IT'S PERFORMANCE THAT COUNTS!

PERFORMANCE AIRCRAFT OF HAYWARD INC

22005 SKYWEST DRIVE
HAYWARD, CALIFORNIA 94541
(415) 782-3302

VOR AC[illegible]RACY TEST

TEST LOCATION	NAV 1 ERROR	NAV 2 ERROR	DATE	SIGNATURE
HWD	-1	-3	9-6-88	RS Phillips
HWD	OSF -2	OST -3	9-25-18	J Nolan

PILOT'S OPERATING HANDBOOK
and
FAA APPROVED
AIRPLANE FLIGHT MANUAL

Mooney M20J

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR PART 3, AND CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL.

COMPLIANCE WITH ALL THE MATERIAL IN THIS FLIGHT MANUAL IS MANDATORY.

DO NOT REMOVE FROM AIRCRAFT.

This book meets GAMA Specification No. 1, Specification For Pilot's Operating Handbook, issued Feb. 15, 1975 and revised Dec. 31, 1981.

MOONEY AIRCRAFT CORPORATION
P.O. BOX 72, KERRVILLE, TEXAS 78028

SERIAL NUMBER: 24-1502

REGISTRATION NUMBER: N5772R

FAA APPROVED: C L Stoner

for
Don P. Watson, Manager
Aircraft Certification Division
FEDERAL AVIATION ADMINISTRATION
Department of Transportation
Southwest Region
Fort Worth, Texas

FAA APPROVED in Normal Category based on CAR, PART 3; applicable to Model M20J S/N listed above only.

ISSUED 10-12-84
REVISION A 2-17-88

MANUAL NUMBER 1231

LIST OF EFFECTIVE PAGES

ORIGINAL 10-12-84
REVISION A.......................... 2-17-88

Always destroy superseded pages when inserting revised pages.

LIST OF EFFECTIVE PAGES

CONTINUED - -

1231 A

PILOT'S OPERATING HANDBOOK AND AIRPLANE FLIGHT MANUAL
LOG OF REVISIONS

WARNING: This manual may not include the latest revisions.

Revision Number	Revised Pages	Description of Revisions	FAA Approved	Date
A	1-3, 1-4 1-8, 3-7, 4-14, 4-15, 7-23, 7-40	Relocated Data Added Data	H A Armstrong	2-17-88
	2-5, 3-3, 3-4, 3-5, 4-6, 4-7, 4-9, 4-13, 4-17, 7-44	Changed Data		
	2-11, 4-4, 6-5, 7-34, 8-6	Added or Changed Data		
	4-5, 7-39, 7-40	Changed Page Layout		
	7-4	Deleted Data		
	7-35	Corrected Typo		

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

PILOT'S OPERATING HANDBOOK AND AIRPLANE FLIGHT MANUAL
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The revised portions of affected pages are indicated by vertical black lines in the margin.

CONTENTS

MOONEY M20J

Section I

SECTION I
GENERAL

MOONEY M20J

TABLE OF CONTENTS

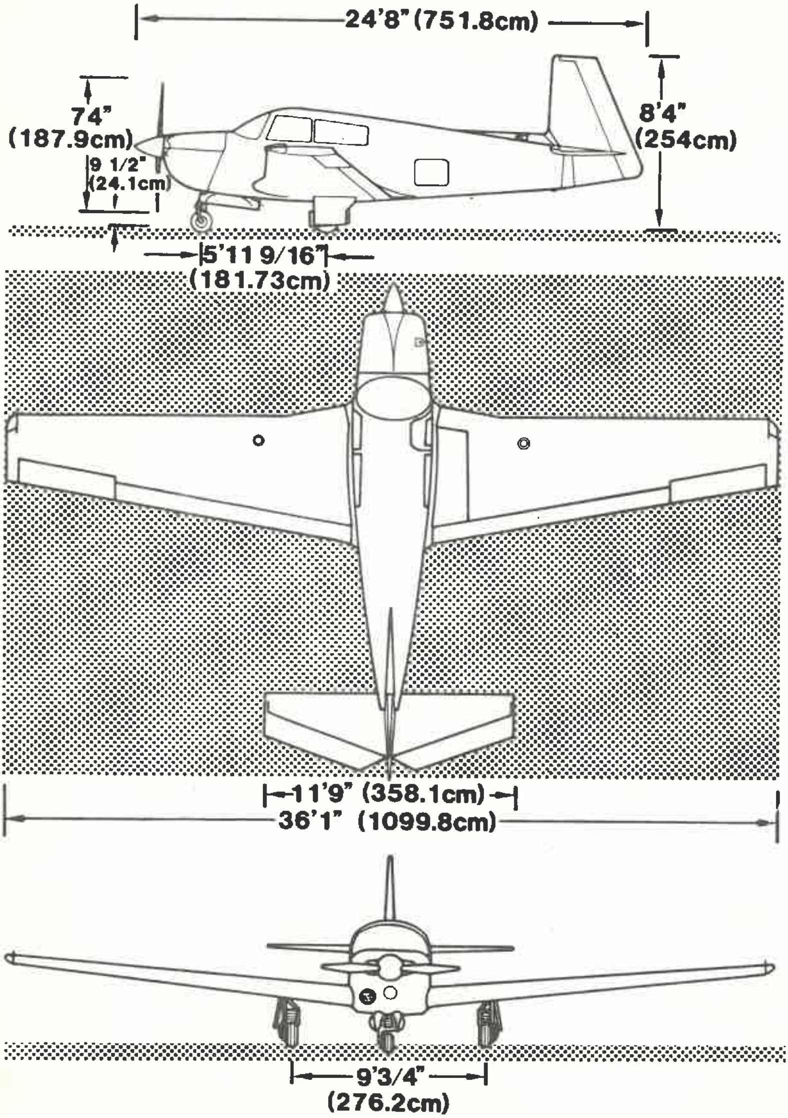


FIGURE 1-1 THREE VIEW

SECTION I
GENERAL

MOONEY M20J

INTRODUCTION

This Pilot's Operating Handbook contains 10 sections and includes the material required to be furnished to the pilot by CAR Part 3. Section IX contains supplemental data supplied by Mooney Aircraft Corporation.

Section I contains information of general interest to the pilot. Section IX contains definitions of the terminology used in this Pilot's Operating Handbook.

DESCRIPTIVE DATA

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 14 degrees left or right of center.

Wheel Base..............71 9/16 in. (181.73 cm)
Wheel Thread............108 3/4 in. (276.2 cm)
Tire Size:
Nose.......................5.00 x 5 (6 ply)
Main.......................6.00 x 6 (6 ply)
Tire Pressure:
Nose.................................49 PSI
Main.................................30 PSI
Min. Turning Radius
(No brakes applied)............41 ft. (12.5 m)

ENGINE

Number of engines..........................1
Engine Manufacturer..............AVCO Lycoming
Model..........................IO-360-A3B6D
Recommended TBO.....................1800 Hours
Type...................Reciprocating, aircooled, fuel injected.
Number of cylinders............4, Horizontally opposed
Displacement...........361 Cu. In. (5915.7 cc)
Bore......................5.125 In. (13.02 cm)
Stroke....................4.375 In. (11.11 cm)
Compression ratio..........................8.7:1

Fuel System
Type....................Fuel Injection Flow
Make.....................Bendix, RSA-5-AD1
Fuel-Aviation Gasoline.........100 or 100LL
min. grade

Accessories
Magnetos..................Bendix D4LN 2021
or D4LN3021
Spark Plugs.................18 MM X .750-20
Thd. Connection
Alternator.............Prestolite 12V, 60A
Starter....................Prestolite 12V

Ratings:
Maximum Continuous Sea
Level BHP-RPM...................200 - 2700

PROPELLER
Number..1
Manufacturer..........................McCauley*
Model Number..............B2D34C214/90DHB-16E*
Number of Blades...........................2
Diameter...........Max. 74.0 in. (187.9 cm)*
Min. 73.0 in. (185.4 cm)*
Type.........................Constant Speed
Governing............Hydraulically controlled
by engine oil

Blade Angles @ 30 in. Sta.:
Low..............13.9 degrees +/- .2 degrees*
High............33.0 degrees +/- .5 degrees*

*OPTION: Hartzell HC-C2YK-1BF/F7666A-3Q
73.0" (185.42 cm) (No cutoff allowed)
Blade Angles: @30 in. sta.
Low: 14.1 degrees +/- .1 degree
High: 29.3 degrees to 31.3 degrees
Spinner: Hartzell No. A2295

FUEL
Minimum Fuel Grade (Color).....100/130 (Green)
100 LL (Blue)
Total Capacity...................66.5 U.S. Gal.
(251.8 Liters)
(55.4 Imp. Gal.)

Usable..........................64.0 U.S. Gal.
(242.4 Liters)
(53.3 Imp. Gal.)

OIL

Total Oil Capacity........8 Qts. (7.57 Liters)
Oil Capacity Minimum for Flight.........5 Qts. (4.73 Liters)
Oil Filter..............................Full Flow

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

MAXIMUM CERTIFICATED WEIGHTS

Maximum Loading (unless limited by C.G. envelope)

Gross Weight...............2740 Lbs. (1243 Kg)
Baggage Area................120 Lbs. (54.4 Kg)
Hat Rack.....................10 Lbs. (4.54 Kg)
Cargo (Rear Seats
Folded Down)...............340 Lbs. (154.2 Kg)

STANDARD AIRPLANE WEIGHTS

Basic Empty Weight...............See Page 1-10
Useful Load..............Varies with installed equipment. See Section VI for specific airplane weight (pg. 6-5).

CABIN AND ENTRY DIMENSIONS

Cabin Width (Maximum)......43.5 In. (110.5 cm)
Cabin Length (Maximum).........114 In. (290 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............35 In. (88.9 cm)
Compartment Height............35 In. (88.9 cm)
Compartment Volume..........17.0 Cu. Ft. (.476 cubic meters)
Cargo Area (with rear
seat folded down)...........33.0 Cu. Ft. (.924 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........................16.4 Lbs./Sq. Ft. (80.07 Kg/sq. m)

Power Loading @ Maximum Gross Weight......................13.7 Lbs./HP (6.21 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

g	Acceleration due to gravity.
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.

Va	MANEUVERING SPEED - The maximum speed at which application of full available aerodynamic control will not overstress the airplane.
Vfe	MAXIMUM FLAP EXTENDED SPEED - The highest speed permissible with wing flaps in a prescribed extended position.
Vle	MAXIMUM LANDING GEAR EXTENDED SPEED - The maximum speed at which an aircraft can be safely flown with the landing gear extended.
Vlo	MAXIMUM LANDING GEAR OPERATING SPEED - The maximum speed at which the landing gear can be safely extended or retracted.
Vne	NEVER EXCEED SPEED or MACH NUMBER - The speed limit that may not be exceeded at any time.
Vno	MAXIMUM STRUCTURAL CRUISING SPEED - The speed that should not be exceeded except in smooth air and then only with caution.
Vs	STALLING SPEED - The minimum steady flight speed at which the airplane is controllable.
Vso	STALLING SPEED - The minimum steady flight speed at which the airplane is controllable in the landing configuration.
Vx	BEST ANGLE-OF-CLIMB SPEED - The airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
Vy	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 - The power developed by the engine.
MCP	MAXIMUM CONTINUOUS POWER - The maximum power for takeoff,normal,abnormal or emergency operations.
MP	MANIFOLD PRESSURE - Pressure measured in the engine's induction system and is expressed in inches of mercury (Hg).
RPM	REVOLUTIONS PER MINUTE - Engine speed.
NRP	NORMAL RATED POWER.

