margin against inadvertent stalls due to gusts.

Beware of overcontrolling in attempting to correct for changes in altitude; applying control pressure abruptly will build up G-forces rapidly and could cause damaging structural stress loads. You should watch particularly your angle of bank, making turns as wide and shallow as possible, and be equally cautious in applying forward or back pressure to keep the nose level. Maintain straight and level attitude in either up or down drafts. Use trim sparingly to avoid being grossly mistrimmed as the vertical air columns change velocity and direction.

MOUNTAIN FLYING

Avoid flight at low altitudes over mountainous terrain, particularly near the lee slopes. -OBSERVE PUBLISHED MINIMUM ENROUTE ALTITUDES (MEA)-. If the wind velocity near the level of the ridge is in excess of 25 knots and approximately perpendicular to the ridge, mountain wave conditions are likely over and near the lee slopes. If the wind velocity at the level of the ridge exceeds 50 knots, a strong mountain wave is probable with strong up and down drafts and severe or extreme turbulence. The worst turbulence will be encountered in and below the rotor zone which is usually 8 to 10 miles downwind from the ridge. This zone is characterized by the presence of "roll clouds" if sufficient moisture is present; alto cumulus standing lenticular clouds are also visible signs that a mountain wave exists, but their presence is likewise dependent on moisture. Mountain wave turbulence can, of course, occur in dry air and the absence of such clouds should not be taken as any assurance that mountain wave turbulence will not be encountered. A mountain wave downdraft may exceed the climb capability of your airplane.

---- AVOID MOUNTAIN WAVE DOWNDRAFTS ----.

VFR - LOW CEILINGS

If you are not instrument rated, avoid "VFR On Top" and "Special VFR". Being caught above an undercast when an emergency descent is required (or at destination) is an extremely hazardous position for the VFR pilot.

Accepting a clearance out of certain airport control zones with no minimum ceiling and one-mile visibility as permitted with "**Special VFR" is not a recommended practice for VFR pilots**.

Avoid areas of low ceilings and restricted visibility unless you are instrument proficient and have an instrument equipped airplane. Then proceed with caution and have planned alternates.

VFR - AT NIGHT

When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain a safe minimum altitude as dictated by terrain, obstacles such as TV towers, or communities in the area flown. This is especially true in mountainous terrain, where there is usually very little ground reference and absolute minimum clearance is 2,000 feet. Don't depend on your being able to see obstacles in time to miss them. Flight on dark nights over sparsely populated country can be almost the same as IFR and should be avoided by untrained pilots.

VERTIGO -DISORIENTATION

Disorientation can occur in a variety of ways. During flight, inner ear balancing mechanisms are subjected to varied forces not normally experienced on the ground. This combined with loss of outside visual reference can cause vertigo. False interpretations (illusions) result and may confuse the pilot's conception of the attitude and position of his airplane.

Under VFR conditions the visual sense, using the horizon as a reference, can override the illusions. Under low visibility conditions (night, fog, clouds, haze, etc.) the illusions predominate. Only through awareness of these illusions, and proficiency in instrument flight procedures, can an airplane be operated safely in a low visibility environment.

Flying in fog, dense haze or dust, cloud banks, or very low visibility, with strobe lights, and particularly rotating beacons turned on frequently causes vertigo. They should be turned off in these conditions, particularly at night.
All pilots should check the weather and use good judgment in planning flights. The VFR pilot should use extra caution in avoiding low visibility conditions.

Motion sickness often precedes or accompanies disorientation and may further jeopardize the flight.

STALLS, SPINS AND SLOW FLIGHT

Stalls, and slow flight should be practiced at safe altitudes to allow for recovery. Any of these maneuvers should be performed at an altitude in excess of 6,000 feet above ground level.
Spins may be dangerous and should be avoided. In fact, most airplanes are placarded against intentional spins. Spins are preceded by stalls. A prompt and decisive stall recovery protects against inadvertent spins. All airplanes are required to have flight characteristics that give adequate advance warning of an impending stall or they must be equipped with an artificial stall warning device. Keep the artificial system in good working order. Do not operate the airplane with the device made inoperative by the use of circuit breakers or other means.

Stalls should be practiced at safe altitudes for ample recovery. Should a spin be encountered inadvertently, spin recovery should be initiated immediately.

As stall attitude is approached, be alert. Take prompt corrective action to avoid the stall or if you are practicing stalls, react the moment the stall occurs. The following is suggested:

1. Do not carry passengers. Be certain that the airplane's center of gravity is as far forward as possible. Forward CG aids spin recovery.
2. Be certain that both student pilot and instructor pilot have a full set of operable controls.
3. Conduct such practice at altitudes in excess of 6.000 ft. above ground level.

Remember that an airplane at or near traffic pattern altitude probably will not recover from a spin before impact with the ground. When descending to traffic pattern altitude and during operation in the traffic pattern and approach, maintain a safe margin above stall speed. During takeoff or go- around, be especially careful to avoid departure stalls associated with turns at low speed. Maintain speeds recommended in this handbook(Section II & V).

STANDARD PROCEDURE FOR SPIN RECOVERY

In the event of an inadvertent spin, the following recovery procedure should be used:

Throttle	**RETARD** to IDLE
Ailerons	**NEUTRAL**
Rudder	Apply **FULL RUDDER opposite** the direction of spin.
Control Wheel	**FORWARD** of neutral in a brisk motion to break stall. Additional **FORWARD** elevator control may be required if the rotation does not stop.
Flaps(If extended)	**RETRACT** as soon as possible
Rudder	**NEUTRALIZE** when spin stops.
Control Wheel	Smoothly **MOVE AFT** to bring the nose up to a level flight attitude **after spin has stopped.**

VORTICES - WAKE TURBULENCE

Every airplane generates wakes of turbulence while in flight. Part of this is from the propeller or jet engine and part from the wing tip vortices. The larger and heavier the airplane the more pronounced wake turbulence will be. Wing tip vortices from large heavy airplanes are very severe at close range, degenerating with time, wind and space. These are rolling in nature from each wing tip. In test, vortex velocities of 133 knots have been recorded.
Exhaust velocities from large airplanes at takeoff have been measured at 25 mph, 2100 feet behind medium large airplanes.

Encountering the rolling effect of wing tip vortices within two minutes or less after passage of large airplanes is hazardous to light airplanes. This roll effect can exceed the maximum counter roll obtainable in an airplane.

The turbulent areas may remain for as long as three minutes or more, depending on wind conditions, and may extend several miles behind the airplane. Plan to fly slightly above or to the upwind side of the other airplane's flight path.

Because of the wide variety of conditions that can be encountered, there is no set rule to follow to avoid wake turbulence in all situations. However, the Airman's Information Manual goes into considerable detail for a number of wake turbulence avoidance procedures. Use prudent judgment and allow ample clearance time and space following or crossing the wake turbulence of other airplanes in all takeoff, climb out, approach and landing operations. Be observant of wake turbulence from all aircraft, regardless of size.

The Airman's Information Manual contains a section on wake turbulence. FAA Advisory Circular AC 90-230 is also recommended reading.

TAKE - OFF AND LANDING CONDITIONS

When taking off on runways covered with water or freezing slush, the landing gear should remain extended for approximately ten seconds longer than normal, allowing the wheels to spin and dissipate the freezing moisture. The landing gear should then be cycled up, then down, wait approximately five seconds and then retract again. Caution must be exercised to insure that the entire operation is performed below Maximum Landing Gear Operating Airspeed.

Use caution when landing on runways that are covered by water or slush which cause hydroplaning (aquaplaning), a phenomenon that renders braking and steering ineffective because of the lack of sufficient surface friction. Snow and ice covered runways are also hazardous. The pilot should be alert to the possibility of the brakes freezing.

Use caution when taking off or landing in gusty winds. Be aware of special wind conditions caused by buildings or other obstructions located near runway in a crosswind pattern.

MEDICAL FACTS FOR PILOTS

GENERAL

Modern industry's record in providing reliable equipment is very good. When the pilot enters the airplane, he becomes an integral part of the man-machine system. He is just as essential to a successful flight as the control surfaces. To ignore the pilot in pre-flight planning would be as senseless as failing to inspect the integrity of the control surfaces or any other vital part of the machine. The pilot himself has the responsibility for determining his reliability prior to entering the airplane for flight.

While piloting an airplane, an individual should be free of conditions which are harmful to alertness, ability to make correct decisions, and rapid reaction time.

FATIGUE

Fatigue generally slows reaction times and causes foolish errors due to inattention. In addition to the most common cause of fatigue, insufficient rest and loss of sleep, the pressure of business, financial worries and family problems, can be contributing factors. If your fatigue is a factor prior to a given flight, don't fly. To prevent fatigue effects during long flights, keep mentally active by making ground checks and radio-navigation position plots.

HYPOXIA

Hypoxia in simple terms is a lack of sufficient oxygen to keep the brain and other body tissues functioning properly. There is wide individual variation in susceptibility to hypoxia. In addition to progressively insufficient oxygen at higher altitudes, anything interfering with the blood's ability to carry oxygen can contribute to hypoxia (anemias, carbon monoxide, and certain drugs). Also, alcohol and various drugs decrease the brain's tolerance to hypoxia.
Your body has no built in alarm system to let you know when you are not getting enough oxygen. It is impossible to predict when or where hypoxia will occur during a flight, or how it will manifest itself. A major early symptom of hypoxia is an increased sense of well-being (referred to as euphoria). This progresses to slow reactions, impaired thinking ability, unusual fatigue, and dull headache feeling.

Symptoms are slow but progressive, insidious in onset, and are most marked at altitudes starting above 10,000 feet. Night vision, however, can be impaired starting at altitudes lower than 10,000 feet. Heavy smokers may experience early symptoms of hypoxia at altitudes lower than non-smokers. Use oxygen on flights above 10,000 feet and at any time when symptoms appear.

HYPERVENTILATION

Hyperventilation or over-breathing, is a disturbance of respiration that may occur in individuals as a result of emotional tension or anxiety. Under conditions of emotional stress, fright, or pain, breathing rate may increase, causing increased lung ventilation, although the carbon dioxide output of the body cells does not increase. As a result, carbon dioxide is "washed out" of the blood. The most common symptoms of hyperventilation are: dizziness; hot and cold sensations; tingling of the hands, legs and feet; tetany; nausea; sleepiness; and finally unconsciousness.

Should symptoms occur that cannot definitely be identified as either hypoxia or hyperventilation try three or four deep breaths of oxygen. The symptoms should improve markedly if the condition was hypoxia (recovery from hypoxia is rapid). If the symptoms persist, discontinue use of oxygen; consciously slow your breathing rate until symptoms clear; then resume normal breathing rate. Normal breathing can be aided by talking aloud.

ALCOHOL

Common sense and scientific evidence dictate that you not fly as a crew member while under the influence of alcohol. Even small amounts of alcohol in the human system can adversely affect judgment and decision making abilities. FAR 91.11 states "(a) No person may act as a crew member-(1) within 8 hours after the consumption of any alcoholic beverage."

Tests indicate that as a general rule, 2 ounces(.06 liters) of alcohol at 15,000 feet produce the same adverse effects as 6 ounces(.18 liters) at sea level. In other words, the higher you get, "the higher you get".

DRUGS

Self-medication or taking medicine in any form when you are flying can be extremely hazardous. Even simple home or over-the-counter remedies drugs such as aspirin, antihistamines, cold tablets, cough mixtures, laxatives, tranquilizers, and appetite suppressors, may seriously impair the judgment and coordination needed while flying. The safest rule is to TAKE NO MEDICINE before or while flying, except on the advice of your Aviation Medical Examiner.

SCUBA DIVING

Flying shortly after any prolonged scuba diving could be dangerous. Under the increased pressure of the water, excess nitrogen is absorbed into your system. If sufficient time has not elapsed prior to takeoff for your system to rid itself of this excess gas, you may experience the bends at altitudes even under 10,000 feet, where most light planes fly.

ADDITIONAL INFORMATION

In addition to the coverage of subjects in this section, the National Transportation Safety Board and the F.A.A. periodically issue general aviation pamphlets concerning aviation safety, and in greater detail. These can be obtained at FAA Offices, Weather Stations, Flight Service Stations, or Airport Facilities. These are very good sources of information and are highly recommended for study. Some of these are titled:

Airman's Information Manual
12 Golden Rules for Pilots
Weather or Not
Disorientation
Plane Sense
Weather Info Guide for Pilots
Wake Turbulence
Don't Trust to Luck, Trust to Safety
Thunderstorm - TRW
IFR-VFR , Either Way **Disorientation Can be Fatal**

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the

GARMIN GI 275 MULTIFUNCTION INSTRUMENT

as installed in

____

Make and Model Airplane

Registration Number: ________________ Serial Number: ________________

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 SA02658SE for the installation and operation of the Garmin GI 275 Multifunction Instrument. This document must be carried in the airplane at all times.

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

FAA APPROVED BY: JR Brownell

JR Brownell
ODA STC Unit Administrator
GARMIN International, Inc
ODA-240087-CE

DATE: 12/23/2020

LOG OF REVISIONS			
Rev	Page	Description	FAA Approval
1	All	Initial issue.	*JR Brownell* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 1/13/2020
2	7	Added hardware variant functionality information to Table 2	*Erik Frisk* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 9/10/2020
	7	Added reference to -20 and -40 hardware variants	
	10	Updated software version number	
	11	Added clarification to Note.	
	12	Added missing installation option	
	14	Removed Section 2.19 “Type Ratings”	
	20	Changed “amber” to “yellow” for consistency throughout document	
	24	Changed “amber” to “yellow” for consistency throughout document	
	29	Corrected AHRS/ADC annunciation figures	
	31	Changed “amber” to “yellow” for consistency throughout document	
	32	Added Note to Section 4.2.1	
	33	Changed “amber” to “yellow” for consistency throughout document	
	33	Added reference to GFC 500	
	38	Changed “amber” to “yellow” for consistency throughout document	
	39	Added reference to -20 and -40 hardware variants	
	39	Changed “amber” to “yellow” for consistency throughout document	
	41	Removed text requiring pilot to verify units match across systems.	
	42	Added reference to -20 and -40 hardware variants	
	45	Corrected typos	
3	10	Updated software version number	*JR Brownell* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 11/30/2020
	56	Updated the Engine and Airframe Timer descriptions to reflect new Hobbs and Tach Timer functionality	

4	8	Corrected table formatting	See Cover Page
	10	Added clarification of Standby Reversionary capabilities	
	11	Added clarification of EIS configuration to include all EIS capabilities and display parameters	
	12	Included VFR GPS antenna and Backup Battery Pack as GI 275 system components	
	13	Added clarifications for Standby instrument configurations with the GI 275; Clarified reversionary function when configured as a Standby instrument; Added Battery Charge Inhibited system message description	
	14	Added ADI to the Definitions	
	15	Added a table to identify AFMS section applicability based on specific system installation	
	16	Added tickbox for GI 275 primary heading installations; Clarified magnetic variation limits for configurations with GI 275 as primary heading source	
	17	Added GPS aiding system message description; Clarified limitations of aerobatic maneuvers for primary and standby ADI configurations; Added clarifications for battery capacity required for aircraft above 25,000ft service ceiling	
	18	Added clarification that QFE altimeter setting is incompatible with GI 275 instrument; Added tickbox selections to define specific system installation and configuration; clarified loss of control warning for IMC flight	
	19	Clarified sensor selection applicability to Garmin cross-comparison AHRS and ADC sensors	
	21	Clarified VFR GPS functionality and limitations; Removed powerplant gauge markings section	
	22	Added original flight instrument requirements for GI 275 system when installed with non GI 275 standby instruments	
	23	Added External EIS Annunciator requirements for GI 275 EIS systems; Added requirement to test any installed annunciator; Added section for recording placards that are removed or modified	
	25	Added a note to clarify that not all emergency procedures may apply to a specific installation	

	26	Clarified procedures for AHRS failure; Added a Caution Note to describe Garmin cross-comparison for AHRS/ADC sensors with specific sensor selections enabled	
	27	Clarified procedures for ADC failure; Added a Caution Note to describe Garmin cross-comparison for AHRS/ADC sensors with specific sensor selections enabled	
	28	Added underline font to Note	
	29	Added underline font to Note and Caution; Added battery temp viewed in system menu	
	32	Added underline font to Note; Added system message description for display overtemperature; Clarified selection of VFR GPS source with the CDI button; Clarified GPS failure procedure to seek VFR conditions	
	33	Added underline font to Note and Caution	
	38	Added descriptions and images for Battery Fault and GPSS Invalid failure conditions	
	39	Added images for ALT and IAS advisories	
	40	Added steps to test any installed external annunciators and verify the Magnetic angle units to match across interfaced systems; Added clarification of 60 minutes battery for aircraft with ceilings above 25,000ft; Added clarification for checking Battery status	
	42	Added reference for Autopilot system description section; Clarified that AP Disconnect Test is not needed for Garmin GFC 500 and GFC 600 autopilot interfaces; Added underline font to Notes and Cautions	
	43	Added underline font to Notes Clarified GPSS modes	
	44	Clarified that GTN VNAV interface requires barometric altitude; Added clarification for EIS alert functionality	
	46	Added tickbox selections to define installed unit configurations	
	49	Added underline font to Caution	
	52	Added tickboxes to define what audio alerts the GI 275 will provide given the system installation and configuration; Added note to clarify failure of audio system interface results in no audio alerts from GI 275	
	53	Clarified that Baro Sync is required and not recommended when interfaced with TXi	

	56	Clarified that barometric altitude is required when interfaced with GTN to provide VNAV functionality	
	60	Removed typo	
	61	Added a note to clarify traffic data availability based on services provided by local region/country; Removed typo	
	67	Added underline font to Note	
	68	Added underline font to Caution	

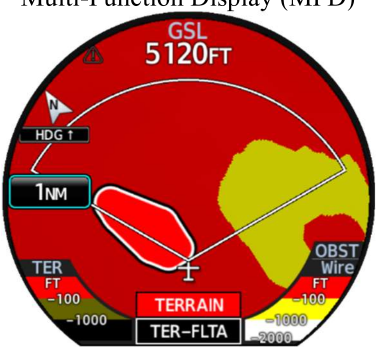
TABLE OF CONTENTS

Section 1. GENERAL

The GI 275 Multifunction Instrument (hereafter referred to as the “GI 275”) is a panel-mounted, multifunction instrument with a single touch display and virtual “Pages” within each instrument that may be configured as individual “instruments”. The GI 275 can be configured as an ADI, HSI, EIS or MFD with multiple hazard awareness pages, depending on the number and type of integrated navigation and hazard sensor sources. The GI 275 can be used as a primary Engine Indication System (EIS) for single and twin-engine aircraft. The ADI and HSI can be installed as stand-alone primary flight instruments as long as there are other equivalent source(s) of primary flight information that are independently powered. The ADI or HSI can also be installed as a backup instrument. Any GI 275 ADI, HSI, or MFD may be configured with an optional internal battery to provide an independent and automatic backup power source.