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.
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, from the lowest through the highest power settings.
Mixture Control	Provides a mechanical linkage to the fuel injector mixture 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.
Tachometer	An instrument that indicates rotational speed of the engine. The speed is shown as propeller revolutions per minute (RPM).
Propeller Governor	The device that regulates the 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 presure 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 degrees F); (3) The pressure at sea level is 29.92 inches Hg (1913.2 mb); (4) The temperature gradient from sea level to the altitude at which the temperature is -56.5 degrees C (-69.7 degrees F) is -0.00198 degrees C (-0.003564 degrees 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 (previously Centigrade).
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 aircraft. It includes the weight of the 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 airplane propulsion.
Useful Load	The basic empty weight subtracted from the maximum weight of the aircaft. 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

Section II

SECTION II
LIMITATIONS

MOONEY M20J

TABLE OF CONTENTS

SECTION II
LIMITATIONS

MOONEY M20J

INTRODUCTION

Section II includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the airplane, its engine, standard systems and standard equipment. The limitations included in this section 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 M20J.

SECTION II
LIMITATIONS

MOONEY M20J

AIRSPEED LIMITATIONS

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

	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	195	198	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	174	176	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed at lb./Kg. 1941/880 2250/1021 2470/1120 2740/1243	 95 103 108 114	 97 105 110 116	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed	109	115	Do not exceed this speed with flaps in full down position.
V_{LE}	Maximum Landing Gear Extended Speed	130	132	Maximum speed at which the aircraft can be safely flown with the landing gear extended.
V_{LO} (EXT)	Max. Speed for Gear Extension	130	132	Max. speed at which the ldg. gear can be safely extended.
V_{LO} (RET)	Max. Speed for Gear Retraction	104	107	Maximum speed at which the landing gear can be safely retracted.

	Maximum Pilot Window Open Speed	130	132	Do not exceed this speed with pilot window open.

FIGURE 2-1 AIRSPEED LIMITATIONS

MOONEY M20J

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 (Full Flap Operating Range)	55-115	Lower limit is maximum weight Vso in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc (Normal Operating Range)	63-176	Lower limit is maximum weight Vs with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc (Caution Range)	176-198	Operations must be conducted with caution and only in smooth air.
Radial Red Line	198	Maximum speed for all operations.

FIGURE 2-2 AIRSPEED INDICATOR MARKINGS

POWER PLANT LIMITATIONS

Number of Engines....................................1
Engine Manufacturer...................Avco Lycoming
Engine Model Number...................IO-360-A3B6D
Engine Operating Limits for
Takeoff and Continuous Operations:
Maximum Power...............................200 BHP
Maximum Engine Speed.......................2700 RPM
Transient Engine RPM Limit..........2970 RPM for
3 seconds or less
Max. Cylinder Head Temperature....475 Degrees F
(246 Degrees C)
Maximum Oil Temperature............245 Degrees F
(118 Degrees C)
Oil Pressure
Normal Operating........................30-80-PSI
Minimum (IDLE ONLY)........................25 PSI
Maximum (cold oil).........................100 PSI
Fuel Pressure
Minimum--------------------------------14 PSI
Maximum--------------------------------30 PSI
Fuel Grade (Color)..................100/130 (Green)
100LL (Blue)
Number of Propellers.................................1
Propeller Manufacturer....................McCauley*
Propeller Model Number........B2D34C214/90DHB-16E*
Propeller Diameter:
Min.........................73.0 In. (185.4 cm)*
Max. (No cutoff allowed)...74.0 In. (187.9 cm)*
Propeller Blade Angles @ 30 In. sta.:
Low..................13.9 Degrees +/- .2 Degrees*
High................33.3 Degrees +/- .5 Degrees*
Propeller Operating Limits.................2700 RPM

*OPTION: Hartzell HC-C2YK-1BF/F7666A-3Q
73.0 In. (185.4 cm) (No Cutoff Allowed)
Low: 14.1 +/- .1 Degree
High: 29.3 Degrees to 31.3 Degrees

100LL fuel is calibrated at 5.82 lb/gal.
100/130 octane fuel is calibrated at 6.0 lb/gal.

NOTE

No cutoff allowed on propeller when de-ice boots are installed.

MOONEY M20J

POWER PLANT INSTRUMENT MARKINGS

INSTRUMENT	YELLOW ARC (CAUTION RANGE)	GREEN ARC NORMAL OPERATING	REDLINE MAXIMUM LIMIT
Tachometer	1500-1950	1950-2700	2700 RPM
Cylinder Head Temperature		300-450 Degrees F 149-232 (Deg. C)	475 Degrees F 246 (Deg. C)
Oil Temperature		150-245 Degrees F 65-118 (Deg. C)	245 Degrees F 118 (Deg. C)
Oil Pressure	(IDLE ONLY) 25 - 60 * **	60-90 PSI	100 PSI
Fuel Pressure	Radial Red Line Min. 14 PSI	14-30 PSI	30 PSI

* Yellow arc (starting and warm-up range)........................90-100 PSI

**Radial red line (minimum idling)..........25 PSI

NOTE

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

SECTION II
LIMITATIONS

MOONEY M20J

WEIGHT LIMITS

Maximum Weight (takeoff and landing)....................2740 lb. (1243 Kg.)
Maximum Weight in Baggage Compartment...................120 lb. (54.4 Kg.) @ Fus. Sta. 95.5
Maximum Weight in Hatrack......10 lb. (4.54 Kg.) @ Fus. Sta. 119.0
Maximum Weight in Cargo Area (Rear seats folded down)..........340 lbs. (154.2 Kg) @ Fus. Sta. 70.7

CENTER OF GRAVITY (GEAR DOWN)

Most Forward-41.0 In. (Fus. Sta. in IN.)
13.4% MAC....................................2250 lb. (1021 Kg.)

Intermediate Forward-41.8 In. (Fuse. Sta. in In.)
14.7% MAC....................................2470 lb. (1120 Kg.)

Forward Gross-45.0 IN. (Fus. Sta. in IN.)
20.1% MAC....................................2740 lb. (1243 Kg.)

Aft Gross-50.1 IN. (Fus. Sta. in IN.)
38.7% MAC....................................2740 lb. (1243 Kg.)

MAC (at Wing Sta. 93.83)..................59.18 In.

Datum (station zero) is 5 inches aft of the center line of the nose gear attaching bolts, and 33 inches forward of the wing leading edge at wing station 59.25.

NOISE LIMITS

The certificated noise level for the M20J at 2740 lbs. (1243 Kg.) maximum weight is 74.0 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.

MANEUVER LIMITS

MOONEY M20J

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

Extreme sustained sideslips may result in fuel venting thereby causing fuel fumes in the cabin.

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

Takeoff maneuvers, prolonged sideslips or steep descents when the selected fuel tank contains less than 8 gallons (48.0 lbs., 30.3 liters, 6.6 IMP. Gal.) of fuel have not been demonstrated and may cause loss of power.

NOTE

Up to 290 foot altitude loss may occur during stalls at maximum weight.

Slow throttle movement required at airspeed above 165 KIAS. Above 165 KIAS, rapid throttle movement may result momentary propeller RPM overspeed.

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.

KINDS OF OPERATION LIMITS

This is a Normal Category airplane approved for VFR/IFR day or night operations when equipped in accordance with FAR 91.

DO NOT OPERATE IN KNOWN ICING CONDITIONS.

Autopilot Limitations - See Section IX.

FUEL LIMITATIONS

NOTE

A reduced fuel quantity indicator is installed in each tank. The bottom tip of these indicators shows the 25 U.S. gallon (94.7 liters) (20.8 IMP. Gal.) usable fuel level in each tank.

NOTE

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

Standard Tanks (2) 33.25 U.S. Gal. each ....(125.9 Liters) (27.7 Imp. Gal.)

Total Fuel: 66.5 U.S. Gal..........(251.8 Liters) (55.4 Imp. Gal.)

Usable Fuel: 64.0 U.S. Gal.........(247.4 Liters) (53.3 Imp. Gal.)

Unusable Fuel: 2.5 U.S. Gal...........(9.5 Liters) (2.1 Imp. Gal.)

Fuel Grade (and Color): 100/130 minimum grade aviation fuel (green). 100LL (low lead) aviation fuel (blue) with a lead content limited to 2 cc per gallon is also approved.

CAUTION

To reduce the possibility of ice formation within the aircraft or engine fuel system it is permissable 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.

OPERATING ALTITUDE LIMITATIONS

If this airplane is not equipped with an approved oxygen system and flight operations above 12,500 feet are desired, this airplane must be, (1) equipped with supplemental oxygen in accordance with FAR 23.1441, (2) operated in accordance with FAR 91 or FAR 135.

OTHER INSTRUMENTS AND MARKINGS The following standard equipment is vacuum operated.

1. Artificial horizon.
2. Directional Gyro.

DECALS AND PLACARDS

CABIN INTERIOR

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

OPERATIONAL LIMITATIONS

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS. NO AEROBATIC MANEUVERS, INCLUDING SPINS, ARE APPROVED. MAXIMUM SPEED WITH LANDING GEAR EXTENDED, 132 KIAS. MAXIMUM SPEED TO RETRACT GEAR, 107 KIAS. MAXIMUM SPEED TO EXTEND GEAR, 132 KIAS. MAXIMUM MANEUVERING FLIGHT LOAD FACTOR—FLAPS UP +3.8, -1.5; DN +2.0, -0.

EMERGENCY MANUAL GEAR EXTENSION

1. PULL LANDING GEAR 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.

On Left Side Panel

DEFROSTER PULL ON	CABIN HEAT PULL ON	CABIN VENT PULL ON

CHECK LIST

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

Console Below Controls

PULL FOR
ALTERNATE
STATIC SOURCE

On Lower Left Instrument Panel

DO NOT OPEN
ABOVE 132 KIAS

On Pilots Window

AVOID CONT. OPERATION BETWEEN
1500 & 1950 RPM W/POWER SETTINGS
BELOW 15" HG. MANIFOLD PRESSURE.

On Right Instrument Panel Adjacent to Tachometer (McCauley propeller only).

RAM AIR
PULL ON

PARK BRAKE
PULL ON

COWL FLAPS
PULL OPEN

On Lower Console Below Controls

PUSH TO RELEASE

Between Seats on Emergency Gear Extension Release

MIKE

PHONE

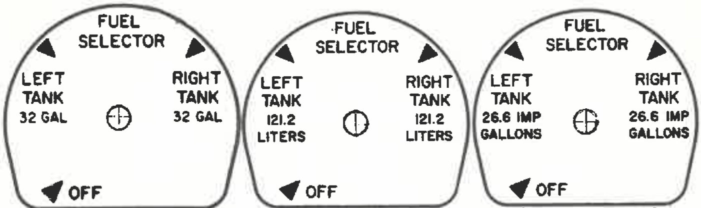
Lower Left Instrument Panel

ENCODER
ON
OFF

WARNING:
FOR AVIATION
EMERGENCY
USE ONLY.
UNLICENSED
OPERATION
UNLAWFUL.

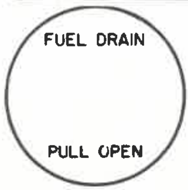
ELT
ON
ARM

ELT Placard - Top Right Instrument Panel
(Legend Varies With Equipment Installed)



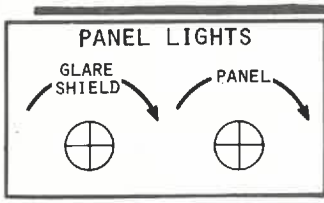
(Standard) (Optional) (Optional)

Floor Board Aft Of Console

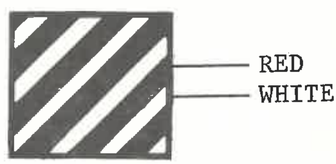


Floor Board Fwd Of Pilot Seat

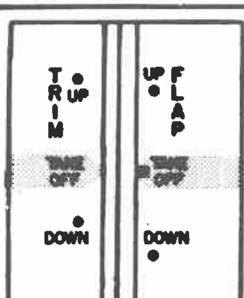
On Magnetic Compass



Right Lower Radio Panel



On Retract Tube
(Displayed thru window on floorboard when LDG. GR. is retracted.)



On Lower Engine Control Console

Above Inside Door Handle

AUXILLARY EXIT
DO NOT OPEN IN FLIGHT
TO OPEN - PULL OFF COVER, PULL WHITE KNOB, LIFT UP HANDLE
(LATCH DOOR WITH OUTSIDE HANDLE)

Above Inside Baggage Door Handle

FLAPS UP

Right Console
Above and Below
Flap Switch

FLAPS DN

On Retract Tube

(Displayed thru window in floorboard when LDG. GR. is extended.)

THROTTLE PUSH INCREASE | **PROP PUSH INCREASE** | **MIXTURE PUSH RICH**

Above Each Control on Lower Instrument 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

Above Baggage Compartment On Hatrack Shelf.

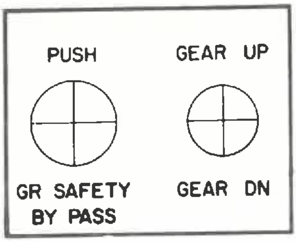
WARNING: DO NOT EXCEED 120 LBS
(54.4 Kg) IN THIS COMPARTMENT
SEE AIRCRAFT LOADING SCHEDULE DATA
FOR BAGGAGE COMPARTMENT ALLOWABLE

On Top Baggage Door Jamb.

WARNING:

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

On Forward End of Rear Seat Bottom Structure



Upper Center
Instrument Panel

GLARE SHIELD — PANEL

Under Right Radio
Panel (Fuses)

BUS — BATT

Under circuit
Breaker Panel
(Fuses)

FUSELAGE INTERIOR

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

MAINTAIN ↓

LEVEL HERE

On Hydraulic
Brake Reservoir

EXTERIOR:

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

TIRE PRESSURE 30 LBS.

On Main Gear Doors

TIRE PRESSURE 49 LBS

On Nose Gear Door

FUEL – 100 (GREEN) OR
100 LL (BLUE) MIN. OCT.
32 U.S. GAL

STANDARD

FUEL-100 (GREEN) OR
100 LL (BLUE) MIN OCT
121.2 LITERS USEABLE

OPTIONAL

FUEL-100 (GREEN) OR
100 LL (BLUE) MIN OCT
26.6 IMP GAL USEABLE

OPTIONAL

On Fuel Tank Caps

TOWING LIMITS

WARNING
DO NOT EXCEED
TOWING LIMITS

On Nose Gear Leg

DO NOT PUSH

On Leading Edge of Horizontal Stabilizer and Trailing Edge of Both Sides of Rudder

---

NO STEP

On Inboard End Of Flaps, Wing Leading Edges and Wing Ahead Of Flaps

---

HOIST POINT

On Underside of Wings (2 plcs)

INFORMATIONAL:
The following placards are not required for airworthiness but are provided for informational purposes or aesthetics.

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

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

Above Battery On Aft Side Baggage Compartment Bulkhead

Front Center of Control Wheels

DIM OFF BRT
CABIN LIGHT

On Headliner By Interior Light Switches

AIR VENT
— OPEN →

On Headliner Near overhead shutoff valve.

OPTIONAL:
See Section IX Supplements For Optional Placards Required.

Section III

SECTION III
EMERGENCY PROCEDURES

MOONEY M20J

TABLE OF CONTENTS

SECTION III
EMERGENCY PROCEDURES

MOONEY M20J

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.

ANNUNCIATOR PANEL WARNING LIGHTS

WARNING LIGHT	FAULT & REMEDY
Gear Unsafe	Landing gear is not in fully extended or retracted position. Refer to "Failure of landing gear to extend electrically" procedure on page 3-12 or "Failure of Landing Gear to Retract" procedure on page 3- 13
Left or Right Fuel Low	2 1/2 to 3 gallons of usable fuel remain in the respective tanks. Switch to fuller tank.
VAC (Flashing)	Suction is below 4.25 inches of mercury.
VAC (Steady)	Suction is above 5.5 inches of mercury.

NOTE

Attitude and directional gyros are unreliable when VAC light is illuminated. Vacuum system should be checked and/or adjusted as soon as practicable.

Volts (Flashing)	Low voltage. Refer to "Alternator Low Voltage" on page 3-10.
Volts (Steady)	Overvoltage or trippage of voltage relay. Refer to "Alternator Failure" on page 3-10.
RAM Air	RAM air is on (when landing gear is extended); close before landing.
Start Power ON	Switch or relay has malfunctioned and starter is

energized. Flight should be terminated as soon as practicable. Engine damage may result.

ENGINE

POWER LOSS - DURING TAKEOFF ROLL

Throttle....................................CLOSED
Braking....................................Maximum
Fuel Selector..................................OFF
Magneto/Starter Switch.........................OFF
Master...OFF

POWER LOSS - AFTER LIFTOFF AND DURING CLIMB

Lower nose, establish best glide speed.
Fuel selector............OTHER TANK (fullest tank)
Throttle...........................Full FORWARD
Mixture...............................Full RICH
Magneto switch..................................BOTH
Propeller..............................High RPM
High Boost.......................................ON

If engine does not restart, proceed to POWER OFF LANDING, page 3-10.

POWER LOSS - IN FLIGHT

Immediately upon noting any condition that could eventually lead to an engine failure (loss of oil or fuel system presure, or rough engine operation) ,perform the following checks if time and altitude permit.

Low Fuel Quantity.................Fuel selector to fullest tank
Low Fuel Pressure............Aux. fuel pump on-off if no improvement noted
Mixture Control..........................Full RICH

Magneto/Starter Switch..........Switch to LEFT and RIGHT single magneto operation; if no improvement, switch to BOTH

If no improvement is noted, proceed to LAND as soon as practicable.

AIR START PROCEDURE

Throttle..............................OPEN 1/4 Travel
Propeller....................................2700 RPM
Fuel Pressure...................................CHECK
If no fuel pressure is noted:
Fuel Boost Pump....................................ON
Fuel Selector............OTHER TANK (fullest tank)
Magneto Starter/Switch ....Check on "BOTH"
Mixture.....................IDLE CUTOFF (Initially)
Mixture..................Advance slowly toward RICH until engine starts
When engine starts..............Retard throttle to desired power setting
Boost...OFF

Re-establish cruise power and RPM - then lean mixture as required.

If engine does not restart establish best glide speed and proceed to POWER OFF LANDING, page3-10.

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)
Landing Gear..................DOWN or UP, depending on terrain
Wing Flaps.....................EXTEND, as necessary

NOTE

If fire is not extinguished, attempt to increase airflow over the engine by increasing glide speed and open cowl flaps. Plan a power off landing as described in this section. Do not attempt an engine restart.

ENGINE ROUGHNESS

//////////////
///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 on page 3-4.

Severe roughness may be sufficient to cause propeller separation. Do not continue to operate a rough engine unless there is no other alternative.

Engine Instruments..............................CHECK
Fuel Selector.............................OTHER TANK
Mixture..................READJUST to power setting being used
Ignition.............CHECK if mixture readjustment is ineffective
Throttle....................RETARD until roughness is minimal
Magneto/Starter.................R then L, BOTH. If roughness disappears on single ignition, adjust power and continue
If severe engine roughness cannot be eliminated LAND as soon as practicable.

HIGH CYLINDER HEAD TEMPERATURE

Mixture.....................READJUST to proper fuel flow for power being used
Cowl Flaps........................OPEN as required
Airspeed.................................INCREASE
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

Monitor...............Oil temperature and pressure
Pressure below 25 PSI.......Expect engine failure, proceed to POWER OFF landing page 3-10.

ENGINE DRIVEN FUEL PUMP FAILURE

An engine driven fuel pump failure is probable when the engine will only operate with the boost pump on. Operation of the engine with a failed engine driven fuel pump and the BOOST ON will require smooth operation of the engine controls and corresponding mixture change when the throttle is repositioned or the engine speed is changed. When retarding throttle or reducing engine speed lean the mixture to prevent the engine from quitting from an overrich condition. Enrich the mixture when opening the throttle or increasing engine speed to prevent engine stoppage from a lean condition. Always lean to obtain a smooth running engine. The following procedure should be followed when a failed engine driven fuel pump is suspected:

Mixture...............................IDLE CUTOFF
Throttle...........................CRUISE Position
Boost Pump.......................................ON
Mixture..........Increase until engine starts and adjust for smooth engine operation
LAND as soon as practicable.

SMOKE & FIRE

ENGINE FIRE-GROUND

Mixture........................IDLE CUTOFF (Full Aft)
Fuel Selector Valve..............................OFF
Magneto/Starter Switch...........................OFF
Master Switch....................................OFF
Extinguish with Fire Extinguisher.

ELECTRICAL FIRE IN FLIGHT (Smoke in Cabin)

Master Switch....................................OFF

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

Stall warning is not available with master switch OFF. Gear warning is not available with master switch 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
Select ESSENTIAL switches ON one at a time, and permit a short time to elapse before activating an additional circuit.

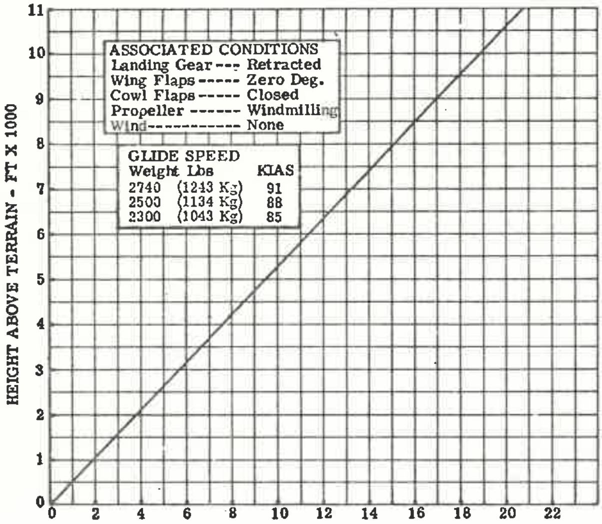
EMERGENCY DESCENT PROCEDURE

In the event an emergency descent from high altitude is required, rates of descent of approximately 2,000 feet per minute or greater can be attained with the aircraft in two different configurations. With the gear and flaps retracted and cowl flaps closed an airspeed of 195 knots will be required for maximum rate of descent. With the gear extended, flaps retracted and cowl flaps closed an airspeed of 132 knots will also give approximately the same maximum rate of descent. At 132 knots and the gear extended, the angle of descent will be greater, thus resulting in less horizontal distance traveled than a descent at 195 knots. Additionally, a descent at 132 knots will provide a smoother ride and less pilot work load. The following procedure should be used for an emergency descent:

Power..............................RETARD Initially
Airspeed..................................132 KIAS
Landing Gear................................EXTEND
Wing Flaps......................................UP
Cowl Flaps..................................CLOSED
Power During Descent.......AS REQUIRED to Maintain
Cylinder Head Temperature
300 Degrees F (149 Degrees C) minimum

GLIDE

MAXIMUM GLIDE DISTANCE
MODEL M20J



GROUND DISTANCE - NAUTICAL MILES

LANDING EMERGENCY

POWER OFF-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...............................OFF
Flaps.......................Full DOWN (33 Degrees)
Gear...............DOWN or UP Depending on Terrain
Approach Speed.........................71 KIAS
Master......................OFF, prior to landing

MOONEY M20J

POWER ON - GEAR RETRACTED

Emergency Locator Transmitter..................ARMED
Seat Belts and Shoulder Harnesses...........SECURE
Cabin Door..............................UNLATCHED
When sure of making landing area: (firm sod or foamed runway recommended)

- Fuel Selector...............................OFF
- Throttle.................................CLOSED
- Mixture...........................IDLE CUTOFF
- Magneto/Starter.............................OFF
- Flaps..................Full DOWN (33 Degrees)
- Master......................................OFF
- Approach Speed.............As Slow As Possible
- Wings...........................Keep LEVEL

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 2700 RPM

FUEL

LOW FUEL FLOW

Check Mixture..............................ENRICH
Fuel Selector........................Fullest TANK
If condition persists, use Boost Pump if necessary and LANDING should be made as soon as practicable.

ELECTRICAL

ALTERNATOR FAILURE (Voltage warning light illuminated)

Radio Master...................................OFF
Master...........................OFF, then ON
If Warning Light is still illuminated, the following steps are required:

- Alternator Field Circuit Breaker...........PULL
- Non-essential Electrical Equipment..........OFF
- LAND as soon as practicable.