Individual GI 275s may be grouped or connected as follows to expand and enhance their capabilities and to provide redundancy. Groups of connected GI 275s are hereafter referred to as a “GI 275 system” in this document.

Attitude Direction Indicator (ADI) 	Units configured as an ADI will contain a single page that displays aircraft attitude. Altitude, airspeed, vertical speed and heading may also be displayed on the ADI page depending on the aircraft configuration.

Horizontal Situation Indicator (HSI)  	Units configured as an HSI will contain two pages; an HSI page and an HSI Map page. The HSI Page is a conventional HSI with CDI, VDI, heading indication and compass card. There are navigation annunciations and distance/time fields. The HSI MAP Page includes a top-down view, inset map, hazard awareness overlays (traffic, terrain, topo), along with traditional lateral and vertical navigation cues.
Multi-Function Display (MFD)  	Units configured as an MFD contain multiple installer configurable pages that may include HSI, HSI Map, CDI, Map, Terrain, Traffic, Weather, Radar Altimeter, Stormscope, and Engine Indication System (EIS)

Standby ADI 	The HSI and MFD can be configured as a “Standby” instrument to preserve the display of primary flight data in the event the primary ADI fails or the pilot reverts the display either through the rotation of the outer knob counter-clockwise or engages the reversionary switch. An ADI page will be available during both normal operation and when reverted to preserve the display of primary flight data. A stand-alone ADI may also be considered a Standby ADI since it provides full-time display of primary flight data.

<table>
<tr>
<td>Engine Indication System (EIS)

</td>
<td>Units configured for EIS will always display Engine RPM, Fuel Quantity, and Manifold Pressure (if applicable) on the upper portion of the screen.

Five configurable pages are available on the EIS unit:
• Main
    ○ Contains all gauges with red/yellow markings
• Aux
• EGT
• CHT
• Fuel

Available gauges are as follows:
• Engine RPM
• Manifold Pressure
• Oil Pressure
• Oil Temperature
• EGT, Primary EGT
• CHT
• TIT
• CDT
• IAT
• Alternator Amps
• Battery Charge/Discharge
• Battery Volts
• Bus Volts
• Fuel Flow
• Fuel Pressure
• Fuel Quantity
• Carb Temp</td>
</tr>
</table>

Table 1- GI 275 System Function

Function	GI 275 Base (-00)	GI 275 ADAHRS (-10/-30)	GI 275 ADAHRS + AP (-20/-40)
Primary ADI		✓	✓
MFD/Standby ADI		✓	✓
MFD	✓	✓	✓
EIS	✓	✓	✓
HSI	✓*	✓	✓
HSI/Standby ADI		✓	✓
Autopilot Interface			✓

*Requires interface to another GI 275 with an internal ADAHRS configured.

Table 2- GI 275 Hardware Variant Functionality

GMU 11 and GMU 44B	Magnetometer Heading Sensors
GEA 24 or GEA 110	Engine Sensors
GTP 59	OAT temperature Probe
GSB 15	USB Port
Backup Battery (internal)	Battery Pack
VFR GPS Antenna	GPS Antenna

Table 3- GI 275 System Components

MFD functions are supported by GPS navigator interfaces and a variety of other optional interfaces such as traffic systems, Stormscope®, and satellite and ADS weather sources.

Although intuitive and user friendly, the system 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 who are not familiar with the GI 275s or GI 275 system 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 GI 275 system.

1.1 ADAHRS

The integral ADAHRS, included in the GI 275 -10, -20, -30, and -40 variants, senses aircraft attitude and air data for GI 275 display of primary flight data and can provide attitude and air data for use by other installed systems.

The ADAHRS requires GPS and airspeed inputs for aiding the system. GI 275 includes an optional GMU 11 or GMU 44B magnetometer interface to determine magnetic heading and an OAT probe for measuring outside air temperature.

1.2 Standby Instruments and the GI 275 ADI

GI 275 installations may provide standby attitude, altitude, and airspeed instruments. Several types of standby instruments might be installed, including a standby GI 275 ADI, other ADI, or individual analog instruments.

The GI 275 can be a standalone standby instrument without interfacing to other sensors and only using its internal sensors. In this configuration, the GI 275 is a full-time dedicated ADI.

GI 275 system has a configuration for redundancy which is satisfied by using a GI 275 MFD or HSI that is configured as a standby instrument. This configuration is only possible when the GI 275 is providing reversionary capabilities with multiple sensors interfaced to the GI 275. When configured as a standby instrument with reversionary capabilities, the GI 275 MFD and HSI include an ADI Page which is displayed automatically when faults are detected or when selected by the pilot through a reversionary switch.

Both the GI 275 primary and standby ADIs have their own integral ADAHRS and internal batteries for independence and redundancy.

1.3 Backup Battery

The GI 275 may be configured to include a backup battery to provide emergency power to a GI 275 ADI, HSI or MFD. The backup battery is mounted in an internal, partitioned aluminum chassis within the GI 275 to provide thermal security and automatic backup power when aircraft power is unavailable.

NOTE

> Backup battery charging requires the battery temperature between 0°C and 60°C. A system message "Charge Inhibited – unable to charge the battery" will indicate that the battery is no longer charging.

1.4 Definitions

ADAHRS:	Air Data and Attitude Heading Reference System
ADC:	Air Data Computer
ADI:	Attitude Direction Indicator
ADS:	Automatic Dependent Surveillance
AHRS:	Attitude Heading Reference System
AMMD:	Airport Moving Map Display
CDI:	Course Deviation Indicator
CRS:	Course
EIS:	Engine Indication System
FD:	Flight Director
FLTA:	Forward-looking Terrain Alerting
GPSS:	GPS Steering
HDG:	Heading
HSI:	Horizontal Situation Indicator
IFR:	Instrument Flight Rules
IMC:	Instrument Meteorological Conditions
LOI:	Loss of Integrity
MFD:	Multi-Function Display
MFI:	Multi-Function Instrument
PED:	Portable Electronic Device
SBAS:	Space-based Augmentation System
SVT:	Synthetic Vision Technology
TAWS:	Terrain Awareness and Warning System (a TSO-C151b function)
TIS-A:	Traffic Information Service (Addressed)
TIS-B:	Traffic Information Service (Broadcast)
VFR:	Visual Flight Rules
VMC:	Visual Meteorological Conditions
VNAV:	Vertical Navigation
VS:	Vertical Speed

1.5 Functions Included in this Installation

The following table identifies the AFMS sections which contain information relevant to this installation. This table is for the purpose of navigating the AFMS and to assist with identification of important system functions included with this installation.

Section	Heading / Title	Tick Box Marked
Section 2.2	Heading operation	☐
Section 2.8	Standby / Primary Instruments	☐
Section 2.29	Placards	☐
Section 2.29.3	VFR Limitations	☐
Section 4.2.4	VNAV functionality	☐
Section 7	Instruments Installed	☐
Section 7.3	Equipment and Circuit Breakers	☐
Section 7.11	Audio Alerts provided	☐
Section 7.16	Autopilot interfaces	☐

Section 2. LIMITATIONS

2.1 Minimum Software Version

The following or later software versions must be installed for this AFMS revision to be applicable to the installation:

Component	Identification	Software Version
GI 275	Multi-Function Instrument	2.20

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 Heading Operational Area

☐ This installation uses GI 275 as the primary heading source

If the GI 275 is used as the primary heading source, IFR Operations are prohibited north of 72°N and south of 70°S latitudes. In addition, IFR operations are prohibited in the following four regions:

1) North of 65° North latitude between longitude 75° W and 120° W

2) North of 70° North latitude between longitude 70° W and 128° W

3) North of 70° North latitude between longitude 85° E and 114° E

4) South of 55° South latitude between longitude 120° E and 165° E

Loss of heading may occur near the poles.

2.3 Magnetic Variation Operational Area

If the GI 275 is used as the primary heading source, IFR operations are prohibited in areas where the magnetic variation is greater than 99.9 degrees East or West.

2.4 Navigation Angle

The Magnetic/True Navigation Angle (as selected in the MENU → SYSTEM → UNITS Page) must match the navigation angle selected on all interfaced GPS/SBAS navigators. If this is not done the navigation deviations will not be accurate.

2.5 ADAHRS Normal Operating Mode

The ADAHRS integrity monitoring uses GPS data and air data. Since the internal ADC provides full time air data, the only required external input is from an approved and installed GPS.

A system message will be generated if the ADAHRS has not received GPS aiding.

NOTE

GI 275 attitude will remain valid if either GPS or Air Data is lost.

Dispatch into IFR flight is not authorized unless the Primary GI 275 ADAHRS is receiving valid GPS *and* air data. The GI 275 monitors the integrity of these systems automatically and will advise the pilot if the GPS and/or air data is lost or invalid.

NOTE

In dual GPS installations, only one GPS needs to be available to the ADAHRS or AHRS for IFR flight.

2.6 Aerobatic Maneuvers

Do not conduct aerobatic maneuvers if the GI 275 is installed and being used as a primary or standby ADI. If aerobatic maneuvers are to be conducted, it is recommended that the GI 275 power be removed. Power can be restored and normal operations conducted once the aerobatic maneuvering is complete.

2.7 Electronic Standby and/or Primary Instrument Power

For IFR aircraft, the backup battery's charge state for the standby and/or primary instrument must be verified before flight. The battery indication turns yellow if there is less than 60 minutes of battery capacity. For aircraft with service ceilings below 25,000 ft, only 30 minutes of backup battery operation is required. For aircraft with a service ceiling above 25,000ft, 60 minutes is required. Refer to the battery status and information found in the battery menu (Menu → Systems → Battery). Refer to section 4.1.1 for more information.

2.8 Standby and/or Primary Flight Instruments

Do not use a QFE altimeter setting with this system. System functions will not operate properly with a QFE altimeter setting. Use only QNH altimeter setting for height above mean sea level, or the standard pressure setting, as applicable.

- ☐ This installation does not have separate standby instruments or does not require standby instruments (aircraft limited to VFR).
- ☐ This installation uses the GI 275 as the primary flight display instrument and uses pneumatic instruments, the aircrafts original flight instruments, or a different electronic display as the standby flight display.
- ☐ This installation uses a connected GI 275 system with independent ADHARS and backup batteries for the primary and standby flight instruments. IFR flight must not be initiated unless the systems check in Section 2.7 is completed successfully to verify the following:
  - The backup battery is operational and sufficiently charged. Refer to Section 2.7.
  - Attitude, heading, altitude, and airspeed from AHRS/ADC 1 are operational on the pilot's primary GI 275 ADI with no warnings, cautions, or advisories present
  - Selecting the Reversion Backup Switch to the "ON" position causes the standby GI 275 to change and lock to the ADI page, and displays primary flight information.
- ☐ This installation uses a GI 275 ADHARS and backup batteries for the standby flight instruments to a separate primary flight display. IFR flight must not be initiated unless the systems check in Section 2.7 is completed successfully to verify the following:
  - The GI 275 backup battery is operational and sufficiently charged. Refer to Section 2.7.
  - Attitude, heading, altitude, and airspeed from AHRS/ADC 1 are operational on the pilot's primary GI 275 ADI with no warnings, cautions, or advisories present

WARNING

Failure to observe these limitations may result in the loss of all attitude or air data or both, resulting in loss of aircraft control during flight in IMC.

2.9 Sensor Selection

Do not select or operate on secondary AHRS or ADC sensors, unless directed to do so as part of an emergency or abnormal procedure in this AFMS.

CAUTION

In installations with a Garmin cross-comparison for AHRS/ADC sensors, changing the AHRS/ADC sensor source when a white ATTITUDE/IAS/ALT annunciation is displayed on the primary GI 275 ADI will result in the selection of an inoperative sensor source and subsequent loss of information. Operating primary and standby GI 275 ADIs on the same sensor source will inhibit the AHRS/ADC comparison monitor.

2.10 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.

If the installed TAWS or Terrain Alerting system is inoperative, the synthetic vision display on the GI 275 ADI must be selected off.

2.11 Moving Maps

The GI 275 Map page (ownship position relative to map features) must not be used as the primary or sole means of navigation or course guidance.

2.12 Autopilot Disconnect

The “AP DISC” button in the GI 275 ADI Menu → Options (if present for the installation) must disconnect the autopilot when pressed. If the button does not disconnect the autopilot when pressed, then the autopilot must not be used.

2.13 Terrain Display

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

2.14 Terrain/TAWS Alerts

Terrain/TAWS alerts must be inhibited when landing at an airport that is not in the airport database unless the airport can be designated as a user airport (GTN Navigator only).

2.15 Datalink Products (SiriusXM and FIS-B)

Do not use datalink weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by datalink weather products may not accurately depict current weather conditions.

Do not use the indicated datalink weather product age to determine the age of the weather information shown by the datalink weather product. Due to time delays inherent in gathering and processing weather data for datalink transmission, the weather information shown by the datalink weather product may be significantly older than the indicated weather product age.

Do not rely solely upon datalink services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS may be depicted.

2.16 Traffic Display

The display of traffic is intended as an aid to visual acquisition and must not be used as the sole basis for maneuvering the aircraft to avoid traffic.

2.17 Stormscope® Display

Stormscope® lightning information displayed 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.

2.18 Surface Operations

The GI 275 Map page shall not be used as the sole basis for ground maneuvering. The zoomed-in Map page does not comply with the FAA requirements and is not certified as an airport moving map display (AMMD). Map page use is limited to airport surface orientation to improve flight crew situational awareness during ground operations.

2.19 Fuel Flow

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 to determine fuel used, fuel remaining, or fuel reserves.

2.20 Fuel Computer

The fuel computer functions must not be used as the primary means of determining the quantity of fuel in the tanks. The aircraft fuel quantity gauge(s) are the primary means of determining fuel quantity.

2.21 Glove Usage

The touchscreen can be operated with gloves made for capacitive touchscreens.

2.22 VFR GPS

The VFR GPS (VGPS) is an emergency position source which can provide temporary navigational aid for limited en-route direct-to capability when the certified navigator data is:

- Unavailable or
- Invalid or
- VFR flight if no other GPS source is interfaced.

2.23 Service Required

It is prohibited to initiate flight when a "Service Required" advisory is present on the ADI or EIS display.

2.24 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

The GI 275 wireless interface and data provided to a portable electronic device are not approved to replace any certified avionics, including installed navigation or traffic/weather equipment.

2.25 Database Updates

Database updates via USB or wireless transfers must be done while the aircraft is on the ground and stationary. In-flight database transfers or updates are inhibited in flight.

2.26 Kinds of Operations

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 Code of Federal Regulations Part 91, Part 121, and Part 135 when appropriately maintained.

The table below lists the minimum fully functional equipment required for operation of the GI 275.

Equipment	Number installed	VFR	IFR
GI 275 ADI	1	1	1
GI 275 HSI/MFD as Standby ADI	1	0	1
GMU 11 or 44B Magnetometer	1*	0	1*
Reversion Backup Switch	1*	0	1*
GPS/SBAS Navigator or VFR GPS antenna	1**	1	1**
Non-stabilized Magnetic Compass	1	1	1

* Connected to GI 275 ADI

** Connected to GI 275 ADI or the GI 275 HSI/MFD as a Standby ADI

Figure 1- Minimum GI 275 Flight Instrument System when installed with a GI 275 Standby ADI

Equipment	Number installed	VFR	IFR
GI 275 ADI	1	1	1
GMU 11 or 44B Magnetometer	1	0	1
GPS/SBAS Navigator or VFR GPS antenna	1	1	1
Non-stabilized Magnetic Compass	1	1	1
Original flight instruments w/ turn rate indicator*	0 or 1	0	0 or 1
Original flight instruments w/ third attitude source*	0 or 1	0	0 or 1

* Either the original flight instruments with a turn rate indicator or the original flight instruments with a third attitude source must be installed as standbys for IFR flight.

Figure 2- Minimum GI 275 Instrument System when installed with non-GI 275, supporting Standby Instruments

Equipment	Number installed	Req'd
GI 275 EIS	1 or 2*	1 or 2*
Engine Adaptor Unit (GEA 24/110)	1 or 2*	1 or 2*
External EIS Annunciator	0, 1, 2, or 4**	0, 1, 2, or 4**

* One GI 275 EIS and GEA 24/110 are required per engine
** An external annunciator is installed when the GI 275 EIS is outside of the pilot's primary field of view.

Figure 3- Engine Indication System

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, any additional engine instruments required by the aircraft Kinds of Equipment list as listed in the Aircraft Flight Manual.

If the GI 275 EIS is installed outside of the pilot's primary field of view, an external annunciator is required. If installed, this annunciator must be tested for proper operation prior to flight.

2.27 Minimum Flight Crew

Installation of a GI 275 does not affect a Minimum Flight Crew determination.

2.28 Placards

2.28.1 Removed / Modified Placards

- ☐ No placards have been removed or modified.
- ☐ The following placards have been removed or modified:

____
____
____
____
____

2.28.2 GI 275 Reversion Backup Switch

Adjacent to the GI 275 Reversion Backup Switch:

On

Auto

2.28.3 Installations Limited to VFR

- ☐ This installation is not limited to VFR.
- ☐ This installation is limited to VFR and the following placard is required:

“AIRCRAFT LIMITED TO VFR”

2.28.4 Aircraft Category

There is no placarding that is specific or unique to aircraft category.

Section 3. EMERGENCY PROCEDURES

NOTE

Depending on the installation, some procedures contained within this section may not apply.

3.1 Emergency Procedures

3.1.1 Loss of Primary Flight Information

If the primary GI 275 ADI fails (loss of some or all primary flight information, display is blank, frozen, or unresponsive).

1. Use standby flight instruments for attitude, airspeed, altitude, and heading reference.
2. If GI 275 reversionary capability is available, the standby GI 275 should automatically change to the ADI page and promptly restore primary flight information. If manual reversion is required, move the Reversion Backup Switch to the “ON” position.
3. Refer directly to the navigation source for navigation information (such as GPS).
4. Seek VFR conditions or land as soon as practical.

   If autopilot is engaged:

5. Verify autopilot mode selections and cross check against standby flight and navigation data. Consider disengaging the autopilot.