ALTERNATOR LOW VOLTAGE (Voltage warning light flashing)

Alternator Field Circuit Breaker........RESET ONCE
If warning light still flashing, the following are required:

Alternator Field Circuit Breaker...........PULL
Non-essential electrical Equipment..........OFF
LAND as soon as practicable.

NOTE

A tripped main alternator circuit breaker can only be caused by a shorted alternator circuit and cannot be corrected by resetting the breaker. This should be verified by attempting to reset the breaker not more than one time. If this fails, pull the alternator field breaker, turn off all non-essential electrical equipment and terminate the flight as soon as practical.

LANDING GEAR

FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY

Airspeed............................132 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 inches) 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

Malfunction of landing gear requires maintenance inspection and repair prior to activating electrical system.

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

("GR SAFETY BY PASS", both gear annunciator lights illuminated and gear warning horn activated.)

"GR SAFETY BY PASS SWITCH"...........DEPRESS until gear fully retracted
"GEAR UNSAFE" and "GEAR DOWN" Lights...........OUT
"GEAR RELAYS" Circuit Breaker........PULL (Warning horn off)
Gear Extension.................RESET "GEAR RELAYS" Circuit Breaker
Gear Switch....................................DOWN
Check "Airspeed Safety Switch" as soon as practicable.

NOTE

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

OXYGEN

Refer to Section IX if aircraft is equipped with oxygen.

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 the outside of the aircraft to the cabin interior.

When the alternate static air source is in use adjust the indicated airspeed and altimeter readings according to the appropriate alternate static source airspeed and altimeter calibration tables in Section V.

The static air source valve is located in the lower left portion of the pilot's flight panel above the pilot's left knee.

Alternate Static Source....................PULL ON
Airspeed and Altimeter
Readings................CHECK Calibrations Tables, SECTION V

UNLATCHED DOOR IN FLIGHT

If the 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 approximtely 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 practicable, during the landing flare have a passenger hold the door to prevent it from swinging open.

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..................................96 KIAS

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

ICE PROTECTION

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

DO NOT OPERATE IN KNOWN ICING CONDITIONS.

If icing conditions or heavy snow is inadvertently encountered:

Ram Air.......................................OFF
DO NOT turn Ram air on again when entering clear air until assured all ice and snow has melted from the aircraft.

Pitot Heat....................................ON

Alternate Satic Source........................ON

Cabin Heat....................................OFF
until engine operation is normal.

Avoid Further Icing Conditions.

EMERGENCY EXIT OF AIRCAFT

CABIN DOOR
- PULL latch handle AFT.
- OPEN door and exit aircraft.

BAGGAGE COMPARTMENT DOOR
- Fold rear seat backs forward, CLIMB OVER.
- PULL off plastic cover.
- PULL white button.
- Lift red handle "UP".
- OPEN door and exit aircraft.
- To verify re-engagement of outside latch mechanism, open outside handle fully, close inside red handle to engage pin into cam slide of latch mechanism, push in on white button until it snaps in place. Replace cover. Operate outside handle in normal manner.

SPINS

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

Up to 2000 feet of altitude may be lost in a one turn spin and recovery; therefore, stalls at low altitude are extremely critical.

NOTE

The best spin recovery 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 minimuze 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:

Rudder..............Apply FULL RUDDER opposite the direction of spin
Control Wheel........FORWARD of neutral in a brisk motion. Additional FORWARD elevator control may be required if the rotation does not stop.
Ailerons..................................NEUTRAL
Throttle..........................RETARD to IDLE
Hold anti-spin controls until rotation stops.
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.

OTHER EMERGENCIES

Refer to Section IX for Emergency Procedures of Optional Equipment.

Section IV

SECTION IV
NORMAL PROCEDURES

MOONEY M20J

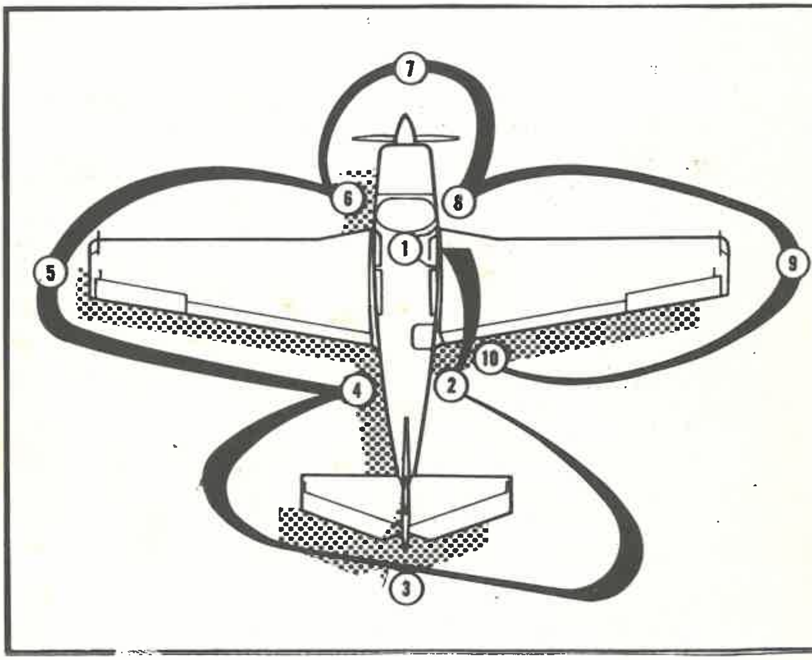
TABLE OF CONTENTS

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 (Supplements).



PREFLIGHT WALK AROUND DIAGRAM

PREFLIGHT INSPECTION

1. Cockpit -

Gear Switch..DOWN
Magneto/Starter....................................OFF
Master Switch......................................ON
Internal/External Lights...........................CHECK
Fuel Gauges, Quantity..............................CHECK
Master Switch......................................OFF
Fuel Selector.............R: PULL gascolator ring (5 seconds)
Fuel Selector.............L: PULL gascolator ring (5 seconds)

2. Instrument Static Port.............UNOBSTRUCTED

Right Fuselage................CHECK skin condition
Tail tiedown..................................REMOVE

3. Empennage -
Elevator and rudder attach points and control linkage attachments..........................CHECK
General skin condition.......................CHECK
Remove all ice, snow, or frost.

4. Dorsal fin -
Fresh Air Vent...............................CLEAR
Instrument Static Port...............UNOBSTRUCTED

Left Fuselage................CHECK Skin condition
Tailcone Access Door.......................SECURED
Static System Drain...............Push Plunger UP, (Hold 3-5 Seconds)

5. Left wing -
Skin condition.....Remove all ice, snow, or frost.
Flap and attach points.......................CHECK
Aileron and attach points....................CHECK
Control linkages.............................CHECK
Wing tips and lights.........................CHECK

NOTE

A reduced fuel indicator is located in the filler neck. This indicator is used to indicate usable fuel capacity of 25 U.S. gallons (94.7 liters) (20.8 IMP. Gal.)

NOTE

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

Left wing leading edge.......................CHECK
Pitot tube..........................UNOBSTRUCTED
Heat Element Operative.
Stall Switch Vane...................UNOBSTRUCTED

Fuel Tank...............CHECK QUANTITY. SECURE CAP
Tiedown...REMOVE
Tank Vent...............................UNOBSTRUCTED
Wheel chock.....................................REMOVE
Left main gear, shock discs and tire.........CHECK
Left main gear doors...........................CHECK
Fuel tank sump drain..............DRAIN Until Clear
Pitot System Drain.................Push plunger UP, (Hold for 3-5 seconds)
Gascolator drain valve............CLOSED (Check for drips)

6. Left Cowl Area
Windshield.......................................CLEAN
Left Side Engine Cowl Fasteners............SECURED
Left Cowl Flap...................................CHECK

7. Propeller, CHECK for nicks, cracks, oil leaks, rotational movement. CHECK deice boots (if installed).
Spinner...................CHECK for security, cracks
Cooling Air and Induction Intake......UNOBSTRUCTED
Landing Light......................CHECK Lens & Bulb
Ram Air Door..................CHECK CLOSED & SECURE
Nose gear, shock discs and tire................CHECK
Nose Gear Door.............CHECK for Loose Linkage
Wheel chock.....................................REMOVE

8. Right cowl area
Right Side Engine Cowl Fasteners...........SECURED
Engine Oil Level...........CHECK (full for extended flight. Minimum qty. 6 qts.)
Exhaust Pipe..................................SECURED
Right Cowl flap..................................CHECK
Windshield.......................................CLEAN
Cabin Cooling Vent.......................UNOBSTRUCTED

9. Right Wing -
Fuel Tank Sump Drain..............DRAIN until clear
Right main gear, shock discs and tire........CHECK
Right main gear doors..........................CHECK
Wheel chock.....................................REMOVE
Tank vent...............................UNOBSTRUCTED
Tiedown...REMOVE
Right wing leading edge.........................CHECK

NOTE

The reduced fuel indicator is located in the filler neck. This indicator is used to indicate usable fuel capacity of 25 U.S. gallons (94.7 liters) (20.8 IMP. gal.)

NOTE

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

Fuel tank..............CHECK QUANTITY. SECURE CAP
Wing tip and lights...........................CHECK
Aileron and attach points.....................CHECK
Flap and attach points........................CHECK
Control linkages..............................CHECK
Wing skin condition. Remove all ice, snow, or frost.

10. Baggage door..........................SECURED

BEFORE STARTING CHECK

Preflight Inspection.....................COMPLETED
Seats, seat belts and
shoulder harness..................ADJUST & SECURE
Magneto/starter switch..........................OFF
Master switch...................................OFF
Radio master switch.............................OFF
Fuel boost pump.................................OFF
Alternate static source....................Push OFF
Internal/External lights........................OFF
Pitot heat......................................OFF
Throttle.....................................CLOSED
Propeller..................................HIGH RPM
Mixture.................................IDLE CUTOFF
Cowl flaps.................................PULL OPEN
Parking brakes..................................SET
Ram Air Control.................................OFF
Flap switch......................CENTERED (flaps up)

Cabin heat....................................PUSH OFF
Defrost.......................................PUSH OFF
Cabin vent..................................AS DESIRED
Fuel selector.............................FULLEST TANK
Compass slave....................IN (if installed)
Circuit breakers..................................CHECK
Emergency locator transmitter......................ARM
Radios................SET FREQUENCIES (Non-digital radios)
Landing gear switch................................DOWN
Internal/External Lights............................OFF
Passengers..................Emergency and general information briefing
Refer to Section IX for Optional Equipment Checks.
Obtain local information prior to engine start.

STARTING ENGINE

CAUTION

When Battery will not start engine, inspection should be conducted to determine reason. If determination is made that battery voltage is low, servicing of the battery is essential and charging for at least one hour should be done before engine is started. The Battery or other electrical circuits may be damaged if aircraft is operated with a low battery.

Throttle....................................1/4 OPEN
Propeller...................................HIGH RPM
Mixture.......................Full Forward (RICH)
Master switch..ON
Annunciator lights.......Test (Gear Down Light-ON; L/R fuel quantity light-ON; High/Low volts and vac-FLASHING)
Fuel Boost Pump....................ON to Establish Pressure, then OFF
Mixture................................IDLE-CUTOFF

NOTE

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

Propeller Area..................................CLEAR
Magneto/Starter Switch............TURN and PUSH to start, release to both when engine starts.
Mixture...........................Move slowly and smoothly to RICH
Throttle....................Set at 1000 to 1200 RPM
Engine Oil Pressure........if MINIMUM OIL PRESSURE is not indicated within 30 seconds, STOP ENGINE and determine problem.
Ammeter.............Check (Turn on landing light & observe negative movement of needle).

NOTE

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

FLOODED ENGINE STARTING

Fuel boost pump.................................OFF
Throttle............................FULL FORWARD
Mixture.............................IDLE CUTOFF
Magneto/Starter Switch............TURN and PUSH to start, release to both when engine starts.
Throttle........................Retard to 1200 RPM
Mixture.......................Full forward (RICH)
Engine Oil Pressure........if MINIMUM OIL PRESSURE is not indicated within 30 seconds, STOP ENGINE and determine problem

WARM ENGINE STARTING

Fuel Boost Pump.................................OFF
Throttle............................Slightly open
Mixture.................Full Aft (IDLE-CUTOFF)
Magneto/Starter Switch............TURN and PUSH to start, release to both when engine starts.
Throttle........................1000 to 1200 RPM
Engine Oil Pressure........If MINIMUM OIL PRESSURE is not indicated within 30 seconds, STOP ENGINE and determine problem.

MOONEY M20J

BEFORE TAXI

Radio Master Switch..............................ON
External Lights.........................As desired
Directional Gyro..........SET or SLAVE SWITCH - ON
Instruments....................Normal Operation
Radios...................CHECK (Set Frequencies)
Altimeter...................................SET
Fuel Selector..................Switch tanks, verify engine runs on other tank

TAXI

CAUTION

It may be necessary to increase RPM slightly to prevent flashing of the "LOW VOLTS" light.

Parking Brake.............................Release
Brakes........................Check during Taxi
Directional Gyro..........Proper indication during turns
Turn Coordinator..........Proper indication during turns
Artificial Horizon..............Erect during turns
Taxi..............................Minimum power

BEFORE TAKEOFF

NOTE

A thorough pre-takeoff check is recommended, however EXCESSIVE time spent conducting a pre-takeoff check list will effect fuel economy.

Parking Brake...................................SET
Fuel Selector........................FULLEST TANK
Throttle..........................1200 RPM
Propeller..........................HIGH RPM
Mixture.....................Full Forward (RICH)
Cowl Flaps.........................PULL OPEN

Ram Air....................................CLOSED
Oil Temperature..................75 Degrees F Minimum
(Needle moves off white dot)
Magneto/Starter Switch..................Ground Check

CAUTION

Do not operate the engine at run-up speed unless the oil temperature is 75 Degrees F. minimum. Operation of the engine at too high a speed before reaching minimum oil temperature may cause loss of oil pressure.

Throttle..................................1900-2000 RPM
Magnetos...............CHECK, Both to L, Both to R, Both, (Maximum 175 RPM drop each magneto, 50 RPM 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.

Propeller........CYCLE/return tohigh RPM (3 times)
Throttle..........................Retard to IDLE RPM
Trim................................Takeoff setting
Flaps................Check operation. SET TAKEOFF (15 Degrees)
Controls...........Check free and correct movement
Cabin Door.............................CHECK SECURED
Seat Belts and Shoulder Harness............SECURED
Avionics and auto pilot............Check (Refer to Section IX)
Annunciator Lights......................Press to Test
Internal/External Light..................As Desired
Rotating Beacon/Strobe Lights.....................ON
Pilots Window..................................CLOSE
Emergency Gear Extension Red Handle...........DOWN and LATCHED

Parking Brake.................................Release

TAKEOFF PROCEDURES

NOTE

Move the controls slowly and smoothly. In particular, avoid rapid opening and closing of the throttle as the engine is equipped with a counterweighted crank shaft and there is a possibility of detuning the counter-weights with subsequent engine damage.

Proper engine operation should be checked early in the takeoff roll. Any siginificant 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 prop area instead of being pulled into it.

TAKEOFF

Electric Fuel Boost Pump.............ON at start of takeoff roll
Power...................FULL THROTTLE and 2700 RPM
Aircraft Attitude..............Lift Nose Wheel at 63 KIAS
Climb Speed...............................71 KIAS
Landing Gear...............Retract in Climb Before Attaining an Airspeed of 106 KIAS
Wing Flaps........................Retract in Climb
Electric Fuel Boost Pump................OFF, CHECK Pressure

NOTE

See Section V, page 5-16 for takeoff distances and aircraft weight versus speed table.

TAKEOFF (Maximum Performance)

Electric Fuel Boost Pump............ON at Start of Takeoff roll
Power...................Full Throttle and 2700 RPM
Aircraft Attitude...............Lift Nose Wheel at 62 KIAS
Climb Speed.......66 KIAS until clear of obstacle, then accelerate to 91 to 100 KIAS
Landing Gear...............Retract in Climb After Clearing Obstacle
Wing Flaps.........Retract After Clearing Obstacle
Electric Fuel Boost Pump.......OFF, Check Pressure

NOTE

See Section V, page 5-16, for takeoff distances and aircraft weight versus speed table.

CLIMB

NOTE

Use noise abatement procedure as published by airport and/or this manual.

CLIMB (NORMAL)

Throttle...................26" Hg Manifold Pressure
Propeller...............................2600 RPM
Mixture...........RICH (Lean for Smooth Operation at high elevation)
Cowl Flaps.................FULL OPEN (As Required)
Airspeed..........................91 to 100 KIAS

Maintain these power settings and attitude to at least 3000 feet AGL or cruise altitude.

CLIMB (BEST RATE) (V_Y)

Power....................Full Throttle and 2700 RPM
Mixture..................FULL RICH (Lean at higher altitudes for smooth operation)
Cowl Flaps..............................FULL OPEN
Airspeed.........88KIAS at sea level decreasing to 82KIAS at 10,000 ft.
Ram Air.................ON After Entering Clear Air

NOTE

See Section V, page 5-17 for rate of climb graph.

CLIMB (BEST ANGLE) (V_X)

Power....................FULL THROTTLE and 2700 RPM
Mixture..................FULL RICH (Lean at higher altitude for smooth operation)
Cowl Flaps..............................FULL OPEN
Airspeed...........69 KIAS at sea level increasing approximately 1.0 KIAS for each 5000 feet altitude
Ram Air.................ON After Entering Clear Air

Manifold pressure will drop with increasing altitude at any throttle setting. Power can be restored by gradually opening the throttle.

To increase performance at full throttle pull the Ram Air Control aft (Ram Air ON position) allowing induction air to bypass the air filter and increase manifold pressure.

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

Turn ram air off if encountering icing conditions. Do not fly aircraft into known icing conditions. Using unfiltered induction air when flying in snow or other IFR conditions can be hazardous. Snow can accumulate in the fuel injector impact tubes, or moisture can freeze in the inlet passages under icing conditions to cause loss of power. If snow or icing conditions were encountered DO NOT TURN RAM AIR ON AGAIN when entering clear air until assured that all ice has melted from the aircraft. Do not use ram air in visibly dusty air.

After establishing climb power and trimming the aircraft for climb, check to insure that all controls, switches, and instruments are set and functioning properly.

CRUISE

Upon reaching cruise altitude, accelerate to cruise airspeed, trim the aircraft for level flight, reduce manifold pressure and RPM to desired cruise power, and close the cowl flaps. The cowl flaps may be partially opened (control pulled aft approximately three inches) if necessary, to maintain the oil and cylinder head temperature within the normal operating range.

When cruising at 75 percent power or less, lean the mixture after cruise power is established in accordance with one of the following methods:

A. Leaning using exhaust gas temperature gauge (EGT) (if installed).
   1. Lean the mixture exhaust gas temperature peaks on the EGT indicator.

      ECONOMY CRUISE - Enrich mixture (push mixture control forward) until the EGT indicator drops 14° C(25° F) below peak
      BEST POWER MIXTURE - Enrich mixture until EGT indicator drops 55° C(100° F) below peak.

NOTE

Compared to Economy Cruise Best power mixture will result in an increase in fuel flow and a reduction in range.

2. Changes in altitude and power settings require the peak EGT to be rechecked and the mixture re-set.

B. Leaning without exhaust gas temperature gauge (EGT).

1. Slowly move mixture control lever aft from "FULL RICH" position toward "LEAN" position.

2. Continue leaning until slight loss of power is noted (loss of power may or may not be accompanied by roughness).

3. Enrich until engine runs smoothly and power is regained.

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.

DESCENT

Mixture......................RICH or LEAN for smooth Operation
Power.....................As Required to keep CHT in Green Arc (300° F(149° C) minimum)

CAUTION

Avoid continuous operation between 1500 and 1950 RPM with power settings below 15" Hg. manifold pressure.

NOTE

Exercise caution with power settings below 15" Hg manifold pressure at airspeeds between 70 - 113 KIAS to preclude continuous operation in the 1500 - 1950 RPM restricted range.

CAUTION

Avoid long high speed descents at low manifold pressure as the engine can cool excessively.

Cowl Flaps............CLOSED (Control Full Forward)
Ram Air..............OFF Before Entering Dusty Air layers

NOTE

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

APPROACH FOR LANDING

Internal/External Lights................As desired
Seat Belts, Shoulder Harness.............FASTENED
Landing Gear.................Extend below 132 KIAS (Gear down light on - Check visual indicator on floor)
Mixture.................................FULL RICH
Propeller................................HIGH RPM
Fuel Boost Pump................................ON

Fuel Selector............................FULLEST TANK
Wing Flaps.............As desired (full down below 115 KIAS)

CAUTION

From a flaps retracted trimmed condition, the force required for nose up pitch control will rapidly increase when power is reduced to idle and as flaps are fully extended. Timely trimming action should be accomplished to minimize forces. Control force change with extending landing gear is minimal.

Trim....................................As desired
Ram Air.....................OFF (Warning light off)

NOTE

The parking brake should be rechecked to preclude partially applied brakes during touchdown.

Parking Brake.....................................OFF

GO AROUND (BALKED LANDING)

CAUTION

From a flaps extended and power at idle trimmed condition, the force required for nose down pitch control will rapidly increase when Maximum Continuous Power (MCP) is applied and as flaps are fully retracted. Little control force change will be experienced when retracting the landing gear.

Power......................FULL THROTTLE and 2700 RPM
Mixture....................................FULL RICH
Airspeed....................................65 KIAS
Flaps.....................After climb established- Takeoff position

Trim................Reduce control force by trimming NOSE DOWN
Airspeed......................Accelerate to 73 KIAS
Landing Gear...............................RETRACT
Flaps......................................RETRACT
Cowl Flaps....................................OPEN
Airspeed......................Accelerate to 91 KIAS

LANDING

LANDING (NORMAL)

Airspeed on Final..............71 KIAS (Full Flaps)
Touchdown........................Main wheels first (aligned with runway)
Landing Roll...............Lower nose wheel gently
Brakes...........................Minimum required
Wing Flaps............Retract after clearing runway
Boost Pump...................OFF after landing
Trim..........................Takeoff position

NOTE

See Section V, pages 5-31 through 5-34 for Landing Distance Tables.

LANDING (MAXIMUM PERFORMANCE)

Airspeed on Final..............65 KIAS (Full Flaps)
Touchdown........................Main Wheels First
Landing Roll...........Lower nose wheel quickly as possible
Brakes....................Maximum possible without locking wheels

LANDING (CROSSWIND)

Airspeed on Final.............Above normal approach airspeed with Full Flaps (if crosswind component is above 12 KTS use 1/2 Flaps)
Final Approach..............Allow Aircraft to crab
Prior to flare.............Slip aircraft into wind
Touchdown...............Main wheels first (aligned with runway)

Landing Roll............Lower nose wheel as quickly as possible
Brakes.................As required to slow aircraft as quickly as possible

CAUTION

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

TAXI

Throttle..........................1000 to 1200 RPM
Flaps......................................RETRACT
Cowl Flaps...............................FULL OPEN
Trim.......................................Takeoff
Radios.................................As required
Lighting...............................As required

SHUTDOWN

Parking brake..................................SET
Throttle..........1000 to 1200 RPM (until cylinder head temperature starts to drop)
Radio master...................................OFF
Internal/External Lights.......................OFF
Magneto/Starter Switch............Grounding Check
Mixture.................................IDLE CUTOFF
Magneto/Starter Switch....OFF when propeller stops
Master Switch..................................OFF
Oxygen System (if equipped)....................OFF

SECURING THE AIRCRAFT

Magneto/Starter......................OFF/Key removed
Master Switch..................................OFF
Radio Master...................................OFF
Electrical Switches............................OFF
Parking Brake.............RELEASE and install wheel chocks
For extended parking.........Control wheel secured with seat belts, cabin vents closed, tie down

INTERIOR LIGHTS OFF

aircraft at wing and
tail points.