3.1.2 AHRS Failure

AHRS failure is indicated by the removal of the attitude/heading information and a red X on the GI 275 ADI. Standard rate turn indications will also be removed. A heading failure may also occur as described in Section 3.2.1.

1. Continue flight by reference to the standby ADI or manually select "ON" on the GI 275 reversionary backup switch to force reversion.

2. Seek VFR conditions or land as soon as practicable if there are no other reliable AHRS sensors capable of providing accurate data.

If multiple AHRS sources are installed:

3. Select the operative AHRS (i.e., AHRS 1, 2 or 3) using the ADI sensors menu (MENU → SENSORS)

4. Press and hold the back button to return to the ADI page.

NOTE

If airborne AHRS alignment is necessary, minimize maneuvering and turbulence during and after the restart process. Excessive maneuvering or turbulence may prevent the AHRS from aligning properly. Continue to minimize maneuvering and seek smooth air for the first 5 minutes after the attitude becomes valid following the airborne alignment. If maneuvering or turbulence cannot be avoided, carefully cross-check the AHRS for accuracy against other flight instruments until the alignment has completed and becomes stable.

CAUTION

In installations with a Garmin cross-comparison for AHRS/ADC sensors, changing the AHRS/ADC sensor source when a white ATTITUDE/IAS/ALT annunciation is displayed on the primary GI 275 ADI will result in the selection of an inoperative sensor source and subsequent loss of information. Operating primary and standby GI 275 ADIs on the same sensor source will inhibit the AHRS/ADC comparison monitor.

3.1.3 ADC Failure

ADC failure is indicated by:

- Red X over the airspeed and altitude tapes
- Yellow X over the digital vertical speed value

If valid GPS data is available, the GI 275 will automatically revert to display GPS-calculated altitude relative to mean sea level. GPS altitude is displayed in magenta, in the same location as normal operation.

1. Use standby Airspeed Indicator and Altimeter
2. Seek VFR conditions or land as soon as practical if there are no other reliable ADC sensors capable of providing accurate data.

If multiple ADC sources are installed:

3. Select the operative ADC (i.e., ADC 1, 2, or 3) using the ADI Sensors menu (MENU → SENSORS)
4. Press and hold the back button to return to the ADI page.

CAUTION

In installations with a Garmin cross-comparison for AHRS/ADC sensors, changing the AHRS/ADC sensor source when a white ATTITUDE/IAS/ALT annunciation is displayed on the primary GI 275 ADI will result in the selection of an inoperative sensor source and subsequent loss of information. Operating primary and standby GI 275 ADIs on the same sensor source will inhibit the AHRS/ADC comparison monitor.

3.1.4 ATTITUDE, ALT, or IAS monitor CAUTION

If an ATTITUDE, ALT, or IAS miscompare CAUTION is displayed in yellow on the attitude display or airspeed/altitude tape:

1. Cross check flight instruments against all available information to determine which indications are correct
2. Seek VFR conditions or land as soon as practical

<u>**NOTE**</u>

White ATTITUDE/ALT/IAS no compare annunciations indicate that the other AHRS/ADC source is not available.

3.1.5 Aircraft Electrical System Failure

In the event of a total loss of aircraft electrical power, the GI 275 will cease to operate, except for displays which are equipped with an internal backup battery. Refer to procedures for failure of affected equipment and operation on backup battery.

3.1.6 Operation on Backup Battery (if installed)

Displays equipped with a backup battery will continue to operate after a loss of aircraft electrical power. EIS displays will not be functional. Operation on battery power is indicated by the presence of a battery icon on the affected display. Green battery indication provides at least 60mins, yellow battery indication provides a range between 59mins and 15mins, and red battery indication provides less than 15mins of battery operation.

1. Seek VFR conditions and land as soon as practical.

NOTE

For protection, backup battery operation is inhibited if the battery's temperature drops below -20° C or exceeds 80° C. Battery parameters such as the battery temperature can be viewed in the System Menu.

CAUTION

To conserve power and to preserve the display of primary flight data and direct-to navigation capabilities with the optional VGPS receiver, GI 275 backup battery operation internally load-sheds interfaces, which will disable the normal interface with certified navigators or other hazard awareness systems. Depending on how these were installed and configured to the GI 275, some information from these configured systems will not be available when the GI 275 is operating on its backup battery.

3.1.7 Display Backup Malfunction

Display backup malfunction is indicated by the unit locking on the ADI page. All other configured pages will not be accessible on the standby ADI or HSI.

3.1.8 Backup Battery Malfunction

A malfunction of the backup battery is indicated by the following indication in the upper left corner of the screen with a system advisory message:

1. Seek VFR conditions or land as soon as practicable.

3.1.9 EIS Failure

EIS failure is indicated by the loss of displayed information on the EIS, including a blank, frozen, or unresponsive display of EIS parameters.

1. Position engine controls to ensure operation within engine limitations.

3.1.10 Terrain Alerts

Aural Alert	Annunciation All Pages	Annunciation Terrain Page	Action
"Terrain, Terrain Pull up, Pull up" -OR- "Obstacle, Obstacle Pull up, Pull up" -OR- "Wire, Wire Pull up, Pull up" -OR- "Warning, Terrain, Terrain" -OR- "Warning, Obstacle, Obstacle" -OR- "Warning, Wire, Wire" -OR- "Pull up"	TER	PULL UP -OR- TERRAIN -OR- OBSTACLE -OR- WIRE	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" -OR- "CAUTION, Obstacle" -OR- "CAUTION, Wire"	TER	TERRAIN -OR- OBSTACLE -OR- WIRE	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.
"Too low, Terrain"		TERRAIN	Establish climb to the minimum altitude for present position/procedure
"Sink Rate"		TERRAIN	Decrease rate of descent
"Don't sink"		TERRAIN	Establish a positive rate of climb

3.2 Abnormal Procedures

3.2.1 Heading Failure

If the GI 275 is configured with a VFR GPS or interfaced to a certified GPS source, the HDG indications will be replaced with track (TRK) indications in magenta in the event of a heading failure. The heading bug and course pointer will continue to function normally, using GPS ground track as a reference instead of magnetic heading.

Figure 4- Bottom of the ADI when HDG failed (with GPS)

Figure 5- Top of the HSI when HDG failed (with GPS)

If there is no GPS in the GI 275 system or if the GPS has failed, the heading failure will be indicated by a red “X” in place of the heading readout on the ADI or HSIs.

Figure 6- Bottom of the ADI when HDG failed (no GPS)

Figure 7- Top of the HSI when HDG failed (no GPS)

If GPS track is not available:

1. Use standby compass for heading reference.

NOTE

Without magnetic heading or GPS track, the CDI provides no directional information. Only course deviation information is presented, and the orientation of the CDI is based on the selected course, regardless of aircraft heading. Course deviation indications will behave like a traditional CDI. VOR deviations will be relative to the selected course with a TO/FROM indication. Localizer deviations will not be affected by the selected course, and reverse sensing will occur when tracking inbound on a localizer back course.

3.2.2 Display Overtemperature

If the display is in an overheating condition, the system will alert the pilot with a system message. The system message will read "Display Overtemperature"

1. Prepare for loss of the affected display.

3.2.3 GPS Data Failure

GPS data failure may be indicated by any or all of the following:

- Loss of GPS course deviation information on HSI
- Yellow "LOI" text on the ADI
- Yellow "DR" text on the moving map
- Yellow "NO GPS POSITION" text on the moving map
- Loss of waypoint bearing/distance information

1. Select alternate GPS source, if available, by pressing "CDI" button on ADI.
    - If the VFR GPS is configured in the system, while cycling the CDI button the VGPS will become a selectable source. This is limited to Direct-to capability, if configured.

If alternate GPS source is not available:

2. Select alternate navigation source (VOR or LOC, if available) or refer directly to external navigation data.
3. Seek VFR conditions as soon as practical.

3.2.4 Navigation Data Failure (VOR/LOC/GS)

Navigation data failure may be indicated by any or all of the following:

- Loss of course deviation information on ADI
- Loss of glideslope/glidepath information on ADI
- Loss of bearing pointer on HSI

1. Select alternate navigation source or refer directly to external navigation data.

3.2.5 Synthetic Vision Malfunction

If the synthetic vision depiction is known or suspected to be inaccurate or malfunctioning:

1. Turn off synthetic terrain using the Menu → Options → Terrain SVT menu on the ADI.

3.2.6 Electrical Load Shedding

The following equipment is considered non-essential. If it becomes necessary to reduce electrical load (for example, during loss of generators or alternators), power to these units may be removed in the order listed.

1. MFD circuit breaker(s) [if installed and not configured as standby ADI] – PULL

NOTE

Any non-required displays on the co-pilot side may also be powered off.

3.2.7 AHRS ALIGN

If an "AHRS ALIGN / Keep Wings Level" annunciation is displayed on the attitude indicator in flight, limit aircraft operation to:

- ±10º bank
- ±5º pitch
- 200 KTAS or less

CAUTION

Exceeding these values may delay or prevent AHRS alignment.

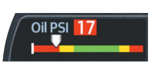
3.2.8 EIS Display Parameter Failure

Indicated by individual parameters having a red or yellow X drawn through the gauge and data removed (see EIS failure procedure for loss of entire EIS function).

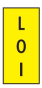
1. Monitor remaining parameters and set engine controls to operate within limitations.

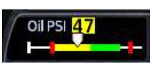
3.3 WARNINGs, CAUTIONs, and Advisories

The following tables show the color and significance of the warning, caution, and advisory messages which may appear on the GI 275 displays.

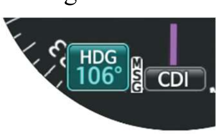
3.3.1 WARNING Annunciations – Red		
Annunciation	*Pilot Action*	*Cause*
HDG Fail 	Use Standby Magnetic Compass or GPS track information	Display system is not receiving valid heading input from the ADAHRS or AHRS; accompanied by a red X through the digital heading display.
Red X 	Reference the data source or alternate equipment.	A red X through any display field, indicates that display field is not receiving data or is corrupted.
Red EIS Alert Banner 	Observe the warning indication on the EIS display and take appropriate action.	One or more engine parameters have exceeded a warning threshold.
Red Engine Parameter 	Take appropriate action to correct condition causing engine parameter exceedance	The engine parameter has exceeded the warning threshold.
Terrain warning 	Take appropriate action to maneuver the aircraft away from the conflicting terrain	Terrain warning due to aircraft proximity to surrounding terrain

3.3.2 CAUTION Annunciations – Yellow

Annunciation	*Pilot Action*	*Cause*
AHRS ALIGN – Keep Wings Level 	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 NOT READY – Do Not Takeoff 	Remain stationary and allow AHRS to finish initialization and allow navigators to acquire sufficient GPS position.	AHRS sensors are not ready for flight. Additionally, the interfaced navigator does not have sufficient GPS position.
LOI 	Loss of Integrity Monitoring	GPS integrity is insufficient for the current phase of flight.
No GPS Position 	Use alternate information for positional and situational awareness	GPS data is unavailable.
Yellow X 	Reference the data source or alternate equipment.	A yellow X through any display field, indicates that display field is not receiving data or is corrupted.
ATTITUDE 	Fly aircraft manually and crosscheck attitude indication with standby attitude indicator and other sources of attitude information (airspeed, heading, altitude, etc.)	The ADI attitude monitors have detected an AHRS malfunction or an error between AHRS sources (if multiple sources installed). Autopilot may disconnect if AHRS is being used to drive the autopilot.

ALT and/or IAS (text on ADI) ALT	Cross-check the flagged information against other sources to identify erroneous information.	Differences detected between displayed airspeed and/or altitude (multiple ADC installations only).
AHRS 1/2/3 AHRS 1	Confirm intended AHRS source selection	The ADI is using the cross-side AHRS sensor and AHRS monitor is indicating a miscompare or no-compare (multiple ADI and AHRS installations only).
ADC 1/2/3 ADC 1	Confirm intended ADC source selection	The ADI is using the cross-side ADC sensor and ADC monitor is indicating a miscompare or no-compare (multiple ADI and ADC installations only).
Yellow Alert Banner on EIS BATT VOLTS	Observe the caution indication on the EIS display and take appropriate action.	One or more engine parameters have exceeded a caution threshold.
Yellow EIS Parameter 	Take appropriate action to correct condition causing engine parameter exceedance.	The engine parameter has exceeded the caution threshold.
Traffic Caution TFC	Visually acquire the traffic to see and avoid.	The interfaced traffic system has determined that nearby traffic may be a threat to the aircraft.
Terrain Caution TER	Take appropriate action to maneuver the aircraft away from the conflicting terrain	Terrain caution due to aircraft proximity to surrounding terrain
TAWS N/A, TAWS FAIL ~~TER~~	Use vigilance, terrain depiction and TAWS alerting are no longer provided.	External system that is providing TAWS alerting has failed, or the GI 275 cannot communicate with the system.

Battery Fault 	Observe the fault condition on the GI 275 by entering the system messages for further details. Seek VFR flight conditions or land as practical.	The Internal battery has detected an issue which may not allow the battery to charge or discharge properly. Such as “Charge Inhibited - unable to charge the battery”
GPSS Invalid 	Set an active GPS leg to engage GPSS mode or select HDG as the function.	GPSS mode invalid, wings level command sent to autopilot, no active GPS leg, GPS not selected on HSI/ADI 1.

3.3.3 Advisories – White		
Annunciation	*Pilot Action*	*Cause*
ATTITUDE, ALT, or IAS (text on ADI) ATTITUDE ALT IAS	Be aware that the other (unselected) AHRS/ADC source is not available	The other (unselected) AHRS/ADC source is unavailable.
AHRS 1/2/3 AHRS 1	Confirm intended AHRS source selection	The ADI is using the cross-side AHRS sensor (multiple ADI and ADC installations only).
ADC 1/2/3 ADC 1	Confirm intended ADC source selection	The ADI is using the cross-side ADC sensor (multiple ADI and ADC installations only).
Messages Icon 	View and consider advisory messages. Refer to the GI 275 Pilot Guide for appropriate pilot or service action.	Typically, these indicate system or database status, or data communication issues within the GI 275 System.
Terrain Inhibited ~~TER~~	Use vigilance, traffic system will not provide alerting.	Terrain is inhibited or a terrain test is in progress
External Navigator Message Icon 	View and consider advisory messages on interfaced navigator. Refer to Pilot Guide for the external navigator for appropriate pilot of service action.	Typically, these indicate system or database status.

Section 4. NORMAL PROCEDURES

4.1 Before Takeoff

1. Review displays for any abnormal warning, caution, or advisory indications.
2. Perform a visual inspection of the fuel tank or other method such as a dipstick, sight gauge, or drip gauge to verify that the fuel quantity indication provided by the GI 275 is accurate.

   Do not use the unverified fuel quantity indication provided by the GI 275 as the sole means of complying with the requirements of CFR 14 91.103, 91.151, or 91.167.
3. If equipped with a TAWS/Terrain warning system, ensure that the terrain alert audio test can be heard clearly (a system test audio clip is played during the startup self-test).
4. Push to test any installed external annunciators to ensure proper function.
5. Verify that the MAG/TRUE navigation angle selection on the GI 275 and any interfaced navigators match.

4.1.1 ADI System Check

1. For IFR aircraft, verify that no yellow or red battery icon is displayed on the primary or standby ADI. If a yellow icon is present, verify the battery's remaining capacity is more than 30 mins if the aircraft's service ceiling is below 25,000ft, or more than 60 mins if the aircraft's service ceiling is above 25,000ft.
   - Refer to the battery status and information found in the battery menu (Menu → Systems → Battery).
2. Verify that attitude, heading, altitude, and airspeed are displayed normally on the ADI (no warnings, cautions, or advisories related to these functions).
3. Select the Reversion Backup Switch to the "ON" position
   a. Verify that the ADI information is displayed on the backup display
   b. Ensure that attitude, heading, altitude, and airspeed are displayed normally on the standby ADI (no warnings, cautions, or advisories related to these functions)

4. Select the Reversion Backup Switch to the “AUTO” position and verify that the display return to their normal state and other configured pages are once again selectable.

4.2 Autopilot Operation

Refer to Section 7.15 for the applicable autopilot interface capability and installation details.

4.2.1 Autopilot Disconnect Test

The autopilot may receive attitude from a GI 275 ADI. If this is installed, an “AP DISC” button will be present in the Menu → Options menu, and this function must be tested using the following procedure.

This procedure is not required if a Garmin GFC 500 or GFC 600 autopilot is interfaced.

NOTE

Garmin GFC 500 / GFC 600 installations will not have an “AP DISC” button present in the Menu → Options menu even though the GI 275 ADI is providing attitude.

1. While on the ground, engage the autopilot.
2. In the ADI Menu → Options, press the AP DISC button and verify that the autopilot disconnects.

CAUTION

Do not use the autopilot if the AP DISC button fails to disengage the autopilot normally.

4.2.2 Autopilot NAV / APR mode coupling

To couple the autopilot NAV / APR mode:

1. Select the desired navigation source on the Pilot’s ADI (NAV Options Menu) or the CDI button.
2. Select the desired NAV / APR mode on the autopilot.

NOTE

The autopilot will use the source that is displayed on the Pilot’s ADI or HSI.

4.2.3 GPSS Emulation

When enabled by the installer for autopilots that do not support GPSS roll steering, GPSS allows a configured legacy autopilot to fly GPS curved plan legs (e.g., arcs, procedure turns, etc.) as well as straight legs. When the GPSS emulation mode is enabled in the GI 275 ADI, the autopilot will direct the aircraft to and then guide the aircraft along the active GPS flight plan leg. To use GPSS:

1. Select the desired GPS navigation source on the Pilot's ADI.
2. Enable GPSS emulation on the ADI using the AP REF button in the Menu → Options → NAV Options → HDG Options menu.
3. Engage the autopilot in HDG mode.

NOTE

When GPSS emulation is enabled, the GI 275 ADI's heading bug function will be disabled. This is indicated by a hollowed-out heading bug, and the ADI/HSI heading button will display "GPSS" near the crossed-out heading bug. The "GPSS" text will be white when GPSS commands are available, and it will be yellow when there is no GPSS command available.

The following images show GPSS mode active, but no signals are sent.

The following images show GPSS mode active and sending signals.

NOTE

The GPSS commands to the autopilot are based on the GPS source displayed on the pilot's side ADI (typically the primary ADI or ADI #1).

4.2.4 Coupling the Autopilot for Enhanced Descent-Only VNAV

The GI 275 allows for the display of Enhanced Descent Only (EDO) Vertical Navigation (VNAV) deviations when interfaced with a Garmin GTN. In order to provide autopilot coupling to the EDO VNAV guidance, the interface must also include a Garmin GFC 600 or GFC 500 with VNAV capability. If EDO VNAV is enabled on the GTN in these installations, EDO VNAV guidance may be coupled to the autopilot using the VNAV function of the GFC.
The GTN interface for (VNAV) functionality requires barometric altitude.

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

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

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

4.3 EIS Operation

4.3.1 Main EIS Page

The *Main EIS* page of the GI 275 displays all engine gauges that have limitations (red and/or yellow markings). The crew must periodically review the engine indications on the *Main EIS* page if the GI 275 is displaying any other EIS page. Any parameters with associated alerts or cautions will be displayed on the Main EIS page, and will generate an annunciation that is present on all pages. Acknowledging the alert/caution banner with touch or knob press will return the pilot to the Main EIS page.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTION

The following units are installed in this aircraft:

- ☐ ADI
- ☐ HSI
- ☐ HSI Standby ADI
- ☐ MFD
- ☐ MFD Standby ADI
- ☐ EIS

A detailed GI 275 Pilot's Guide is available through the Garmin website or your Garmin dealer.

If a GSB 15 is installed it provides a USB port for loading software and databases. This can also power portable electronic devices but does not provide any data connection to the GI 275 for those devices.

Wireless connectivity is provided for ground database updates. Database updates cannot be performed in-flight. Additionally, the GI 275 supports a Bluetooth connection to personal electronic devices running Garmin Pilot for the supplemental display of traffic, attitude and GPS position. This connection will work in-flight however the personal electronic device must be paired with GI 275 while on the ground.

The following colors are used consistently within the GI 275 system:

Color	Functions
Red	Warning conditions Operating Limits
Yellow	Caution conditions Conditional operating ranges
Green	Safe operating conditions Normal operating ranges VOR/Localizer Data
White	Scales and Markings Current data and values, status
Magenta	GPS Data Active flight plan legs
Cyan	Pilot-selectable references

7.1 Controls Overview

A dual concentric knob with a center push-button provides the primary means with which to navigate between screens and access menus and functions of the GI 275. The outer knob will always change from Page-to-Page on GI 275s that have multiple pages. A display touch is required in most cases to select the display field of a Page that will be changed by inner knob rotation or press. The inner knob changes the value of the selected field. For primary, stand-alone ADIs the outer knob does not provide any control since there is no other page available for selection. When the outer knob is rotated, a momentary display of knob function is provided at the top of each page.

To access the Menu, press and hold the inner knob. To access the Menu via touchscreen, swipe up from the bottom of the GI 275 display.

7.2 Display Brightness

Display brightness is controlled automatically based on input to a bezel-mounted photocell. The brightness level can be manually adjusted using controls in the Menu → Backlight selection. Optionally, brightness can be controlled using the aircraft's cockpit lighting dimmer control.

7.3 System Power Sources

The GI 275 primarily depends on aircraft power to function. The GI 275 system is directly connected to the aircraft's main or essential bus and energized when the aircraft master switch is turned on. Other systems, like the navigation equipment, weather datalink, and autopilot are typically located on the avionics bus and may not be functional when this bus is powered off.

The major components of the GI 275 are protected with resettable circuit breakers available to the pilot. These breakers are labeled as follows (appropriate boxes will be checked):

Installed	Circuit Breaker Label	Equipment
☐	PFD	Primary ADI
☐	EIS	GI 275 configured for Engine Monitoring – Single Engine
☐	EIS L and EIS R	GI 275 configured for Engine Monitoring – Multi Engine
☐	MFD	GI 275 configured as a MFD
☐	MFD/STBY ADI	GI 275 configured as a MFD with standby ADI
☐	ATT	GI 275 configured as an Attitude Indicator only
☐	HSI	GI 275 configured as an HSI
☐	HSI/STBY ADI	GI 275 configured as an HSI with standby ADI
☐	ENG SNSR	GEA (24 or 110) Engine/Airframe Unit
☐	STBY ADI	Standby ADI (Stand-alone)
☐	USB	GSB 15 USB Interface

7.4 System Status

The GI 275 status can be viewed via the Menu → System → Info menu. This includes the serial number and system ID of the unit, the software version loaded on the unit, and the AHRS and ADC software versions.

An External LRUs list displays information and status of various units that are interfaced to the GI 275 system. This list only includes LRUs that can report status information, which is typically limited to other Garmin LRUs. Software versions, serial numbers, and LRU status is typically provided. A green checkmark indicates normal online status, and a red X indicates offline or failed status. Some LRUs, like the GDL 69, GSR 56, and GTX 345, provide a button to see more detailed information about the status of that unit.

7.5 Databases

The GI 275 utilizes databases to provide some system functions.

Database status information is available to the pilot at system startup on the MFD splash screen and during normal operations on the Menu → System → Databases (or DB) menu. Controls are provided for manually initiating a database update. EIS units only use a Nav database. System time (as received from an interfaced GPS navigator or the internal VFR GPS) is used to determine if a database is within its effective period. Databases are displayed in yellow if they are expired, not yet effective, or if the current date/time is unknown. Databases are displayed in white if they are within their effective date range. All database status information is depicted in white on the System Status page.

Databases can be updated using the USB port, by syncing with other compatible units, or using database concierge through a PED. Databases are stored internally on the GI 275s.

The terrain and basemap databases are updated periodically and do not expire.

The Garmin or Jeppesen navigation database contains data associated with navigation including airports, navigation aids, airways, airspaces, and other data. This database is updated on a 28-day cycle.

The obstacle database contains data for obstacles and wires that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. Wires which have been identified as a hazard to fixed wing aircraft are included in the database. Coverage of the obstacle database includes the United States and Europe. Wire coverage is limited to the United States. This database is updated on a 56-day cycle.

CAUTION

Not all obstacles or wires are included in the databases.

The Garmin SafeTaxi™ database contains airport diagrams for selected airports. This database is updated on a 56-day cycle.

The magnetic variation model contains data about variations in the earth's magnetic field based on location. This database is included with the navigation database and is updated on a five-year cycle.

7.6 Crew Profiles

The crew profile function is provided for all units to allow the retention of pilot-selectable configurations and settings. If the aircraft is operated by multiple pilots, each pilot can recall their individual settings for use. These profiles include settings from all displays in the system.

If an MFD is installed, the splash screen provides the option for the pilot to select a crew profile upon power up. Otherwise the crew profile can be set in the System → Crew Profile Menu. If no selection is made, the GI 275 will default to the last crew profile used. Only one profile may be selected as active at a time. New profiles are created with the settings currently in use.

7.7 Integrated Standby System

Standby instruments (attitude, altitude, airspeed) may be provided by a second GI 275 display. The GI 275 can be a standby to itself, consisting of two GI 275 displays installed adjacent to each other, with one display configured as the ADI and the second display configured as either an HSI or an MFD.

The standby ADI needs to be of the -10, -20, -30, or -40 type with its own integral ADAHRS. A Reversion Backup Switch is installed which will force the standby ADI into the display backup mode of operation when moved to the "ON" position.

A backup battery will provide power to the ADI, MFD, HSI, or standby ADI in the event of aircraft power failure. This configuration will provide the following functionality:

- If the ADI fails or communication with the primary ADI is lost, the MFD with a standby ADI or standby HSI will automatically display its backup primary flight information (attitude, altitude, airspeed).
- Two GI 275 -10 variants monitor and compare their independent attitude, altitude, and airspeed data. If either GI 275 detects a difference between any of the parameters (attitude, altitude, or airspeed), the MFD or HSI will automatically revert to display the standby ADI to restore primary flight information. Yellow miscompare annunciations will appear to indicate the discrepancy.

7.8 GPS Approach Mode Annunciations

When interfaced with a certified GPS navigator and the GPS navigator is the selected source, the GI 275 HSI and HSI Map display the current GPS operational mode. The GI 275 abbreviates the approach modes as defined in the table below.

Description	Annunciation
Lateral Navigation	LNAV
Localizer Performance with Vertical Guidance	LPV
Localizer Performance without Vertical Guidance	LP
Localizer performance approach with advisory vertical guidance	LP+V
Lateral and vertical navigation approach	L/VNAV
Lateral navigation approach with advisory vertical guidance	LNAV+V

7.9 VFR GPS

A Garmin GI 275 may be interfaced with its own optional VFR GPS antenna. In the event that the certified GPS navigation information becomes unavailable, the GI 275 VFR GPS (VGPS) provides 2D GPS position information and Direct To navigation capability. Aside from selecting VGPS as the CDI source and then selecting a Direct To waypoint, airport, or navigational aid within the GI 275 Direct To Menu, there is no pilot action required to enable or use the VFR GPS. When VGPS data is in use, "VGPS" is annunciated as the selected navigation source.

Synthetic Vision and Terrain alerting functionality is available with the VGPS.

7.10 Aircraft Audio Interface

The primary (pilot) ADI is interfaced to the aircraft audio system to provide aural alerts (altitude alerter, minimums, terrain). If multiple ADIs are installed, only the primary ADI is interfaced to the audio system (to prevent duplicate aural alerts).

An MFD may be interfaced to the audio system for terrain alerts or touch clicks, but only if there is no primary ADI installed.

The GI 275 EIS is not interfaced to the audio system.

The general audio alerts that this GI 275 system can provide are:

- ☐ Altitude Alerting
- ☐ Terrain Alerting
- ☐ Decision Height Aural
- ☐ Baro Minimums

NOTE

If the GI 275 interface to the aircraft audio system fails, no aural alerts will be issued from the GI 275 system.

7.11 Messages

Messages are available on all installed GI 275s. A Message annunciation flashes in the upper left corner of each display to notify the pilot when a new advisory is available. The pilot may select Messages in the Menu to display a list of active Messages.

Not all Messages are common to all interfaced GI 275s, meaning unit specific issues will not be shown on all the other GI 275s.

7.12 System Settings

The Menu → System → Setup page provides pilot controls for click volume, time format, and local time offset. Controls are provided to set the nearest airport criteria so that airports not usable by the aircraft type do not appear in waypoint searches.

Units of Measure for temperature, barometric pressure, and nav angle are pilot controllable via the Menu → System → Units page. These units are propagated throughout the GI 275 system. Adjustments to temperature units will not affect EIS temperature gauges.

The units and markings on the ADI are not user-configurable. They match the units as specified in the aircraft's FAA approved Airplane Flight Manual and standby instruments.

If pilot-selected navigation angle settings differ on the navigator and the GI 275, the display aspects will be inaccurate.

7.13 System Data Logging

The GI 275 system incorporates a data logging feature that can record parameters related to the aircraft's primary flight instruments, engine indications, and aircraft configuration. Recorded data is stored in internal memory and can be exported via a USB drive.

7.14 Primary ADI

ADI functions are selected by touching the desired adjustable field on the display. Once selected, the inner knob changes the value (Altitude, IAS, Baro, or Heading). An inner knob press will sync the altitude, IAS, or heading to the current value. Baro sync toggles the ADI in and out of standard altimeter setting (29.92"hg and labeled "STD"). The selectable field defaults to Baro when the knob is idle for a period of time. The default timeout is 10 seconds and may be changed in the Menu.

When interfaced to a Garmin G500/600 TXi, the GI 275 will sync barometer (if Baro Sync is enabled), selected heading, selected altitude, and selected airspeed bugs with the TXi. It is required that BARO SYNC be enabled when using VNAV functionality as the GTN will only use the pilot-side BARO unless there is a failure.

7.14.1 Primary Flight Data

The ADI can display the following parameters depending on the unit configuration; attitude, heading, airspeed, barometric altitude, and vertical speed data. Airspeed and altitude displays include a six second trend indicator.

Pilot selectable bugs may be configured for airspeed, altitude, and heading.

The GI 275 requires at least one GPS source to ensure the integrity of the AHRS.

When dual GI 275 -10, -20, -30, and -40 variants are installed and configured, the pilot is provided with AHRS/ADC source selection controls via the ADI Menu → Options → Sensors menu.

The default ADC and AHRS source on power up is ADC 1 and AHRS 1 for the pilot side ADI and ADC 2 and AHRS 2 for the co-pilot or standby ADI and if a third sensor is installed, it is configured as the standby.

Selection of the non-default sensor source will cause a "ADC [Sensor Number]" or "AHRS [Sensor Number]", respectively, to be displayed with black text on a white background. If there is an AHRS or ADC miscompare or no-compare while on the off-side sensor "ADC [Sensor Number]" or "AHRS [Sensor Number]" will be displayed with black text on a yellow background.

When dual GI 275 -10, -20, -30, and -40 variants are installed and configured, software monitors provide detection of sensor miscompares. If a monitor detects a difference between sources exceeding the allowable limit, a visual attitude, altitude, heading, or airspeed miscompare annunciation will be shown on the ADI.

Miscompares are annunciated using black text on a yellow background as follows: airspeed miscompare is “IAS” shown near the airspeed pointer, barometric altitude miscompare is “ALT” near the barometric altitude pointer, the near the digital heading readout, and attitude miscompare is “ATTITUDE” on the attitude indicator. The ADI inhibits the “IAS”, “ALT”, and “ATTITUDE” annunciations in dual GI 275 ADI installations when both ADIs are displaying the same sensor source.

A no compare monitor is used to determine when data between GI 275s cannot be compared. No compares are annunciated the same as miscompares, except for the black text on a white background.

7.14.2 Attitude

The attitude display has a blue over brown presentation and may be configured in either a Fixed or Sky Pointer orientation by the installer. The ADI can also display Synthetic Vision data (SVT), available as an option.

Standard rate turn marks are provided on the roll scale for bank angles less than 30 degrees when the GI 275 ADI is configured with an OAT sensor.

The Sky Pointer orientation will automatically declutter the IAS and Altitude selectable fields when bank angles exceed 45°. Red chevrons, which indicate the direction to level pitch to assist recovery, are displayed when pitch attitudes exceed ~10° nose down or ~25° nose up.

Slip/skid information is shown using a white trapezoid below the roll angle indicator.

7.14.3 Synthetic Vision Technology

SVT may optionally be provided to assist the pilot in maintaining situational awareness with terrain, obstacles, and airborne traffic.

SVT controls are provided via Menu → Options → Terrain/SVT. Synthetic terrain, horizon headings, and airport signs can be enabled or disabled from this menu.

SVT provides additional information on the ADI:

- **Synthetic Terrain:** an artificial, database-derived, three-dimensional view of the terrain ahead of the aircraft within a field of view of approximately 25 degrees left and 25 degrees right of the aircraft heading.
- **Obstacles**: obstacles such as towers, including buildings over 200 AGL that are within the depicted synthetic terrain field of view. Powerlines are not depicted in synthetic vision.
- **Flight Path Marker (FPM)**: an indication of the current lateral and vertical path of the aircraft. The FPM is always displayed when SVT is enabled. The FPM will be dashed when it hits the vertical or lateral display limit.
- **Traffic**: a display on the ADI indicating the position of other aircraft detected by an interfaced traffic system.
- **Horizon Line**: a white line indicating the true horizon is always displayed on the SVT display.
- **Horizon Headings**: Headings may be overlayed just above the horizon line on the ADI.
- **Airport Signs**: pilot-selectable “signposts” displayed on the synthetic terrain display indicating the position of nearby airports that are in the navigation database.
- **Runway Highlight**: a highlighted presentation of the location and orientation of the runway(s) at the destination airport.

The synthetic terrain display is intended to aid the pilot awareness of the terrain and obstacles ahead of the airplane. It may not provide either the accuracy or fidelity, or both, on which to solely base decisions and plan maneuvers to avoid terrain or obstacles. The synthetic vision elements are not intended to be used for primary aircraft control in place of the primary flight instruments.

7.14.4 Airspeed

If configured, the airspeed tape on the left side of the ADI displays red/white striping to indicate the maximum allowable airspeed (V_{NE}/V_{MO}). This maximum allowable airspeed display is configured to indicate the appropriate maximum allowable airspeed for the airplane.

The airspeed tape displays a red low-speed awareness band at the lower range of the airspeed tape. This low-speed awareness band is displayed at airspeed values below V_{S0}. It does not indicate an actual or calculated stall speed and does not adjust with variations in aircraft weight or other factors.

All other airspeed tape indications are configured to indicate the type design limitations. The airspeed tape does not adjust these additional markings for variations with aircraft weight, altitude, or other factors.

Airspeed references ("V speeds") are shown on the airspeed tape when enabled for display by the pilot via Menu → Options → Airspeeds.

7.14.5 Barometric Altitude and Vertical Speed

If configured, barometric altitude is displayed on a tape on the right side of the display. The vertical speed is displayed via an inset window adjacent to the altitude numerical value. The Baro setting may be adjusted by touching the field and rotating the inner knob or simply rotating the knob when the active field reverts to the Baro field home state. Altitude, airspeed, and heading bugs may be configured and synchronized across all GI 275 ADIs and configured G500 TXi displays. The Altitude bug may be removed by adjusting the value to -1,000 ft.

If a GTN is interfaced to provide Vertical Navigation (VNAV) functionality, then barometric altitude is required. Baro sync should be enabled on GI 275 units. VNAV uses the pilot-side baro setting unless that GI 275 fails, in which case the co-pilot side baro setting will be used (if installed).

7.14.6 Navigation

Navigation information is presented on the ADI using an optional lateral deviation indicator (LDI) above the heading display and a VDI to the left of the altitude readout. For MFD installations, the CDI/VDI are shown on CDI, HSI, and HSI map pages. Additionally, the CDI/VDI are displayed on the HSI and HSI map page on HSI installations. Bearing Pointers may be displayed on the HSI Page.

Navigation information can be cycled through up to four independent sources in normal operation by pressing the "CDI" button at the bottom of the HSI, HSI Map, or CDI pages. The navigation source can also be changed using the NAV Option Menu on the ADI (Menu → Options). VGPS will be displayed as an additional navigation source if all certified navigators fail or will be the only navigation source in installations without a certified GPS source. The selected navigation source is shown on the left side of the HSI or LDI. CDI source selection can be synchronized across multiple GI 275 and G500 TXi's if enabled by the pilot.

7.14.7 HSI

The course pointer and deviation indicator are shown as a single, solid line for GPS 1 and VLOC 1, and as an outline with no fill for GPS 2 and VLOC 2. GPS and VLOC sources are further differentiated with color.

The selected course is displayed above and to the right of the HSI. The selected course is set via touchscreen keyboard entry or dual-concentric knob.

In addition, the HSI can display two simultaneous bearing pointers sourced from GPS or VHF NAV.

The bearing pointer display and navigation source are pilot controlled under the Menu → HSI Options → Bearing sub menus.