Section V

SECTION V
PERFORMANCE

MOONEY M20J

TABLE OF CONTENTS

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, power control system properly set for critical altitude, using average pilot techniques.

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.

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.

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, 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 M20J.

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.

RANGE ASSUMPTIONS

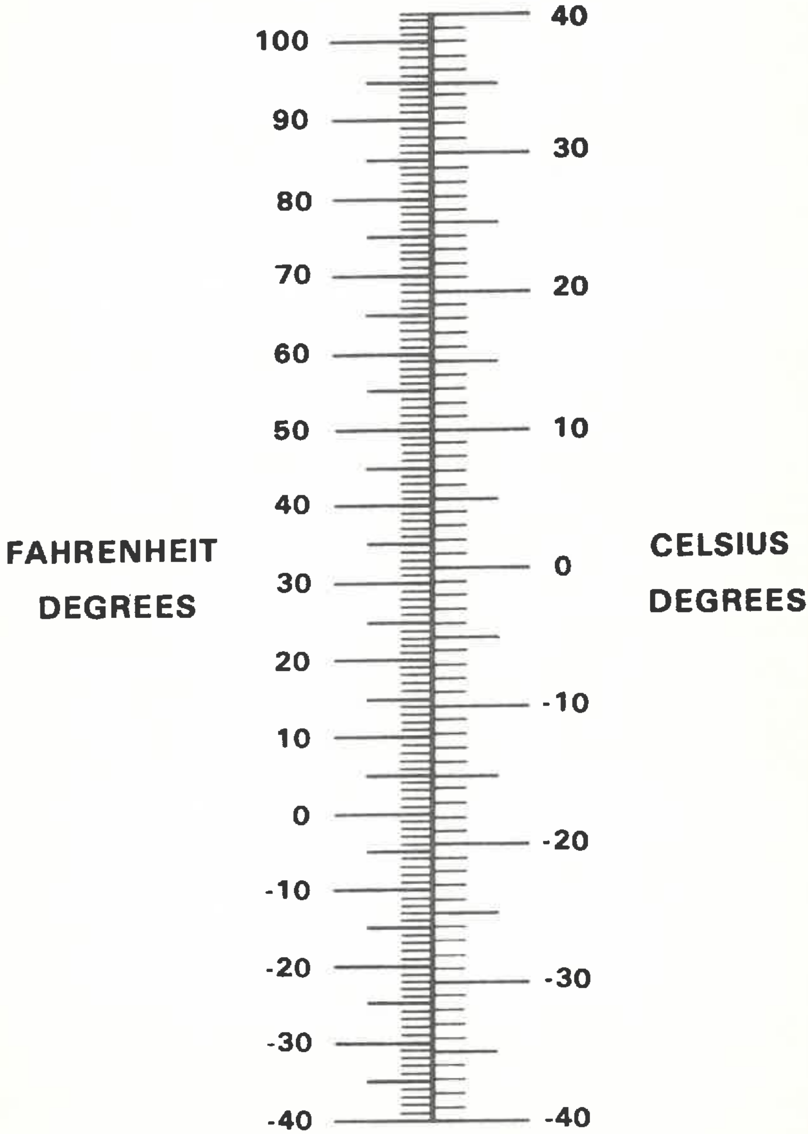
Range data climb allowance is based on climbing at maximum continuous power to cruise altitude.

No range increase due to descent from cruise altitude has been allowed in the range curves. Range reserves of 45 minutes at cruise power have been allowed on Range Data. Other conditions used in the Ranges shown are listed on each chart.

WINTER OPERATIONS

When snow and ice are likely to be present on the taxi and runway surfaces the inboard landing gear doors should be removed. Accumulation of ice and snow could prevent landing gear operation. If the inboard landing gear doors have been 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:

a. Decrease true airspeed at normal cruise power setting by approximately 5 knots.
b. Decreased range may be as much as 50 nautical miles for 64.0 gallon fuel capacity.



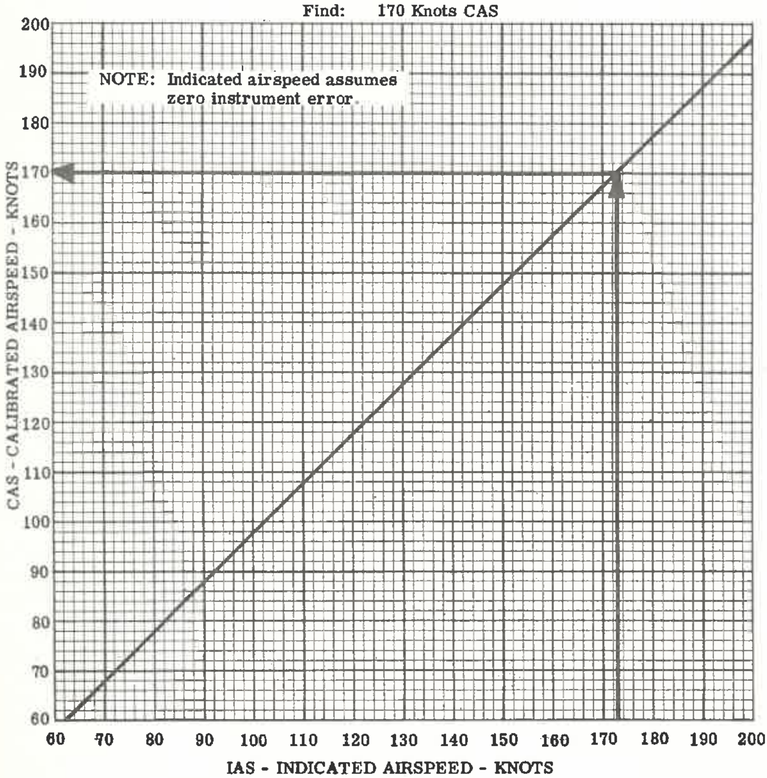
TEMPERATURE CONVERSION

AIRSPEED CALIBRATION

PRIMARY STATIC SYSTEM

FLAPS AND GEAR UP, POWER ON

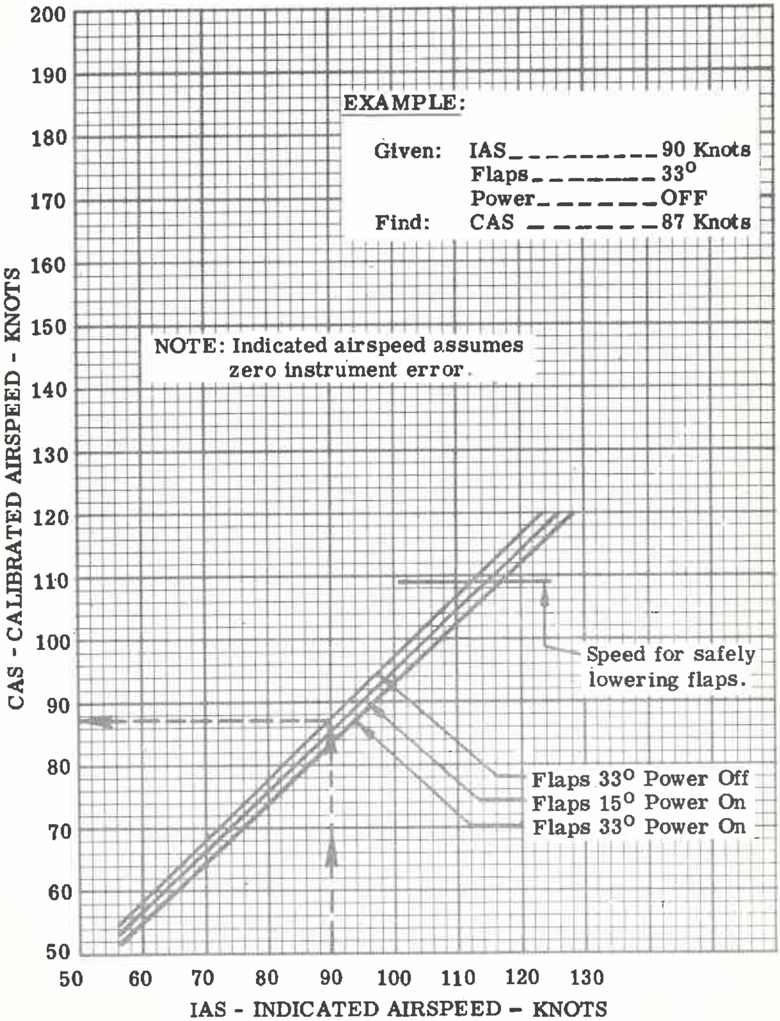
EXAMPLE:
Given: 173 Knots IAS
Find: 170 Knots CAS



AIRSPEED CALIBRATION

PRIMARY STATIC SYSTEM

FLAPS AND GEAR DOWN



AIRSPEED CALIBRATION
ALTERNATE STATIC SYSTEM

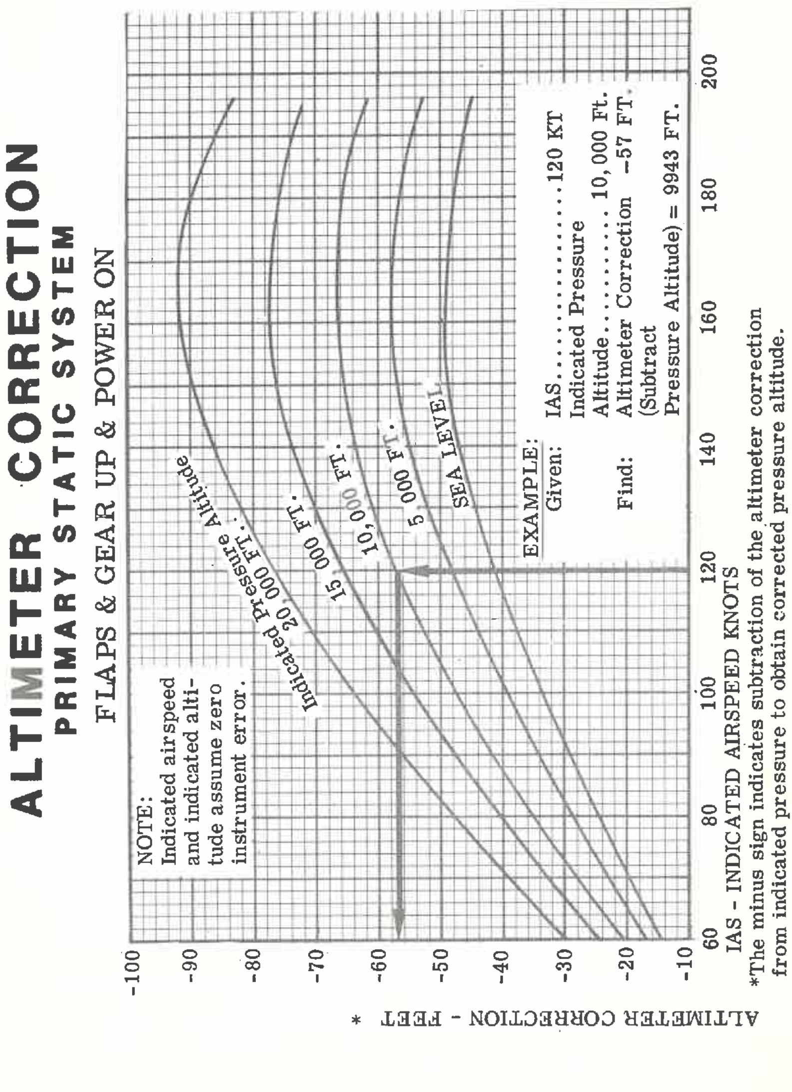
IAS KIAS	Gear & Flaps Up KIAS	Gear & Flaps Down (15°) KIAS	Gear & Flaps Down (33°) KIAS
61	--	-2	-3
70	-2	-3	-5
78	-3	-4	-7
87	-3	-6	-8
96	-4	-7	-10
104	-5	-7	-10
113	-5	-7	-10
122	-6	--	--
130	-6	--	--
139	-6	--	--
148	-6	--	--
156	-6	--	--
165	-3	--	--
174	-3	--	--
182	-4	--	--
191	-4	--	--
200	-5	--	--