The HSI Map includes an integral moving map within the HSI depiction. HSI map data is a subset of the data on the MFD map page. Traffic, terrain, obstacle, topographic, and weather overlays are also available for the HSI map. Flight plan, runways, TAWS FLTAs, and TFRs are always displayed. Overlays are controlled on the Menu → HSI Options → HSI Map Options → Map Options menu.

7.14.8 Lateral Deviation Indicator (LDI)

A Lateral Deviation Indicator (LDI) is displayed on the ADI above the heading display when selected in the Menu. This LDI shows course deviation, navigation source, and VLOC station identifier or GPS phase of flight. The LDI uses the same color convention as the HSI .

The LDI incorporates automatic reverse sensing correction into the deviation display. When the difference between the heading and the selected course is greater than 107°, the LDI will enable reverse sensing correction. Reverse sensing correction inverts the course deviation needle and to/from indicator so that they correctly indicate the direction of the course and waypoint. The course deviation needle will be deflected in the direction of the desired course, and the to/from indicator will point in the direction of the waypoint (similar to how the HSI depiction inverts with heading changes).

Message, waypoint, phase of flight, LOI, and DR annunciations from a GTN or GNS interfaced to the GI 275 are annunciated on the LDI.

7.14.9 Vertical Deviation Indication (VDI)

Vertical guidance is shown by a vertical deviation indicator (VDI) adjacent to the altitude tape. The VDI displays glideslope (GS) information from an ILS source, glidepath (GP) information for a GPS approach, or barometric VNAV guidance from a GTN navigator.

7.14.10 Minimum Altitude Display and Alerting

When enabled by the pilot, an altitude minimums bug will be displayed in cyan on the altitude tape. If a radar altimeter is installed, the pilot can select between barometric or radar-altitude minimums. If installed with a G500 TXi, the minimums set on the TXi will crossfill to the GI 275.

Altitude minimums are accessed under the Menu → Options → Minimums sub menu.

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 yellow. 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 minimums altitude.

7.15 Autopilot Interfaces

The GI 275 system can interface with certain types of autopilots.

The GI 275 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).
- ☐ Course / NAV Selection coupling to the autopilot.
- ☐ Heading Bug steering to the autopilot.
- ☐ Roll Steering emulated via heading mode.
- ☐ Roll Steering capable autopilot.
- ☐ Altitude Pre-Selector integrated with the autopilot.
- ☐ Flight Director display driven from external autopilot or FD computer.
- ☐ GI 275 provides attitude / air data to autopilot

7.15.1 Navigation Data for Autopilots

The GI 275 can provide course and heading data to the autopilot based on the data selected for display on the HSI. For aircraft equipped with multiple GPS/NAV systems, the HSI can act as a selection hub for the autopilot's NAV mode. Alternatively, the NAV mode can be selected using the NAV Options menu on the ADI. The GI 275 may also provide GPS Steering (GPSS) data.

Not all autopilot systems are approved for providing vertical guidance on GPS-based approaches; consult the AFMS for the autopilot and/or GPS system.

If the installation has pilot and copilot HSIs, control of navigation course, heading, or altitude data affecting the autopilot from the co-pilot side can only be made if the systems are synchronized with each other.

If the autopilot can receive GPSS Roll Steering, the data is transmitted via a digital communications bus from the GI 275 to the autopilot. The HSI receives this data from the GPS. In dual GPS installations, the HSI sends Roll Steering information from the selected GPS source.

For autopilots which are not GPSS Roll Steering capable, the GI 275 can convert GPSS turn commands into a heading error signal for the autopilot. When the autopilot is operated in HDG mode and GPSS is selected as the GI 275's heading source, the autopilot will fly the turn commands from the GPS navigator selected on the GI 275. If an autopilot is interfaced to the GI 275 which supports GPS steering (GPSS), a menu selection is provided in the ADI (Menu → Options → NAV Options→ HDG to change the autopilot heading reference between GPSS and selected heading. When GPSS is selected, the heading bug will become hollow and the selected heading display will annunciate "GPSS" with an icon of a crossed out heading bug. The heading bug may still be adjusted by the pilot as a visual reference without affecting GPSS or its steering commands to the autopilot.

If the GPSS data is invalid (for example, if there is no active GPS leg) or the selected HSI source on HSI / ADI 1 is not GPS, the annunciated GPSS text will be yellow and a wings level command will be sent to the autopilot.

GPSS commands are not available when the CDI source is a VOR or LOC.

7.15.2 Flight Director Display

If autopilot flight director commands are interfaced to the GI 275, they will be presented as a single cue flight director on the ADI. Control of the flight director is accomplished via the autopilot/flight director controller; there are no pilot controls or adjustments for the flight director on the GI 275.

The GI 275 limits the distance the flight director pitch commands may deviate from the Aircraft Reference Symbol. If the pitch command provided by the autopilot flight director is greater than the position allowed by the GI 275, the command bars will be displayed at the maximum offset position allowed by the GI 275. As the aircraft pitch changes to satisfy the command bars, the bars will continue to be displayed at the maximum offset from the Aircraft Reference Symbol until the aircraft pitch deviation is within the command display limit.

7.15.3 Attitude and Rate Data Sources for Autopilots

Attitude-based autopilots may be interfaced to the GI 275 ADI, -20/-40 variant. If the GI 275 system is providing attitude to the autopilot, it will be noted in Section 7.15 above. Otherwise, the autopilot is receiving attitude or rate information from the standby or a remote gyro and the autopilot attitude input is independent of the attitude displayed on the GI 275 ADI.

It is recommended that pilots thoroughly familiarize themselves with the autopilot system and how it is interfaced with the GI 275 and other installed avionics to enhance operational efficiency and troubleshooting. Refer to the autopilot flight manual for more specific information.

7.16 MFD

On all MFD pages, the *nose* of the ownship symbol represents the actual location of your aircraft.

7.16.1 Map Page

A 2D moving map function is provided on the MFD. The appearance and determination of data displayed on the moving map is controlled by pilot selections made in the Menu. The Menu provides on/off controls for map overlays, a map detail selector, and a map setup button which accesses additional map controls.

The map range can be altered by “pinch zooming” the touchscreen or rotating the inner knob when the Range field is active. The range scale of the map is indicated by a range ring, centered on the ownship, with the current selected range shown at the 9 o’clock position on the ring. In addition to range adjustment, a panning function is provided to allow the position of the map to be centered on a location other than that of the ownship. The Panning mode is entered by dragging a single finger on the display and exited by touching the BACK softkey. The map orientation is continuously displayed in the top left corner of the Map Page.

The active flight plan of an interfaced navigator is shown in magenta on the Map. Traffic, Terrain, Weather, Land, and Aviation data can be selected for overlay on the Map as well.

7.16.2 Traffic Display

The MFD can display traffic data from interfaced traffic systems. Sources of traffic data include TIS-A, TAS/TCAS, and ADS-B TIS-B. The information from these systems is displayed on and may be controlled within the GI 275 MFD's Traffic Page.

NOTE

> Traffic data availability depends on the services provided in the local region/country as well as the interfaced equipment.

The Traffic Page displays traffic according to selected range, relative to the aircraft ownship. It also shows the traffic system status and allows ADS targets to be selected for more information. Traffic controls and options are contained within the Traffic Page Menu, depending on the interfaced traffic system type. A display altitude filter is also provided via Menu selection. Filtering of targets based on relative altitude is accomplished by the display and affects the traffic displayed on the Traffic, HSI Map, and Map Pages. When interfaced to a TIS-A traffic system, altitude filtering is not available.

The *center* of the traffic target icon serves as the reported location for the target aircraft.

Additional functions are provided on the dedicated traffic page when an ADS-B traffic system is interfaced, including the depiction of motion vectors.

Absolute motion vectors are white and show 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 green and depict the motion of the traffic target relative to the ownship. 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 the ownship indicates that the traffic target *is* converging with your aircraft.

For ADS-B traffic systems - if while on ground without valid magnetic heading and the aircraft stops the traffic page orientation will change from TRACK UP to LATCHED. In this mode the display remains oriented to the last valid track until a new valid track is obtained.

Traffic can be displayed on the moving map as an overlay. Additional filtering based on traffic type (all, advisories, alerts) can be selected using the Menu Traffic selection. For TIS-A traffic selection of the advisories and alerts will result in display of alerted targets only.

Traffic page units are always in nautical miles and feet. If systems units for altitude are selected to meters, then an annunciation is provided on the traffic page indicating that traffic altitudes are depicted in feet and the traffic overlay icon for the map includes a "FT" indication.

If a traffic alert occurs and the MFD is not selected to the dedicated traffic page, then a traffic "popup window" is provided which depicts the traffic and provides controls to either go to the dedicated traffic page or close the popup window. All other pages on an ADI, HSI or MFD will display a yellow TFC annunciator in the upper right corner of the screen when alerts are present.

7.17 Terrain Awareness and Alerting

The following terrain awareness and alerting functions may be provided by the GI 275 system: Terrain Proximity, Terrain FLTA, or TAWS-B. If the GI 275 system is interfaced to a GNS or GTN navigator equipped with TAWS-B, then the GI 275 will display TAWS-B parameters provided by the GNS or GTN. The Terrain or TAWS function provided by the GI 275 system is indicated by a text box on the bottom of the Terrain Page.

Terrain Proximity function is a 2D depiction of terrain, obstacle, and powerlines with no alerting. A dedicated terrain page is provided on the MFD on which the relative height of terrain, obstacles, and powerlines are depicted using color to convey the height of the obstruction relative to aircraft altitude based on database data. Obstacle and wires are displayed on the terrain page at certain zoom scales. Obstacle data is displayed at zoom settings of 10nm or less and wire data is displayed at zoom settings of 5nm or less. The Terrain Proximity function is present on the system regardless of other higher level terrain functions that may be selected.

If SVT is enabled in the GI 275 system, then the Terrain - FLTA function is provided. Forward Looking Terrain Alerts and Reduced Terrain Clearance Alerts are provided for terrain, obstacles, and wires.

If the GI 275 is interfaced to a GNS or GTN with TAWS-B enabled, then TAWS alerts are only displayed from the GPS/TAWS navigator interfaced as GPS 1 and are displayed regardless of the CDI 1-2 setting.

Visual indications are provided for terrain, obstacle, and wire alerts as follows:

- For all GI 275 configurations which provide alerts and all configurations where the GI 275 is interfaced to GNS or GTN with TAWS-B enabled:

    - An annunciator located in the upper right corner of all configured pages on ADI, HSI and MFD units provides text annunciations of alert conditions.

- For all GI 275 configurations which provide alerts and all configurations where the GI 275 is interfaced to a GTN with TAWS-B enabled:
    - If a terrain alert occurs and the MFD is not selected to the dedicated terrain page, then a terrain “popup window” is provided, which depicts the obstruction generating the alert with controls provided to either go to the dedicated terrain page, inhibit the terrain alert, or close the popup window. On a primary ADI GI 275, if a terrain alert occurs, an annunciation will illuminate in the top right corner of the display.
    - The terrain page and map page, if the terrain overlay is enabled, will depict the area or obstruction causing the alert as an area of color corresponding to the alert severity and encircling the obstruction.
    - If Synthetic Vision depiction is turned on, an area corresponding to the alert area on the map/terrain page is shaded in the corresponding color for terrain alerts. Obstacle alerts will cause the relevant obstacle to be depicted in the alert color in SVT. Powerline alerts do not have a corresponding indication in SVT.
    - In Dual ADI installations, GI 275 generated alert audio is only provided by the Pilot side GDU. If the Pilot side GDU becomes inoperative, the Co-Pilot side GDU visual annunciations may still function, but the aural alerts will not be heard.

Controls are provided for terrain, obstacle, and wire alerts as follows:

- For all GI 275 configurations in which the GI 275 system provides alerts:
    - Controls are provided in the Terrain Page menu. A “Terrain Inhibit” button inhibits terrain, obstacle, and powerline alerts when pressed. An annunciation is provided on all configured pages to indicate that alerts are inhibited. A “Terrain Test” button initiates a self-test sequence which results in aural and visual self-test annunciations.

7.17.1 Weather Data

The MFD can display weather data from interfaced datalink systems. Sources of weather data include the Garmin "GDL 69(A)" and "GDL 69(A) SXM" Sirius XM receivers and Garmin ADS-B transceivers. If one of these optional weather datalink receivers is installed, the pilot will be able to access graphical and text weather products using the MFD. Datalink weather products use color and/or timestamps to indicate the recency with which the data was received.

Selected weather products from each receiver can be overlaid on the map page as well as the enhanced HSI map while all received products can be displayed on the dedicated weather pages. The products available on the map page and HSI are different for each weather receiver. The map page and HSI provide controls to select the desired weather receiver; only one weather receiver can be selected at a time.

Text and graphical datalink weather associated with a facility can only be viewed when a database which includes that facility is installed.

The MFD can optionally display data from Stormscope® lightning detection systems. Stormscope data can be depicted on the map page, dedicated Stormscope page, and HSI map. For detailed information about the capabilities and limitations of the Stormscope system, refer to the documentation provided with that system.

7.17.2 Waypoint Information

The MFD provides pages that display information about the different waypoint types. These pages can be accessed by touching one of the supported waypoint types on the map and then pressing the provided Waypoint Info button.

7.18 Engine Indication System

Engine gages are optionally provided for single and twin engine aircraft with four and six-cylinder reciprocating engines.

The following indications are provided in all EIS installations:

- Tachometer
- Manifold Pressure (If required)
- Oil Pressure
- Oil Temperature

Other engine gauges may be provided by either the EIS display or previously installed indicators in their original locations. The following gauges may be provided on the GI 275 EIS display:

- Fuel Flow
- Cylinder Head Temperature (CHT)
- Exhaust Gas Temperature (EGT)
- Fuel Pressure
- Electrical gauges (Amps / Volts)
- Main and Auxiliary Fuel Quantity
- Carburetor Air Temperature (CAT)
- Turbine Inlet Temperature (TIT)
- Inlet Air Temperature (IAT)
- Compressor Discharge Temperature (CDT)
- IAT/CDT Differential

Additional functions provided by the EIS system include a fuel computer, hour meters, and pilot-selectable engine advisories.

The layout of EIS gauges is dependent on the GI 275 display type and number of engines. The determination of which data is presented in which slot is set by the installer in configuration mode based on data in the STC which specifies the data located in each position. The markings on the EIS gauges are the same as those markings provided by the previously installed gauges and depict the operating ranges and limitations provided in the Airplane Flight Manual and Type Certificate Datasheet.

Some previously installed aircraft gauges included non-required markings such as advisory marks for certain altitude and power combinations. EIS gauges will include all markings required to comply with operating limitations associated with that gauge. Markings not required by regulation and which do not convey limitations or operating ranges are provided to the pilot by means of a placard.

EIS gauges include display characteristics to attract the pilot's attention when outside normal operating ranges. Gauge alerting behavior in caution or warning ranges is suppressed when the engine is OFF and the aircraft is on the ground.

All gauges will highlight the digital readout in yellow or red when entering a non-safe range and cause the colorized CAUTION or WARNING annunciator to flash at the bottom of the EIS screens.

7.18.1 Tachometer

For aircraft in which a starting vibrator is installed the RPM indication is not accurate during engine cranking.

For aircraft equipped with P lead sensors to measure engine RPM, the RPM indication may momentarily fluctuate when selecting operation on a single magneto.

7.18.2 Carburetor Air Temperature

The Carburetor Air Temperature gauge (if installed) is marked with a blue arc from -15 to 5 ^{o}C which indicates a range of temperatures where carburetor icing is likely to occur. Operation in this temperature range should be avoided in conditions where carburetor icing is possible (humid air or visible moisture).

7.18.3 CHT

CHT is displayed on a graph on the CHT page. Each cylinder will numerically display it's respective CHT below the indicated bar. Additionally, CHT is displayed on a bar gauge on the main or aux gauge page. CHT on the bar gauge will indicate the temperature associated with the hottest cylinder.

7.18.4 EGT

An exhaust gas temperature gauge is provided on the EIS display for all configurations. The EIS display can provide indications of EGT for each cylinder and additionally can indicate primary EGT which is a measurement of the EGT in the exhaust manifold.

Primary EGT (if installed) will be displayed on a bar gauge on the main or aux gauge page. Cylinder specific EGT is displayed on a graph on the EGT page. Each cylinder will numerically display its respective EGT below the indicated bar. Additionally, cylinder specific EGT is displayed on a bar gauge on the main or aux gauge page. EGT on the bar gauge will indicate the temperature associated with the hottest cylinder.

7.18.5 Mixture Leaning

GI 275 EIS provides two different lean assist methods, rich of peak or lean of peak.

Lean assist mode is entered by pressing the Lean Button on the EGT page. Lean mode automatically detects the EGT peak and indicates peak by using a bar above the EGT indicator for the cylinder. As the mixture is leaned, the system will transition from "Rich of Peak" indications to "Lean of Peak" indications automatically. The system requires fuel quantity indication, fuel flow indication and EGT indication to function.

Rich of peak leaning detects and indicates the first engine cylinder to peak during the leaning process. Once the first peak in EGT is detected, the temperature differential from the recorded maximum EGT of the first cylinder to peak is displayed.

Lean of peak leaning detects and indicates the last engine cylinder to peak during the leaning process. Once the last cylinder peak EGT is detected, the system will display the temperature differential from the recorded maximum EGT of the last cylinder to peak.

NOTE

The Lean Assist is meant to aid the pilot in detecting the peak temperatures. Smooth leaning technique is required for the system to be able to accurately detect the peak temperature.

Caution should be used to ensure that, during the leaning procedure, the engine is not leaned beyond the engine or aircraft limitations and that the engine continues to operate smoothly after setting the mixture. Should any engine roughness occur during leaning, consult the aircraft POH or AFM for appropriate leaning of the engine.

The Lean Find functions are calculated using the relationship between fuel flow and EGTs. If a false EGT peak is observed and does not automatically reset, disable the Lean Find function, reset throttle and mixture controls, and reattempt.

It is recommended to set the aircraft power settings for cruise flight prior to beginning the lean find process.

7.18.6 Fuel Quantity

Usable fuel may be displayed on the EIS display. Main fuel quantities are grouped together and aux/tip fuel quantities are grouped together.

Previously installed aircraft low fuel quantity annunciators will be deactivated as part of the fuel quantity installation in some aircraft. In this case, the low fuel annunciators will be placarded as deactivated, and a red or yellow arc must be added to the fuel quantity gauge to indicate the fuel level that corresponds to the low fuel annunciation.