The minus sign indicates subtraction of the given numbers from KIAS to obtain KCAS assuming zero instrument error

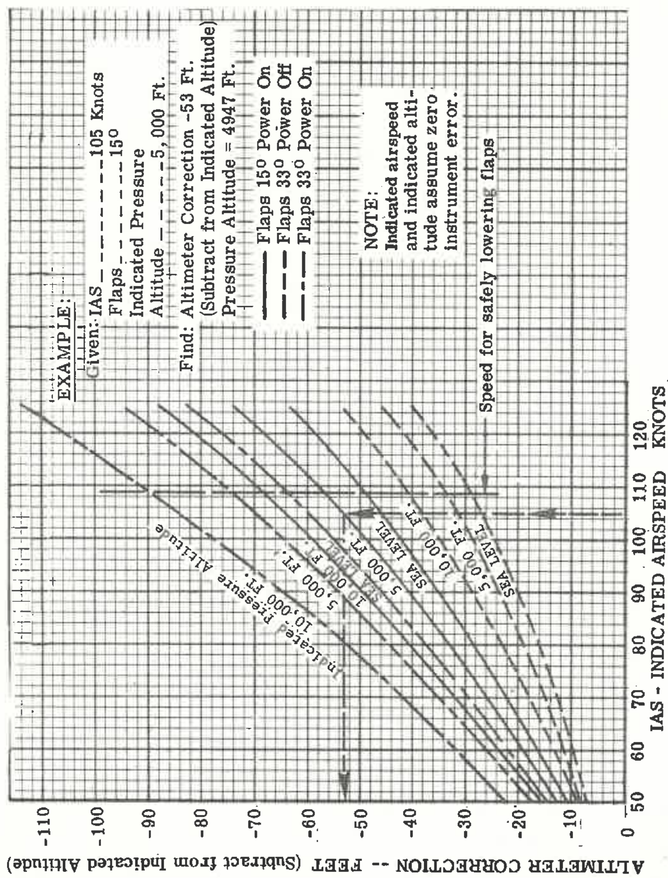
CONDITIONS: Storm Window and Vents: Closed
Defroster: ON

POWER: ON

ALTIMETER CORRECTION



ALTIMETER CORRECTION
PRIMARY STATIC SYSTEM
FLAPS AND GEAR DOWN



ALTIMETER CORRECTION
ALTERNATE STATIC SYSTEM

CONDITIONS: Storm Window and Vents: Closed, Defroster: On, Power: On

	SEA LEVEL			10,000 FT.		
		Gear & Flaps Down			Gear & Flaps Down	
KIAS	Gear & Flaps Up	15°	33°	Gear & Flaps Up	15°	33°
61	--	-10	-21	-4	-15	-28
70	-17	-20	-35	-21	-28	-39
78	-26	-37	-55	-36	-50	-76
87	-32	-54	-71	-43	-71	-99
96	-40	-55	-82	-55	-77	-102
104	-54	-63	-96	-73	-86	-130
113	-54	--	--	-84	--	--
122	-64	--	--	-87	--	--
130	-72	--	--	-99	--	--
139	-75	--	--	-101	--	--
148	-99	--	--	-134	--	--
156	-54	--	--	-73	--	--
165	-54	--	--	-73	--	--
174	-68	--	--	-94	--	--
182	-64	--	--	-83	--	--
191	-75	--	--	-103	--	--
200	-91	--	--	-125	--	--

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

STALL SPEED vs ANGLE OF BANK

ASSOCIATED CONDITIONS:
Forward C.G.
Power Idle

GROSS WEIGHT	GEAR AND FLAP POSITION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS
2740 LBS (1243 KGS)	GEAR UP, Flaps 0°	59.0	61.0	63.5	65.5	70.0	72.0	83.5	85.5
	GEAR DOWN, FLAPS 15°	56.5	60.0	60.5	64.0	67.0	71.0	80.0	84.0
	GEAR DOWN, FLAPS 33°	53.0	54.0	57.0	59.0	63.0	65.0	75.0	77.0
2500 LBS (1134 KGS)	GEAR UP, FLAPS 0°	56.5	58.5	60.5	62.5	67.0	69.0	79.5	81.5
	GEAR DOWN, FLAPS 15°	54.0	57.0	58.0	61.5	64.0	68.0	76.5	80.5
	GEAR DOWN, FLAPS 33°	50.5	51.5	54.5	55.5	60.0	61.5	71.5	73.5
2300 LBS (1032 KGS)	GEAR UP, FLAPS 0°	54.0	56.0	58.0	60.0	64.5	66.5	76.5	78.5
	GEAR DOWN, FLAPS 15°	52.0	55.0	55.5	58.5	61.5	65.0	73.0	77.0
	GEAR DOWN, FLAPS 33°	48.5	49.0	52.0	52.5	57.5	60.0	68.5	70.5

NOTE:

Up to 290 feet altitude loss may occur during stalls at maximum weight.

EXAMPLE:

Weight	2500 LBS (1134 KGS)
Landing Gear	Down
Flaps	15°
Angle of Bank	45°
Stall Speed	64.0 KCAS (68.0 KIAS)

NORMAL TAKEOFF DISTANCE

TAKEOFF WEIGHT - LBS (KGS)	TAKEOFF SPEED - KIAS	SPEED AT 50 FT - KIAS
2740 (1243)	63	71
2500 (1134)	60	68
2300 (1043)	58	65

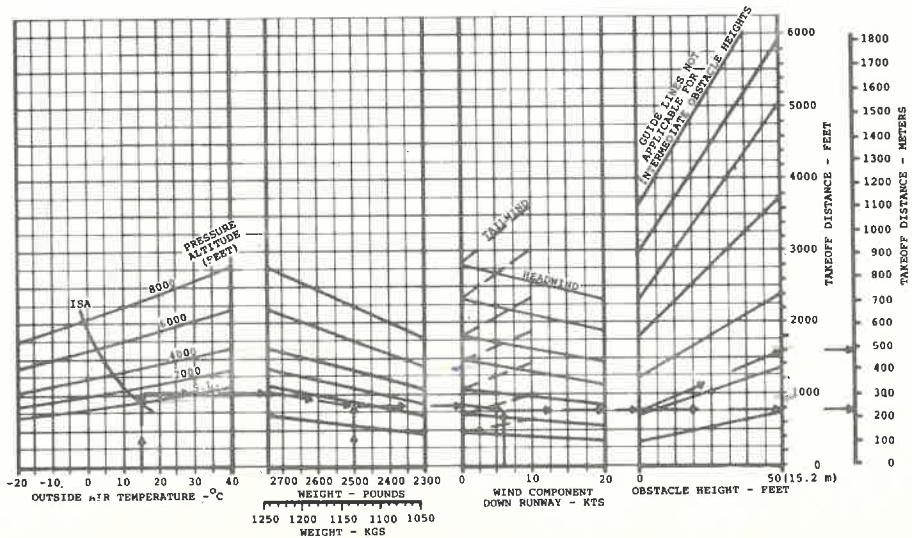
NOTE
1) MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KNOTS
2) CONDITIONS OF HIGH HUMIDITY CAN RESULT IN AN INCREASE OF UP TO 10% TO THE TAKEOFF DISTANCE

ASSOCIATED CONDITIONS

POWER	FULL THROTTLE, 2700 RPM (BEFORE BRAKE RELEASE)
LANDING GEAR	EXTENDED UNTIL OBSTACLE CLEARED
WING FLAPS	15°
COWL FLAPS	FULL OPEN
RUNWAY SURFACE	PAVED, LEVEL & DRY
MIXTURE	LEAN FOR SMOOTH OPERATION

EXAMPLE: ⟶

OAT	15°C
PRESSURE ALTITUDE	1500 FT.
WEIGHT	2500 LBS. (1134 KGS)
HEADWIND COMPONENT	6 KTS
GROUND ROLL	750 FT. (229 m)
TOTAL TAKEOFF DISTANCE (50 FT. OBSTACLE)	1575 FT. (480 m)



MAXIMUM PERFORMANCE TAKEOFF DISTANCE

TAKEOFF WEIGHT - LBS (KGS)	TAKEOFF SPEED KIAS	SPEED AT 50 FT. - KIAS
2740 (1243)	62	66
2500 (1134)	60	63
2300 (1043)	57	60

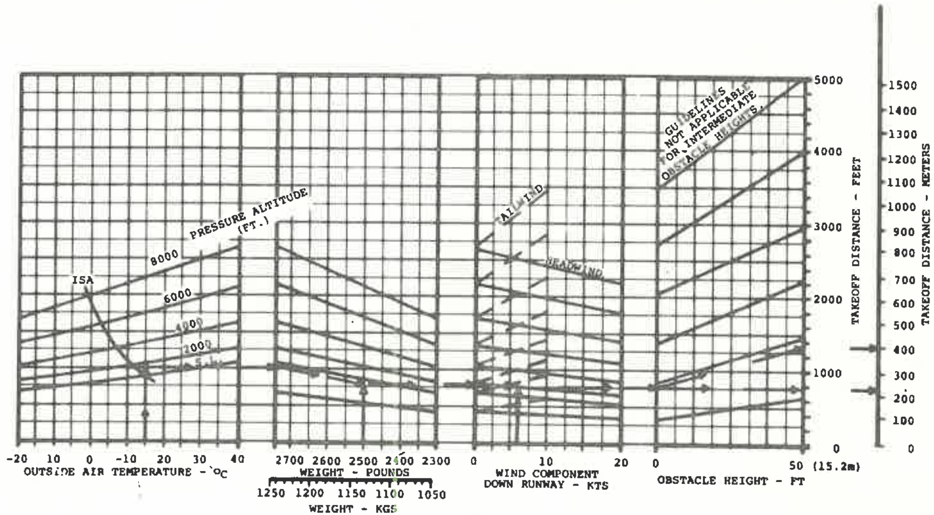
NOTE 1) MAXIMUM DEMONSTRATED CROSSWIND VELICITY IS 11 KNOTS.
2) CONDITIONS OF HIGH HUMIDITY CAN RESULT IN AN INCREASE OF UP TO 10% TO THE TAKEOFF DISTANCE.