7.18.7 Fuel Computer

A Fuel Computer/Totalizer is provided on the Fuel page. The fuel computer function provides computation and display of estimated fuel remaining, range, endurance, endurance at destination, fuel at destination, range at destination, and fuel used. The fuel computer calculates these values using the engine fuel flow sensor, ground speed, flight plan, and estimated fuel remaining. Estimated fuel remaining is independent of the measured fuel quantity shown on the fuel quantity gauges.

CAUTION

The pilot must ensure that the initial estimated fuel quantity value is accurate. The fuel computer calculates the remaining fuel based on the initial fuel value entered by the pilot. The estimated fuel remaining is derived by the fuel computer by subtracting the measured fuel flow from the initial fuel entry. Fuel quantity indications shown on the fuel gauges may not provide the accuracy required for determination of estimated fuel remaining values. “Fuel Est” and “Act Used” buttons are available to aid the pilot in entering the initial estimated fuel.

CAUTION

The fuel computer functions must not be used as the primary means of determining the quantity of fuel in the tanks. The aircraft fuel quantity gauge(s) are the primary means of determining fuel quantity.

7.18.8 Engine Advisories

Engine advisories can be configured by the pilot from the Menu → [EIS] Main Opts to provide supplemental advisory notifications when a pilot-configured threshold has been exceeded. These thresholds are determined solely by the pilot and do not affect the EIS Page presentation, EIS operating ranges, or gauge alerting thresholds.

The following parameters may be configured by the pilot to provide advisories: High CHT, Low Oil TEMP, High Oil TEMP, CHT Cooling Rate, EGT DIFF, Low Endurance, Low EST Fuel Remaining, Low Bus Voltage, High Bus Voltage, Low Voltage, High Battery Voltage, and High TIT.

7.18.9 Engine and Airframe Timers

The Timers can be accessed from the Engine Menu.

Timer Label	Timer Function
FLIGHT	Flight timer increments in tenths of an hour whenever the aircraft is in an airborne state. This can be triggered via a weight on wheels switch, GPS ground speed, airspeed, or engine RPM depending on the aircraft installation.
HOBBS	Similar to an analog HOBBS meter that increments in tenths of an hour whenever one engine is registering >5 PSI of engine oil pressure
TACH	Similar to analog tachometers such that the timer increments in tenths of an hour based on the current engine RPM compared to the cruise power setting for that engine as determined by the installer.

On multi-engine aircraft, the TACH hour meter for each engine will start incrementing when the respective engine is running, and those TACH timers are tracked separately from one another. The HOBBS hour meter will start incrementing when either engine is running, and the HOBBS timer is synchronized for both engines.

7.19 Wireless Functions

The GI 275 has a wireless transceiver to provide data to personal electronic devices (PEDs) and includes a Bluetooth and Wi-Fi transceiver.
Data such as traffic, datalink weather, entertainment audio information, and attitude information is sent from the GI 275 to the PED. Limitations regarding database operations are found in Section 2.25.

Garmin provides a list of tested and compatible devices that can be used with the Connext platform. Connection to the GI 275 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 Flight Stream product line, please visit: http://garmin.com/connext/supported_devices

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

Mooney M20M/M20R/M20S Series

Dwg. Number: 190-02291-18 Rev. 5

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.

Airplane Serial Number: ______________________

Airplane Registration Number: ______________________

FAA Approved By: Erik Frisk

Erik Frisk
ODA STC Unit Administrator
Garmin International, Inc
ODA-240087-CE

Date: 10-SEP-2020

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

Mooney M20M/M20R/M20S

REV NO.	PAGE NO(S)	DESCRIPTION	DATE OF APPROVAL	FAA APPROVED
1	ALL	Original Issue	01/18/19	Robert G. Murray Garmin ODA STC Unit Administrator
2	ALL	Add G3X Information	3/15/19	Robert G. Murray Garmin ODA STC Unit Administrator
3	ALL	ESP/USP airspeed reference corrections	07/05/19	Robert G. Murray Garmin ODA STC Unit Administrator
4	ALL	Various Procedure Corrections	12/16/19	Robert G. Murray Garmin ODA STC Unit Administrator
5	ALL	Add GI 275 Information	See Cover	See Cover

This page intentionally left blank.

Table of Contents

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

VNAV Vertical Navigation

VOR VHF Omni-directional Range

VS Vertical Speed

YD Yaw Damper

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		Is Navigator #1 interfaced to GFC 500? ☐ YES ☐ NO
VHF Nav Radio #1		Is VHF Nav Radio #1 interfaced to GFC 500? ☐ YES ☐ NO
VHF Nav Radio #2		
Pitch Trim Servo		
Yaw Damper		

INSTALLED FEATURES CHECKLIST

The checked autopilot modes and features are available on this aircraft.

Basic AP Features

☒ Flight Director
☐ Electric Pitch Trim
☐ Yaw Damper
☒ Overspeed Protection
☒ Underspeed Protection

Vertical Autopilot Modes

☒ Pitch (PIT)
☒ Level (Zero vertical speed)
☒ Go Around (GA)
☒ Altitude Hold (ALT)
☒ Vertical Speed (VS)
☒ Altitude Capture via Altitude Preselect
☒ Indicated Airspeed (IAS)
☐ Vertical Navigation (VNAV)
☐ GPS Approach Glidepath
☐ ILS Glideslope

Electronic Stability and Protection

☒ Pitch/Roll Attitude
☒ High Speed Protection
☐ Low Speed Protection

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 C (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	6.40
G3X Software Version	8.30
GI275 Software Version	2.11

A pilot must be seated in the left pilot's seat, with seatbelt fastened, during all autopilot operations.

Do not use autopilot or yaw damper during takeoff and landing.

The GFC 500 AFCS preflight test must complete successfully prior to use of the autopilot or flight director.

The maximum fuel imbalance with the autopilot engaged is 15 gallons.

Autopilot maximum engagement speed is 185 KIAS.

Autopilot minimum engagement speed is 80 KIAS.

The autopilot must be disengaged below 200 feet AGL during approach operations.

The autopilot must be disengaged below 800 feet AGL for all operations other than approach operations.

The GFC 500 autopilot is approved for Category 1 precision approaches and non-precision approaches only.

This page intentionally left blank.

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, yaw damper (if installed), 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.

YAW AXIS FAILURE / ABNORMAL YAW DAMPER DISCONNECT

(Red YD in autopilot status box on display)

This procedure applies only if the optional yaw servo is installed:

1. AP DISC Button, YD Button on GMC, G5 Knob, G3X Autopilot Status Bar, or GI 275 Knob or Autopilot Status Button..PRESS AND RELEASE (to cancel disconnect tone)
2. Aircraft Attitude.. MAINTAIN / REGAIN AIRCRAFT CONTROL

NOTE

The yaw damper disconnect may be accompanied by an amber YD with a red X in the autopilot status box. The YD is inoperative and will not be available. The autopilot may be re-engaged and disengaged normally, but the yaw damper will remain inoperative.

PITCH TRIM FAILURE

(Red PTRIM on G5, GI275, or G3X display)

This procedure applies only 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.

5. Yaw Damper .... ENGAGE AS REQUIRED

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 to 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 80 KIAS.

SECTION 3A – ABNORMAL 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, yaw damper (if installed), ESP, and electric elevator trim will be 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..SET desired heading and SELECT HDG mode
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 necessary)

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 will be 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

This procedure applies only if the optional GPS navigator is installed:

(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 Back 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/or 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 necessary)

HEADING DATA SOURCE FAILURE

This procedure applies only if the optional heading source to the navigator is installed:

1. Autopilot .... SELECT different lateral mode (as necessary)

NOTE

Track information will be displayed on the G5, GI 275, or G3X.

GPSS will not be provided to the autopilot for heading legs.

ELEVATOR MISTRIM

(Amber TRIM UP or TRIM DOWN displayed on the G5, GI 275, or G3X)

This annunciation indicates a mistrim of the elevator while the autopilot is engaged. If an optional 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 the optional pitch trim servo is NOT installed.

1. Refer to the Normal Procedures section of this AFMS, MANUAL PITCH TRIM WITH AUTOPILOT ENGAGED.

If the optional pitch trim servo is installed:

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

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

NOTE

Electric pitch trim should be considered inoperative until the cause of the mistrim has been investigated and corrected.

YAW DAMPER DISCONNECT

(Amber YD displayed in autopilot status box on display)

This failure will only occur if the optional yaw servo is installed.

1. YD Button on GMC or G5 Knob..PRESS AND RELEASE (to cancel disconnect tone)
2. Aircraft Attitude... MAINTAIN / REGAIN AIRCRAFT CONTROL

NOTE

A flashing amber 'YD' in the autopilot status box indicates that the yaw damper has disconnected. If the disconnect was not pilot initiated, Refer to Section 3 – Emergency Procedures, YAW AXIS FAILURE / ABNORMAL DISCONNECT, for further information.

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 wheel. An autopilot disconnect tone will sound and an amber AP will be annunciated on the G5, GI 275, or G3X autopilot status box. If the optional yaw damper is installed, the AP DISC / TRIM INT button will also disconnect the yaw damper, and a disconnect tone will sound and an amber YD will be annunciated on the G5 autopilot status box.

Other ways to disconnect the autopilot include:

– Pressing the AP Key on the GMC 507 Mode Controller. If the optional yaw damper is installed, it will remain engaged until the YD Key is pressed, or the red AP DISC / TRIM INT button is pressed.

– Operating the Electric Pitch Trim Switch (located on the control wheel). If the optional yaw damper is installed, it will remain engaged until the YD Key is pressed, or the red AP DISC / TRIM INT button is pressed.

– Pulling the autopilot circuit breaker.

In the event of unexpected autopilot behavior, pressing and holding the AP DISC / TRIM INT button will disconnect the autopilot and remove all power to the servos.

Yaw Damper Engagement with Autopilot On –- Upon engagement of the autopilot, if the yaw damper is installed, it will automatically engage to provide yaw damping and turn coordination. YD will be annunciated in the autopilot status box.

Yaw Damper Engagement with Autopilot Off –- The yaw damper, if installed, may be engaged with the autopilot disengaged. This will provide yaw damping and turn coordination. YD will be annunciated in the autopilot status box.

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 set Go Around power, then 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/TRK Knob..Rotate to set heading bug to desired heading.
2. HDG Key ....PRESS
   The autopilot will turn the airplane in the direction of the heading bug.

TRACK MODE (TRK)

1. HDG/TRK Knob..Rotate to set track bug to desired track.
2. TRK Key..PRESS
   The autopilot will turn the airplane in the direction of the track bug.

NAVIGATION (VOR)

This mode will only be available if the optional VHF navigator is installed.

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 when the NAV key is pressed. 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)

This mode will only be available if the optional GPS navigator is installed.

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

This mode will only be available if the optional VHF and GPS navigator is installed.

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 prior to the final Approach Fix.

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)

This procedure applies only if the optional VHF and GPS navigator is installed:

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)

This procedure applies only if the optional GPS navigator is installed:

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. Missed Approach Altitude .... SET after GP capture
6. 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),

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 (LP, LNAV)

This procedure applies only if the optional GPS navigator is installed:

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

This procedure applies only if the optional VHF and GPS navigator is installed:

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 Back Course)
4. BC Mode ....VERIFY airplane Captures and Tracks Back 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

This procedure applies only if the optional VHF navigator is installed:

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

SECTION 5 – PERFORMANCE

No Change.

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.

SECTION 7 – SYSTEM DESCRIPTION

AFCS OVERVIEW

The GFC 500 is a digital Automatic Flight Control System (AFCS). It is a two-axis autopilot, with optional 3rd axis yaw damper, 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.

Optional Yaw Damper (YD) — The yaw servo provides Dutch roll damping and turn coordination in response to yaw rate, roll angle, lateral acceleration, and airspeed.

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, 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, optional yaw servo, that also contain autopilot processors, control wheel mounted elevator trim switch (if trim servo is installed), control wheel mounted autopilot / yaw damper 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 69 KIAS is reached, a visual MINSPD message will appear above the airspeed tape and the autopilot will lower the nose to maintain 69 KIAS. An aural “AIRSPEED, AIRSPEED” voice alert will sound for installations connected to an audio panel.

Underspeed Protection is exited automatically when airspeed exceeds 74 KIAS.

Overspeed Protection (OSP) — The GFC 500 will provide Overspeed Protection when the autopilot is engaged.

When the maximum airspeed of 185 KIAS 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 180 KIAS.

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 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 196 KIAS)
- Low airspeed below normal flight (below 65 KIAS)

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 a G5, GI 275, or G3X menu option.

The engagement and disengagement attitude limits are displayed with double hash marks on the roll indicator according to 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.

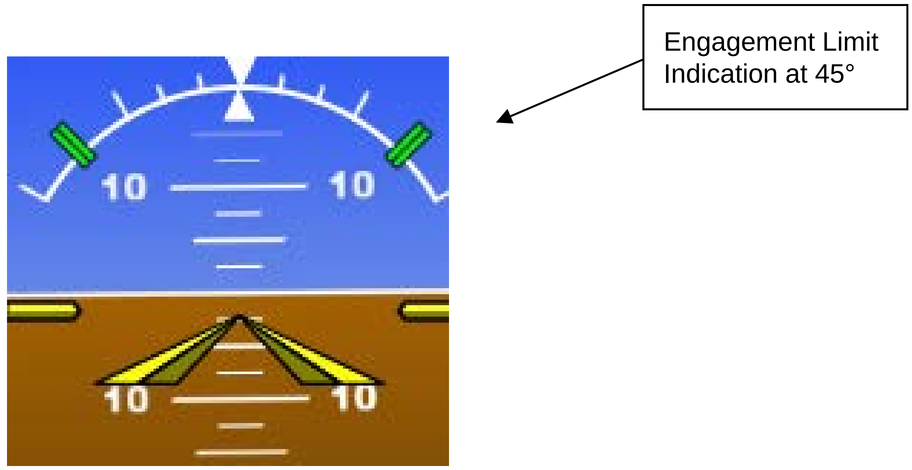


Figure 7-1: Nominal Roll Attitude ESP Engagement Limit Indications

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.

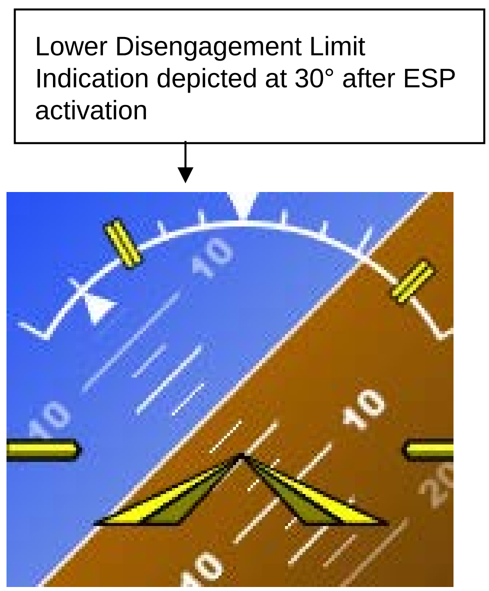


Figure 7-2: Engagement Limit Indications Upon ESP Activation

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.

AUTOPILOT CONTROL UNIT AND DISPLAY

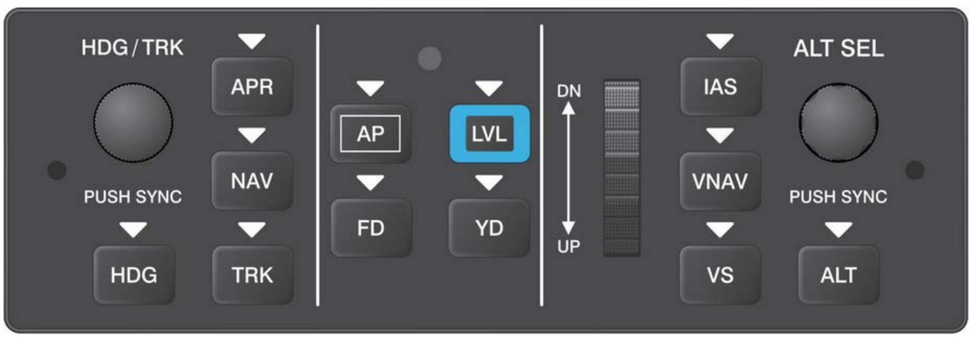


Figure 7-3: GMC 507 Control Unit (Reference Only)

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	69 to 185 KIAS	1 KT
Vertical Path Tracking (VNAV)	**VNAV** 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 196 KIAS	
ESP Low Airspeed Engagement			When above 200 FT AGL, ESP Low Airspeed engages at 65 KIAS. (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, and when VNAV is active if the Selected Altitude is to be captured instead of the VNAV Target Altitude.

** 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. At the completion of the preflight test, the PFT annunciation is removed. 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 is 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.
YD	Yaw Damper normal disconnect.

YD	Yaw Damper abnormal disconnect.
~~YD~~	Yaw Damper has failed. The Yaw Damper is inoperative.

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. When the aircraft's dimming bus is used to control cockpit lighting, the GMC 507 mode control panel lighting is controlled by the dimming bus.

INTRODUCTION

The best of engineering know-how and manufacturing craftsmanship have gone into the design and building of your Mooney Aircraft. Like any high performance airplane, it operates most efficiently and safely in the hands of a skilled pilot.

We urge you to be thoroughly familiar with the contents of your operating manuals, placards, and check list to insure maximum utilization of your airplane. When the airplane has changed ownership, some of these may have been misplaced. If any are missing, replacements should be obtained from any Mooney Marketing or Service Center as soon as possible.

For your added protection and safety, we have added this special section to the Pilot's Operating Handbook to refresh your knowledge of a number of safety subjects. You should review these subjects periodically.

Topics in this section are mostly excerpts from FAA Documents and other articles pertaining to the subject of safe flying. They are not limited to any particular make or model airplane and do not replace instructions for particular types of airplanes.

Your Mooney Aircraft was designed and built to provide you with many years of safe and efficient transportation. By maintaining it properly and flying it prudently, you should realize its full potential.

GENERAL

Flying is one of the safest modes of travel. Remarkable safety records are being established each year. As a pilot you are responsible to yourself, your relatives, to those who travel with you, to other pilots and to ground personnel to fly wisely and safely.

The following materials in this Safety section covers several subjects in limited detail. Here are some condensed DO's and DON'Ts.

DO'S

1. Be thoroughly familiar with your airplane and be current in it, or get a check ride.
2. Pre-plan all aspects of your flight-including weather.
----- **FLY YOUR PLAN** -----.
3. Use services available-FSS, Weather Bureau, etc.
4. Pre-flight you airplane thoroughly.
5. Use your check lists.
6. Have more than enough fuel for takeoff, the planned trip, and adequate reserve.
7. Be sure your weight loading and C.G. are within limits.
8. Be sure articles and baggage are secured.
9. Check freedom of all controls.
10. Maintain appropriate airspeed in takeoff, climb, descent and landing.
11. Avoid other aircraft wake turbulence.
12. Switch fuel tanks before engine starvation occurs.
13. Practice engine out, emergency landing gear extension and other emergency procedures at safe altitude; preferably with a check pilot.
14. Use caution in mountainous terrain.
15. Keep your airplane in good mechanical condition.
16. Stay informed and alert, fly in a sensible manner.

DON'TS

1. Don't take off with frost, ice or snow on the aircraft surfaces.
2. Don't take off with less than minimum recommended fuel, plus reserves.
3. Don't fly in a reckless, show off, careless manner.
4. Don't fly in thunderstorms or severe weather.
5. Don't fly in possible icing conditions. If you encounter icing conditions, alter altitude or course to minimize exposure.
6. Don't apply controls abruptly or with high forces that could exceed design loads of the airplane.
7. Don't fly when physically or mentally exhausted.
8. **DON'T TRUST TO LUCK.**

GENERAL SOURCES OF INFORMATION

There is a wealth of information available to the pilot created for the sole purpose of making your flying easier, faster, and safer. Take advantage of this knowledge and be prepared for an emergency in the remote event that one should occur. You as a pilot also have certain responsibilities under government regulations. These are designed for your own protection. Compliance is not only beneficial but mandatory.

RULES AND REGULATIONS

Federal Aviation regulations, Part 91, General Operating and Flight Rules, is a document of law governing operation of aircraft and the owner's and pilot's responsibilities.

This document covers such subjects as:

Responsibilities and authority of the pilot in command
Certificates required
Liquor and drugs
Flight plans
Pre-flight action
Fuel requirements
Flight rules
Maintenance, preventative maintenance, alterations, inspections and maintenance records

These are only some of the topics covered. It is the owner's and pilot's responsibility to be thoroughly familiar with all items in FAR Part 91 and to follow them.

FEDERAL AVIATION REGULATIONS, PART 39 -AIRWORTHINESS DIRECTIVES

This document specifies that no person may operate a product to which an airworthiness directive issued by the FAA applies, except in accordance with the requirements of that airworthiness directive.

AIRMAN INFORMATION, ADVISORIES, AND NOTICES, FAA AIRMAN'S INFORMATION MANUAL

This document contains a wealth of pilot information for nearly all realms of flight, navigation, ground procedures and medical information. Among the subjects are:

Controlled Air Space
Services Available to Pilots
Radio Phraseology and Technique
Airport Operations
Clearances and Separations
Pre-flight
Departures - IFR
Enroute - IFR
Arrival - IFR
Emergency Procedures
Weather
Wake Turbulence
Medical Facts for Pilots
Bird Hazards
Good Operating Practices
Airport Location Directory

We urge all pilots to be thoroughly familiar with and use the information in this manual.

ADVISORY INFORMATION

Airmen can subscribe to services to obtain FAA NOTAMS and Airman Advisories, and these are also available at FAA Flight Service Stations. NOTAMS are documents that have information of a time-critical nature that would affect a pilot's decision to make a flight; for example, an airport closed, terminal radar out of service, enroute navigational aids out of service, etc.

GENERAL INFORMATION ON SPECIFIC TOPICS

FLIGHT PLANNING

FAR Part 91 requires that each pilot in command, before beginning a flight, familiarize himself with all available information concerning that flight.

All pilots are urged to obtain a complete preflight briefing. This would consist of weather; local, enroute and destination, plus alternates, enroute navaid information. Also airport runways active, length of runways, take off and landing distances for the airplane for conditions expected should be known.

The prudent pilot will review his planned enroute track and stations and make a list for quick reference. It is strongly recommended a flight plan be filed with Flight Service Stations even though the flight may be VFR. Also, advise Flight Service Stations of changes or delays of one hour or more and remember to close the flight plan at destination.

The pilot must be completely familiar with the performance of the airplane and performance data in the airplane manuals and placards. The resultant effect of temperature and pressure altitude must be taken into account in determining performance if not accounted for on the charts. Applicable FAA manuals must be aboard the airplane at all times including the weight and balance forms and equipment lists.

The airplane must be loaded so as not to exceed the weight and the weight and balance loading center of gravity (c.g.) limitations. Also, that at least minimum fuel for takeoff is aboard and sufficient for the trip, plus reserves. Oil in the engines should be checked and filled as required.

INSPECTIONS - MAINTENANCE

In addition to maintenance inspections and preflight information required by FAR Part 91, a complete pre-flight inspection is imperative. It is the responsibility of the owner and operator to assure that the airplane is maintained in an airworthy condition and proper maintenance records are kept.

While the following items cannot substitute for the pre-flight specified for each type of airplane, they will serve as reminders of general items that should be checked.

SPECIAL CONDITIONS CAUTIONARY NOTICE

Airplanes operated for Air Taxi or other than normal operation and airplanes operated in humid tropics or cold and damp climates, etc., may need more frequent inspections for wear, corrosion and or lack of lubrication. In these areas periodic inspections should be performed until the operator can set his own inspection periods based on experience.

| NOTE |

The required periods do not constitute a guarantee that the item will reach the period without malfunction, as the aforementioned factors cannot be controlled by the manufacturer.

Corrosion, and its effects, must be treated at the earliest possible opportunity. A clean dry surface is virtually immune to corrosion. Make sure that all drain holes remain unobstructed. Protective films and sealants help to keep corrosive agents from contacting metallic surfaces. Corrosion inspections should be made most frequently under high-corrosion-risk operating conditions, such as in regions of heavy airborne salt concentrations (e.g., near the sea) and high-humidity areas (e.g., tropical regions).

WALK AROUND INSPECTIONS

All airplane surfaces free of ice, frost or snow.
Tires properly inflated.
All external locks, covers and tie downs removed.
Fuel sumps drained.
Fuel quantity, adequate for trip, plus reserve,(visually checked) and access doors secured.
Oil quantity checked and access doors secured.
Check general condition of airplane, engine, propeller, exhaust stacks, etc.
All external doors secured.

COCKPIT CHECKS

Flashlight available.
Required documents on board.
Use the check list.
All internal control locks removed (If installed).
Check freedom of controls.
Cabin and baggage door properly closed.
Seat belts and shoulder harnesses fastened.
Passengers briefed.
Engine and propeller operating satisfactorily.
All engine gauges checked for proper readings.
Fuel selector in proper position.
Fuel quantity checked by gauges.
Altimeter setting checked.

FLIGHT OPERATIONS

GENERAL

The pilot should be thoroughly familiar with all information published by the manufacturer concerning the airplane. The pilot is required by FAA to operate in accordance with the FAR's and the FAA Approved Airplane Flight Manual and/or placards installed.

TURBULENT WEATHER

A complete weather briefing prior to beginning a flight is the start of assurance of a safe trip. Updating of weather information enroute is another assurance. However, the wise pilot also knows weather conditions change quickly at times and treats weather forcasting as professional advice rather than as absolute fact. He obtains all the advice he can, but still stays alert through knowledge of weather changes, observations, and conditions.

Plan the flight to avoid areas of severe turbulence and thunderstorms. It is not always possible to detect individual storm areas or find the in between clear areas.

Thunderstorms, squall lines and violent turbulence should be regarded as extremely dangerous and MUST be avoided. Hail and tornadic wind velocities can be encountered in thunderstorms that can destroy any airplane, just as tornados destroy nearly everything in their path on the ground.

A roll cloud ahead of a squall line or thunderstorm is visible evidence of violent turbulence, however, the absence of a roll cloud should not be interpreted as denoting the lack of turbulence.

FLIGHT IN TURBULENT AIR

Even though flight in severe turbulence is to be avoided, flight in turbulent air may be encountered under certain conditions. Flying through turbulent air presents two basic problems, to both of which the answer is PROPER AIRSPEED. On the one hand, if you maintain an excessive airspeed, you run the risk of structural damage or failure; on the other hand, if your airspeed is too low, you may stall. If turbulence encountered in cruise or descent becomes uncomfortable to the pilot or passengers, the best procedure is to reduce speed to the maneuvering speed, which is listed in the Limitations Section of the FAA Approved Airplane Flight Manual and Pilots Operating Handbook. This speed gives the best assurance of avoiding excessive stress loads, and at the same time providing margin against inadvertent stalls due to gusts.

Beware of overcontrolling in attempting to correct for changes in altitude; applying control pressure abruptly will build up G-forces rapidly and could cause damaging structural stress loads. You should watch particularly your angle of bank, making turns as wide and shallow as possible, and be equally cautious in applying forward or back pressure to keep the nose level. Maintain straight and level attitude in either up or down drafts. Use trim sparingly to avoid being grossly mistrimmed as the vertical air columns change velocity and direction.

MOUNTAIN FLYING

Avoid flight at low altitudes over mountainous terrain, particularly near the lee slopes. -OBSERVE PUBLISHED MINIMUM ENROUTE ALTITUDES (MEA)-. If the wind velocity near the level of the ridge is in excess of 25 knots and approximately perpendicular to the ridge, mountain wave conditions are likely over and near the lee slopes. If the wind velocity at the level of the ridge exceeds 50 knots, a strong mountain wave is probable with strong up and down drafts and severe or extreme turbulence. The worst turbulence will be encountered in and below the rotor zone which is usually 8 to 10 miles downwind from the ridge. This zone is characterized by the presence of "roll clouds" if sufficient moisture is present; alto cumulus standing lenticular clouds are also visible signs that a mountain wave exists, but their presence is likewise dependent on moisture. Mountain wave turbulence can, of course, occur in dry air and the absence of such clouds should not be taken as any assurance that mountain wave turbulence will not be encountered. A mountain wave downdraft may exceed the climb capability of your airplane.

— AVOID MOUNTAIN WAVE DOWNDRAFTS —.

VFR - LOW CEILINGS

If you are not instrument rated, avoid "VFR On Top" and "Special VFR". Being caught above an undercast when an emergency descent is required (or at destination) is an extremely hazardous position for the VFR pilot.

Accepting a clearance out of certain airport control zones with no minimum ceiling and one-mile visibility as permitted with **"Special VFR" is not a recommended practice for VFR pilots.**

Avoid areas of low ceilings and restricted visibility unless you are instrument proficient and have an instrument equipped airplane. Then proceed with caution and have planned alternates.

VFR - AT NIGHT

When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain a safe minimum altitude as dictated by terrain, obstacles such as TV towers, or communities in the area flown. This is especially true in mountainous terrain, where there is usually very little ground reference and absolute minimum clearance is 2,000 feet. Don't depend on your being able to see obstacles in time to miss them. Flight on dark nights over sparsely populated country can be almost the same as IFR and should be avoided by untrained pilots.

VERTIGO -DISORIENTATION

Disorientation can occur in a variety of ways. During flight, inner ear balancing mechanisms are subjected to varied forces not normally experienced on the ground. This combined with loss of outside visual reference can cause vertigo. False interpretations (illusions) result and may confuse the pilot's conception of the attitude and position of his airplane.

Under VFR conditions the visual sense, using the horizon as a reference, can override the illusions. Under low visibility conditions (night, fog, clouds, haze, etc.) the illusions predominate. Only through awareness of these illusions, and proficiency in instrument flight procedures, can an airplane be operated safely in a low visibility environment.

Flying in fog, dense haze or dust, cloud banks, or very low visibility, with strobe lights, and particularly rotating beacons turned on frequently causes vertigo. They should be turned off in these conditions, particularly at night.
All pilots should check the weather and use good judgment in planning flights. The VFR pilot should use extra caution in avoiding low visibility conditions.

Motion sickness often precedes or accompanies disorientation and may further jeopardize the flight.

STALLS, SPINS AND SLOW FLIGHT

Stalls, and slow flight should be practiced at safe altitudes to allow for recovery. Any of these maneuvers should be performed at an altitude in excess of 6,000 feet above ground level.
Spins may be dangerous and should be avoided. In fact, most airplanes are placarded against intentional spins. Spins are preceded by stalls. A prompt and decisive stall recovery protects against inadvertent spins. All airplanes are required to have flight characteristics that give adequate advance warning of an impending stall or they must be equipped with an artificial stall warning device. Keep the artificial system in good working order. Do not operate the airplane with the device made inoperative by the use of circuit breakers or other means.

Stalls should be practiced at safe altitudes for ample recovery. Should a spin be encountered inadvertently, spin recovery should be initiated immediately.

As stall attitude is approached, be alert. Take prompt corrective action to avoid the stall or if you are practicing stalls, react the moment the stall occurs. The following is suggested:

1. Do not carry passengers. Be certain that the airplane's center of gravity is as far forward as possible. Forward CG aids spin recovery.
2. Be certain that both student pilot and instructor pilot have a full set of operable controls.
3. Conduct such practice at altitudes in excess of 6,000 ft. above ground level.

Remember that an airplane at or near traffic pattern altitude probably will not recover from a spin before impact with the ground. When descending to traffic pattern altitude and during operation in the traffic pattern and approach, maintain a safe margin above stall speed. During takeoff or go- around, be especially careful to avoid departure stalls associated with turns at low speed. Maintain speeds recommended in this handbook(Section II & V).

STANDARD PROCEDURE FOR SPIN RECOVERY

In the event of an inadvertent spin, the following recovery procedure should be used:

Throttle	**RETARD** to IDLE
Ailerons	**NEUTRAL**
Rudder	Apply **FULL RUDDER opposite** the direction of spin.
Control Wheel	**FORWARD** of neutral in a brisk motion to break stall. Additional **FORWARD** elevator control may be required if the rotation does not stop.
Flaps(If extended)	**RETRACT** as soon as possible
Rudder	**NEUTRALIZE** when spin stops.
Control Wheel	Smoothly **MOVE AFT** to bring the nose up to a level flight attitude **after spin has stopped.**

VORTICES - WAKE TURBULENCE

Every airplane generates wakes of turbulence while in flight. Part of this is from the propeller or jet engine and part from the wing tip vortices. The larger and heavier the airplane the more pronounced wake turbulence will be. Wing tip vortices from large heavy airplanes are very severe at close range, degenerating with time, wind and space. These are rolling in nature from each wing tip. In test, vortex velocities of 133 knots have been recorded.
Exhaust velocities from large airplanes at takeoff have been measured at 25 mph, 2100 feet behind medium large airplanes.

Encountering the rolling effect of wing tip vortices within two minutes or less after passage of large airplanes is hazardous to light airplanes. This roll effect can exceed the maximum counter roll obtainable in an airplane.

The turbulent areas may remain for as long as three minutes or more, depending on wind conditions, and may extend several miles behind the airplane. Plan to fly slightly above or to the upwind side of the other airplane's flight path.

Because of the wide variety of conditions that can be encountered, there is no set rule to follow to avoid wake turbulence in all situations. However, the Airman's Information Manual goes into considerable detail for a number of wake turbulence avoidance procedures. Use prudent judgment and allow ample clearance time and space following or crossing the wake turbulence of other airplanes in all takeoff, climb out, approach and landing operations. Be observant of wake turbulence from all aircraft, regardless of size.

The Airman's Information Manual contains a section on wake turbulence. FAA Advisory Circular AC 90-230 is also recommended reading.

TAKE - OFF AND LANDING CONDITIONS

When taking off on runways covered with water or freezing slush, the landing gear should remain extended for approximately ten seconds longer than normal, allowing the wheels to spin and dissipate the freezing moisture. The landing gear should then be cycled up, then down, wait approximately five seconds and then retract again. Caution must be exercised to insure that the entire operation is performed below Maximum Landing Gear Operating Airspeed.

Use caution when landing on runways that are covered by water or slush which cause hydroplaning (aquaplaning), a phenomenon that renders braking and steering ineffective because of the lack of sufficient surface friction. Snow and ice covered runways are also hazardous. The pilot should be alert to the possibility of the brakes freezing.

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GTX 33X and GTX 3X5 Transponders with ADS-B
as installed in

____
Make and Model Airplane

Registration Number: ______________ Serial Number: __________________

This document serves as an FAA Approved Airplane Flight Manual Supplement or Supplemental Airplane Flight Manual when the GTX 33X or GTX 3X5 with ADS-B is installed in accordance with Supplemental Type Certificate SA01714WI. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the FAA approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA approved Airplane Flight Manual, markings, or placards.

FAA Approved By: JR Brownell

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

Date: 6/16/2021

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
1	05/01/2013	All	Complete Supplement	*Robert Murray* Robert Murray ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *05/01/2013*
2	03/08/2016	All	New supplement format with GTX 3X5 added.	*Michael Warren* Michael Warren ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *03/08/2016*
3	12/07/2017	All	Updated SW versions and removed section 3.2.3. Updated section 2.2 Corrected PED FAR reference and additional minor corrections.	*Erik Frisk* Erik Frisk ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *12/21/2017*
4	09/09/2019	4, 6, 7, 9, 11, 13, 14, 18	Added GTX diversity units, updated SW versions, expanded allowed remote control panels, and incorporated other minor changes	*JR Brownell* JR Brownell ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *09/09/2019*
5	06/16/2021	10, 11, 14, 18	Updated GTX 3X5 Main software to version 2.60, added GI 275 as a control display and GPS 175/GNC 355 as a GPS source	See cover page 1

Table of Contents

Section 1. GENERAL

1.1 GTX 33X

The Garmin GTX 33X family consists of the GTX 330 ES and GTX 33 ES (Non-Diversity Mode S Transponders) and the GTX 330D ES and GTX 33D ES (Diversity Mode S Transponders). The ES option of any of the transponders provides ADS-B extended squitter functionality.

All Garmin GTX 33X transponders are a radio transmitter/receiver that operates on radar frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses to ground-based radar on a frequency of 1090 MHz. Each unit is equipped with IDENT capability to initiate the SPI (special position identification) pulse for 18 seconds and will reply to ATCRBS Mode A, Mode C and Mode S All-Call interrogation. Interfaces to the GTX 33X are shown in the following block diagrams.

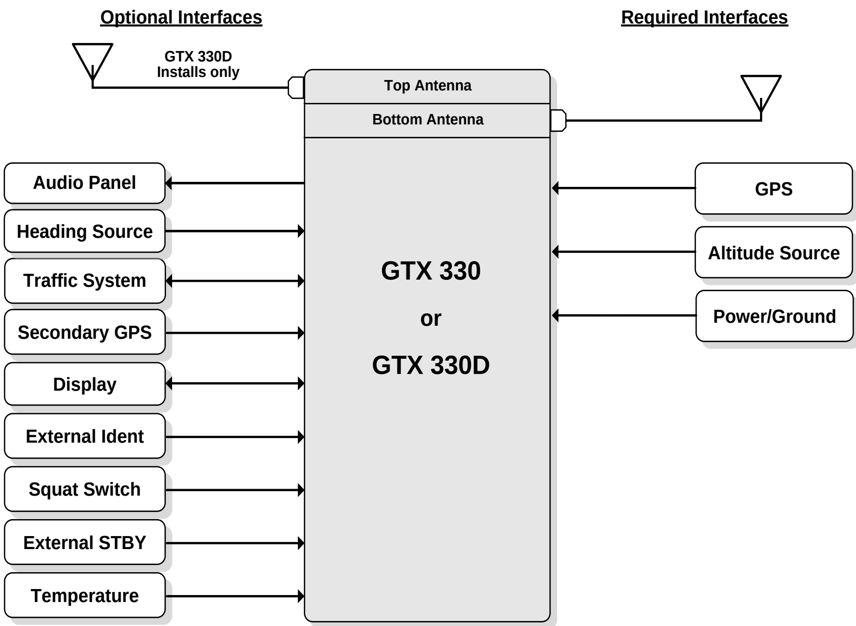


Figure 1 – GTX 330 or GTX 330D Interface Summary

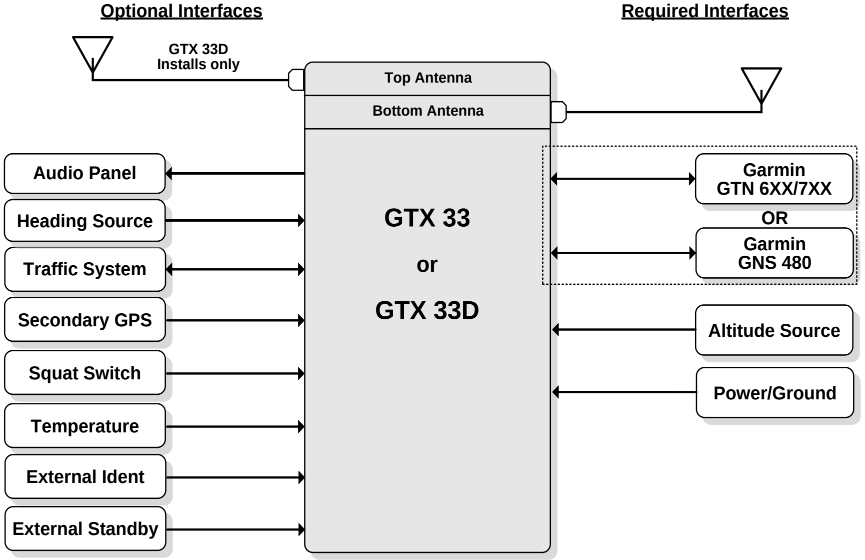


Figure 2 – GTX 33 or GTX 33D Interface Summary

The GTX 33X performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090 MHz)
    - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
        - GPS Position, Altitude, and Position Integrity
        - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
        - Air Ground Status
        - Flight ID, Call Sign, ICAO Registration Number
        - Capability and Status Information
        - Transponder Squawk Codes between 0000-7777.
        - Emergency Status
        - IDENT - initiates SPI (special position identification) pulse for 18 seconds
    - Pressure Altitude Broadcast Inhibit
- Reception of TIS-A traffic data from a ground station
- Provides TIS-A traffic alerting to the pilot via interfaced display and audio output

1.2 GTX 3X5

The Garmin GTX 3X5 family consists of the GTX 335, 335D, 335R, 335DR, 345, 345D, 345R, and 345DR transponders. The functional differences between each of these transponders are described in Table 1. Transponder models with a "D" designation are diversity capable and support both a top fuselage and bottom fuselage antenna.

Function	GTX 335/ 335D	GTX 335 w/GPS	GTX 335R/ 335DR	GTX 335R w/GPS	GTX 345/ 345D	GTX 345 w/GPS	GTX 345R/ 345DR	GTX 345R w/GPS
Panel mount	x	x			x	x		
Remote mount			x	x			x	x
Mode S	x	x	x	x	x	x	x	x
ADS-B (out)	x	x	x	x	x	x	x	x
ADS-B Traffic					x	x	x	x
FIS-B					x	x	x	x
Internal GPS		x		x		x		x
Bluetooth					x	x	x	x
Optional Garmin Altitude Encoder	x	x	x	x	x	x	x	x

Table 1 – GTX 3X5 Unit Configurations

Interfaces to the GTX 3X5 are shown in Figure 3.

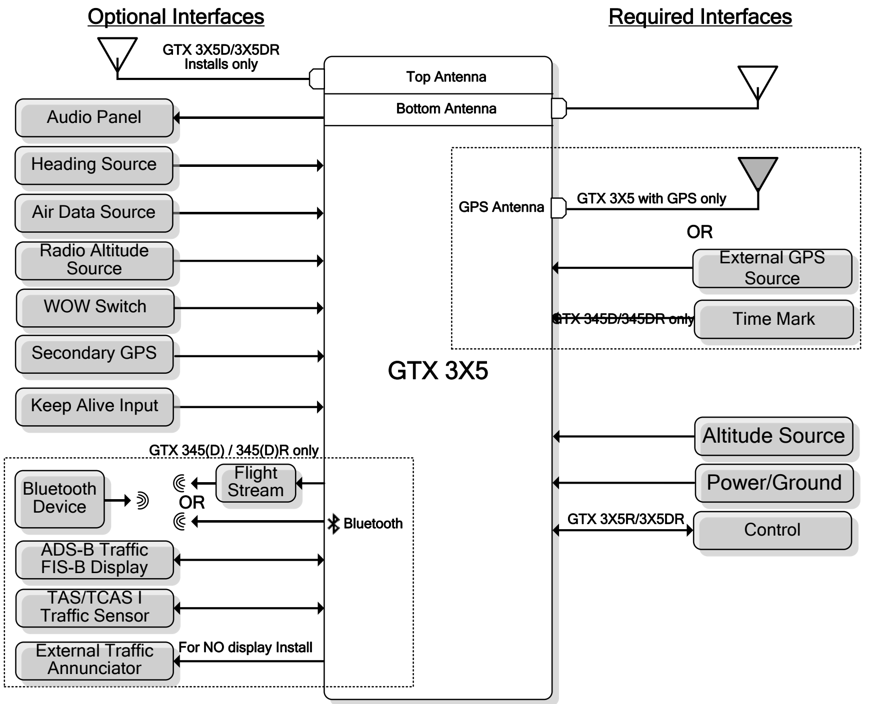


Figure 3 – GTX 3X5 Interface Summary

The GTX 3X5 performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090 MHz)
  - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
    - GPS Position, Altitude, and Position Integrity
    - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
    - Air Ground Status
    - Flight ID, Call Sign, ICAO Registration Number
    - Capability and Status Information
    - Transponder Squawk Codes between 0000-7777.
    - Emergency Status
    - IDENT - initiates SPI (special position identification) pulse for 18 seconds
  - Pressure Altitude Broadcast Inhibit

The GTX 335 performs the following additional functions:

- Reception of TIS-A traffic data from a ground station
- Provide TIS-A traffic alerting to the pilot via interfaced display and audio output.

The GTX 345 performs the following additional functions:

- Reception of ADS-B In data on 1090 MHz
  - ADS-B (Data directly from another transmitting aircraft)
  - ADS-R (Rebroadcast of ADS-B data from a ground station)
- Reception of ADS-B In data on UAT (978 MHz)
  - ADS-B (Data directly from another transmitting aircraft)
  - ADS-R (Rebroadcast of ADS-B data from a ground station)
  - TIS-B (Broadcast of secondary surveillance radar) (SSR) derived traffic information from a ground station.
  - FIS-B (Broadcast of aviation data from a ground station)
- Provide ADS-B traffic information and alerting to the pilot via an interfaced display
  - Correlation and consolidation of traffic data from multiple traffic sources
  - Aural and visual traffic alerting
- Provide FIS-B data to the pilot via an interfaced display
  - Graphical and textual weather products
    - NEXRAD
    - PIREPs
    - AIRMET/SIGMETs
    - METARs
    - TAFs
    - Winds Aloft
  - Aviation Data
    - TFRs
    - NOTAMs

1.3 Capabilities

The Garmin GTX 33X and GTX 3X5 as installed in this aircraft have been shown to meet the equipment requirements of 14 CFR § 91.227 when operating in accordance with sections 2.1 and 2.2 of this supplement.

1.4 Installation Configuration

This aircraft is equipped with a GTX 33X and/or GTX 3X5 with the following interfaces/ features:

Equipment Installed:

<u>Transponder #1</u>	<u>Transponder #2 (if installed)</u>
☐ GTX 330	☐ GTX 330
☐ GTX 330D	☐ GTX 330D
☐ GTX 33	☐ GTX 33
☐ GTX 33D	☐ GTX 33D
☐ GTX 335	☐ GTX 335
☐ GTX 335D	☐ GTX 335D
☐ GTX 335R	☐ GTX 335R
☐ GTX 335DR	☐ GTX 335DR
☐ GTX 345	☐ GTX 345
☐ GTX 345D	☐ GTX 345D
☐ GTX 345R	☐ GTX 345R
☐ GTX 345DR	☐ GTX 345DR

Interfaced GPS/SBAS Position Source(s):

GPS #1	GPS #2 (if installed)
☐ Internal	☐ Internal
☐ GTN 6XX/7XX Series	☐ GTN 6XX/7XX Series
☐ GNS 400W/500W Series	☐ GNS 400W/500W Series
☐ GNS 480	☐ GNS 480
☐ GIA 63W	☐ GIA 63W
☐ GDL 88 (GTX 330 only)	☐ GDL 88 (GTX 330 only)
☐ GPS 175/GNC 355	☐ GPS 175/GNC 355

Interfaced Pressure Altitude Source:

Pressure Altitude Source #1	Pressure Altitude Source #2 (if installed)
☐______________________	☐______________________
☐ Garmin Altitude Encoder	☐ Garmin Altitude Encoder

Interfaced Remote Control Display (Required for remotely mounted GTX variants):

Transponder #1 Remote Control Display	Transponder #2 Remote Control Display (if installed)
☐ GTN 6XX/7XX	☐ GTN 6XX/7XX
☐ GNS 480	☐ GNS 480
☐ G950/1000 Display	☐ G950/1000 Display
☐ GI 275	☐ GI 275
☐ Gables 7534 Controller	☐ Gables 7534 Controller
☐ Gables 7614 Controller	☐ Gables 7614 Controller
☐ CTL-92 Controller	☐ CTL-92 Controller
☐ CTL-92E Controller	☐ CTL-92E Controller

Interfaced Active Traffic System:

☐ None

☐ TCAD

☐ TAS/TCAS

NOTE

If the system includes all of the following components:

- GTX 345R or GTX 345DR,
- G950/1000 Display, and
- TCAD or TAS/TCAS

Then the aircraft is no longer equipped with a TSO compliant active TCAD, TAS or TCAS system. Any operational requirement to be equipped with such system is no longer met.

1.5 Definitions

The following terminology is used within this document:

ADS-B: Automatic Dependent Surveillance-Broadcast

AFM: Airplane Flight Manual

AFMS: Airplane Flight Manual Supplement

ATCRBS: Air Traffic Control Radar Beacon System

CFR: Code of Federal Regulations

ES: Extended Squitter

GNSS: Global Navigation Satellite System

GNS: Garmin Navigation System

GPS: Global Positioning System

GTX: Garmin Transponder

GTN: Garmin Touchscreen Navigator

ICAO: International Civil Aviation Organization

LRU: Line Replaceable Unit

PABI: Pressure Altitude Broadcast Inhibit

POH: Pilot Operating Handbook

SBAS: Satellite-Based Augmentation System

SW: Software

TCAS: Traffic Collision Avoidance System

TIS: Traffic Information Service

TX: Transmit

Section 2. LIMITATIONS

2.1 Minimum Equipment

The GTX 33X and GTX 3X5 must have the following system interfaces fully functional in order to be compliant with the requirements for 14 CFR 91.227 ADS-B Out operations:

Interfaced Equipment	Number Installed	Number Required
Uncorrected Pressure Altitude Source	1	1
GPS SBAS Position Source	1 or more	1
Remote Control Display (for remotely mounted transponders)	1 or more	1

Table 2 – Required Equipment

2.2 ADS-B Out

The GTX 33X and GTX 3X5 only comply with 14 CFR 91.227 for ADS-B Out when all required functions are operational. When the system is not operational, ADS-B Out transmit failure messages will be present on the remote control display interface, or the GTX 330 or GTX 3X5 panel display. If a Gables 7534 controller or Collins CTL-92/92E controller is being used the ADS-B equipment failure condition will be annunciated on the Gables or Collins display “Transponder Fail” while the ADS-B Out Position failure will be annunciated by the remotely installed “ADS-B POSN FAIL” Annunciator.

2.3 TIS Traffic Display with User Navigation Angle

Display of TIS traffic from a GTX 33/330 or GTX 335 is not permitted with an interfacing display configured for a navigation angle of “user”.

2.4 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main GTX software version is displayed on the splash screen during start up for the GTX 330 and GTX 3X5 panel mounted units, and the External LRU or System page on the interfaced remote control display for remotely mounted GTX transponders.

Software Item	**Software Version** *(or later FAA Approved versions for this STC)*
GTX 33X Main SW Version	8.04
GTX 3X5 Main SW Version	2.60

Table 3 - Software Versions

2.5 Pressure Altitude Broadcast Inhibit (PABI)

Pressure Altitude Broadcast Inhibit shall only be enabled when requested by Air Traffic Control while operating within airspace requiring an ADS-B Out compliant transmitter. PABI is enabled by selecting the GTX to ON mode.

2.6 Datalinked Weather Display (GTX 345 Only)

Do not use datalink weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by datalink weather products may not accurately depict current weather conditions.

Do not use the indicated datalink weather product age to determine the age of the weather information shown by the datalink weather product. Due to time delays inherent in gathering and processing weather data for datalink transmission, the weather information shown by the datalink weather product may be significantly older than the indicated weather product age.

Do not rely solely upon datalink services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information.

2.7 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

No Change.

3.2 Abnormal Procedures

3.2.1 LOSS OF AIRCRAFT ELECTRICAL POWER GENERATION

XPDR Circuit Breaker.. **PULL**

Transponder and ADS-B Out functions will no longer be available.

NOTE

This guidance is supplementary to any guidance provided in the POH or AFM for the installed aircraft for loss of power generation.

3.2.2 LOSS OF GPS/SBAS POSITION DATA

When the GPS/SBAS receiver is inoperative or GPS position information is not available or invalid, the GTX will no longer be transmitting ADS-B Out data.

For GTX 330 installations:

NO ADSB annunciator illuminated:

Interfaced GPS position sources........................... **VERIFY VALID POSITION**

For GTX 3X5 installations:

NO 1090ES TX annunciator illuminated:

Interfaced GPS position sources........................... **VERIFY VALID POSITION**

For GTX 33 and GTX 3X5R installations:

Reference Display Device documentation for applicable annunciation:

Interfaced GPS position sources........................... **VERIFY VALID POSITION**

Section 4. NORMAL PROCEDURES

The procedures described below are specific only to the panel mounted GTX 330 or GTX 3X5 transponders. Cockpit Reference Guides and Pilot Guides for interfaced remote control displays will provide additional operating information specific to the displays or other traffic systems.

ADS-B Out functionality resides within the GTX transponders thereby providing a single point of entry for Mode 3/A code, Flight ID, IDENT functionality and activating or deactivating emergency status for both transponder and ADS-B Out functions. Details on performing these procedures are located in the GTX 330/330D Pilot's Guide and GTX 3X5 Series Transponder Pilot's Guide.

4.1 Unit Power On

<u>For GTX 330 installations:</u>

GTX Mode.. **VERIFY ALT**
NO ADSB.. **CONSIDERED**

<u>For GTX 3X5 installations:</u>

GTX Mode.. **VERIFY ALT**
NO 1090ES TX .... **CONSIDERED**

<u>NOTE</u>

The NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) may illuminate as the unit powers on and begins to receive input from external systems, to include the SBAS position source.

4.2 Before Takeoff

For GTX 330 installations:

ADS-B TX..**VERIFY ON**
NO ADSB .... **EXTINGUISHED**

For GTX 3X5 installations:

1090ES TX CTL ....**VERIFY ON**
NO 1090ES TX .... **EXTINGUISHED**

NOTE

The ADS-B TX or 1090ES TX CTL must be turned on and the NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) must be **EXTINGUISHED** for the system to meet the requirements specified in 14 CFR 91.227. This system must be operational in certain airspaces after January 1, 2020 as specified by 14 CFR 91.225.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTION

The Garmin GTX 330 and GTX 3X5 Pilot's Guides, part numbers, and revisions listed below contain additional information regarding GTX system description, control, and function.

Title	Part Number	Revision
GTX 330 Pilot's Guide GTX 3X5 Pilot's Guide	190-00207-00 190-01499-00	Rev. G (or later) Rev. A (or later)

Pilot's Guides for interfaced displays, part numbers and revisions listed below, provide additional operating information for the Garmin GTX 33 and GTX 3X5R.

Title	Part Number	Revision
Garmin GTN 725/750 Pilot's Guide	190-01007-03	Rev. E (or later)
Garmin GTN 625/635/650 Pilot's Guide	190-01004-03	Rev. E (or later)
GNS 480 Pilot's Guide	190-00502-00	Rev. D (or later)
GTX 3X5 Series Transponder G1000 Pilot's Guide	190-01499-01	Rev. A (or later)
Garmin GI 275 Pilots's Guide	190-02246-01	Rev. F (or later)
Garmin GPS 175/GNC 355/GNX 375 Pilot's Guide	190-02488-01	Rev. B (or later)

7.1 GTX TIS Behavior

The TIS Standby/Operate controls for GTX 33/330 and GTX 335/335D units only function when the aircraft is airborne.

7.2 GTX 345R/345DR and G950/1000 No Bearing Traffic Alerts

No visual indication is provided for no bearing traffic alerts. Only an aural indication of the no bearing traffic alert is provided. If an aural alert for no bearing traffic has been previously issued, a "no bearing traffic clear" aural indication will be provided once all traffic alerts are resolved.

All aural alerts are inhibited below 500' AGL, therefore a "no bearing traffic clear" aural may not be heard in a landing or touch and go flight scenario.