ASSOCIATED CONDITIONS:

POWER	FULL THROTTLE 2700 RPM (Before brake release)
LANDING GEAR	DOWN UNTIL OBSTACLE CLEARED
WING FLAPS	15°
COWL FLAPS	FULL OPEN
RUNWAY SURFACE	PAVED, LEVEL & DRY
MIXTURE	LEAN FOR SMOOTH OPERATION

EXAMPLE: ⟶

OAT	15°C
PRESSURE ALTITUDE	1500 FT.
WEIGHT	2500 LBS. (1134 KG)
HEADWIND COMPONENT	6 KTS.
GROUND ROLL	750 FT. (229 m)
TOTAL TAKEOFF DISTANCE (50 FT. OBSTACLE)	1325 FT. (404 m)



NORMAL TAKEOFF DISTANCE-GRASS SURFACE

TAKEOFF WEIGHT - LBS (KGS)	TAKEOFF SPEED	SPEED AT 50 FT - KIAS
2740 (1243)	63	71
2500 (1134)	60	68
2300 (1043)	58	65

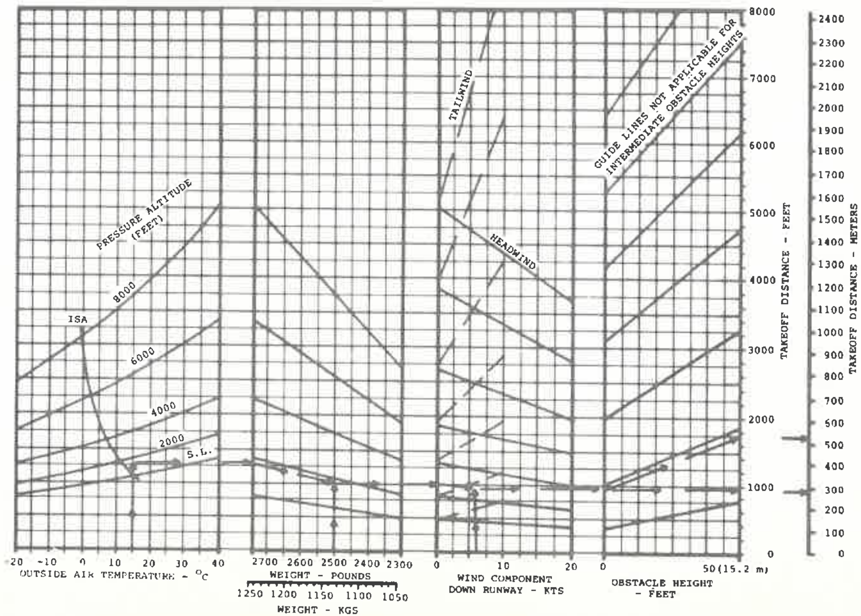
NOTE
1) MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KNOTS
2) CONDITIONS OF HIGH HUMIDITY CAN RESULT IN AN INCREASE OF UP TO 10% TO THE TAKEOFF DISTANCE

ASSOCIATED CONDITIONS

POWER	FULL THROTTLE, 2700 RPM (BEFORE BRAKE RELEASE)
LANDING GEAR	DOWN UNTIL OBSTACLE CLEARED
WING FLAPS	15°
COWL FLAPS	FULL OPEN
RUNWAY SURFACE	SHORT LEVEL DRY GRASS
MIXTURE	LEAN FOR SMOOTH OPERATION

EXAMPLE: →

OAT	15°C
PRESSURE ALTITUDE	1500 FT
WEIGHT	2500 LBS (1134 KGS)
HEADWIND COMPONENT	6 KTS
GROUND ROLL	925 FT (282m)
TOTAL TAKEOFF DISTANCE (50 FT OBSTACLE)	1750 FT (533m)



MAXIMUM PERFORMANCE TAKEOFF DISTANCE - GRASS SURFACE

TAKEOFF WEIGHT - LBS KGS	TAKEOFF SPEED IAS	SPEED AT 50 FT - KIAS
2740 (1243)	62	66
2500 (1134)	60	63
2300 (1043)	57	60

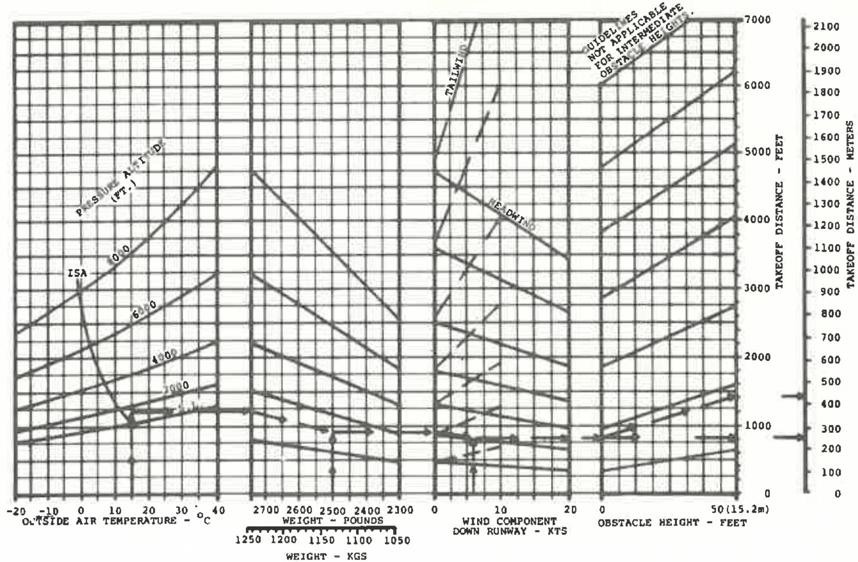
NOTE: 1) MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KTS.
2) CONDITIONS OF HIGH HUMIDITY CAN RESULT IN AN INCREASE OF UP TO 10% TO THE TAKEOFF DISTANCE.

ASSOCIATED CONDITIONS:

POWER	FULL THROTTLE 2700 RPM (Before brake release)
LANDING GEAR	DOWN UNTIL OBSTACLE CLEARED
WING FLAPS	15°
COWL FLAPS	FULL OPEN
RUNWAY SURFACE	SHORT, LEVEL, DRY GRASS
MIXTURE	LEAN FOR SMOOTH OPERATION

EXAMPLE: →

OAT	15°C
PRESSURE ALTITUDE	1500 FT.
WEIGHT	2500 LBS. (1134 KGS)
HEADWIND COMPONENT	6 KTS.
GROUND ROLL	820 FT. (250 m)
TOTAL TAKEOFF DISTANCE (50 FT. OBSTACLE)	1400 FT. (427 m)

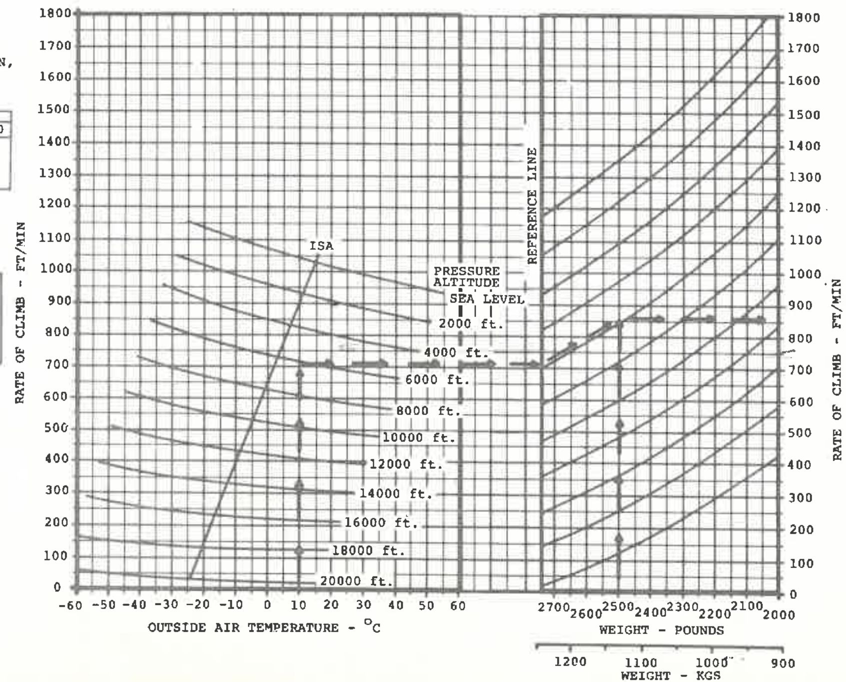


RATE OF CLIMB

GEAR UP, FLAPS UP, COWL FLAPS OPEN, RAM AIR ON,
2700 RPM, FULL THROTTLE, FULL RICH

WEIGHT LBS. (KGS)	CLIMB SPEEDS - KIAS S.L.	5000	10000	15000	20000
2740 (1243)	88	85	81	79	74
2300 (1043)	81	78	74	72	68
2000 (907)	76	73	69	67	64

EXAMPLE:	
Pressure Altitude	6000 FT
OAT	$10^{\circ}C$
Weight	2500 LBS (1134 KGS)
Rate Of Climb	860 FT/MIN
Climb Speed	81 KIAS



TIME, FUEL AND DISTANCE TO CLIMB

Associated Conditions for the Time, Fuel and Distance to Climb graph on the following page:

Climb Speed: Vy from Climb Performance graph on the preceeding page.
Power: 2700 RPM, Full Throttle
Mixture: Full Rich
Ram Air: On
Cowl Flaps: Full Open
Landing Gear: Up
Wing Flaps: Up
Fuel Density 6.0 Lbs./Gal. (.72 Kg/liter)

NOTE:

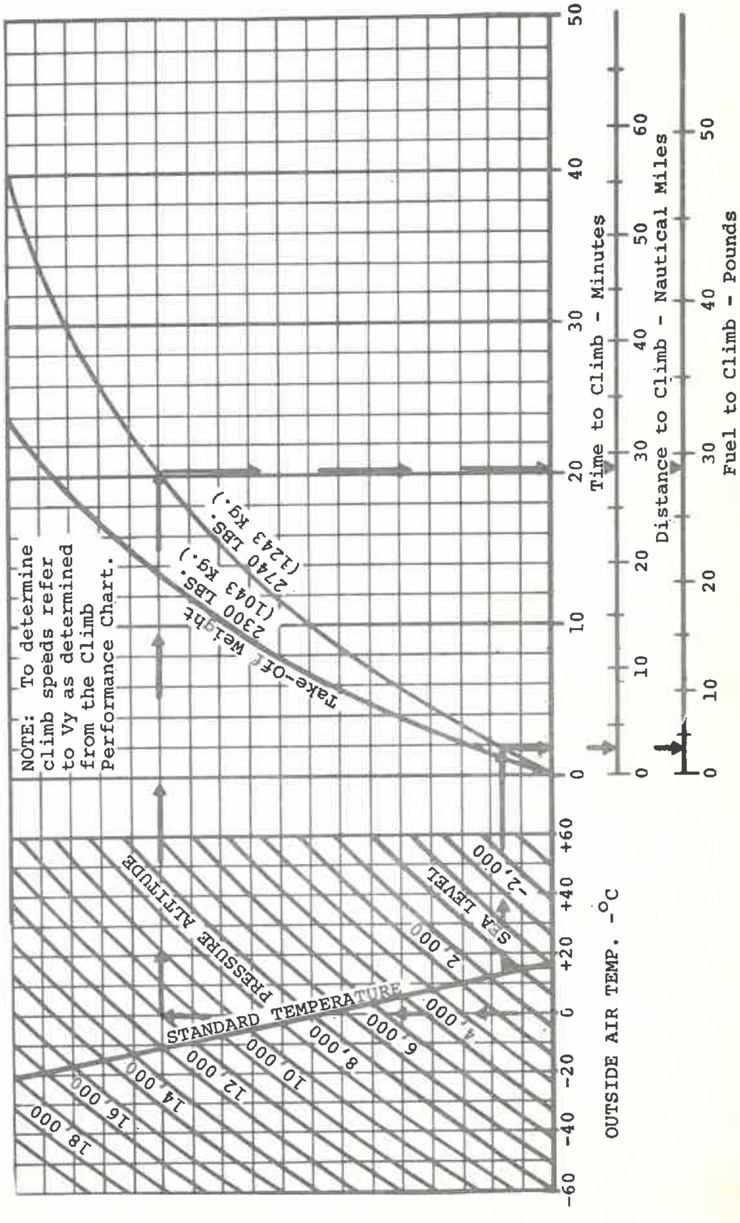
1. Distances shown are based on zero wind.
2. Add 9 LBS. of fuel for start, taxi and takeoff.

EXAMPLE:

Given: Initial Pressure Altitude/OAT 1500 Ft./15°C
Final Pressure Altitude/OAT 12000 Ft./0°C
Takeoff Weight - 2740 lbs./1243 Kg.

Find: Time to Climb (20.2 - 1.7) 18.3 Minutes
Distance to Climb (28.5 - 2.0) 26.5 Naut. Mi.
Fuel to Climb (29.0 - 3.0) 26.0 Lbs.

TIME, FUEL, & DISTANCE TO CLIMB



CRUISE & RANGE DATA CONDITIONS

1. All Cruise and Range Data tables allow for: warmup, taxi, take-off, climb at max. power at the best rate of climb speed (Vy) to cruise altitude; a cruise to destination at the specified power and mixture setting; and a 45-minute fuel reserve at the same altitude and power setting. The data is also based on 64 U.S. gallons of usable fuel, standard atmosphere, and no wind.

2. To obtain the performance shown by the Cruise and Range Data tables on non-standard days, increase or decrease the manifold pressure approximately .4" Hg for each 10°C variation in outside air temperature. Increase manifold pressure for air temperatures above standard and decrease manifold pressure for air temperatures lower than standard.

Mooney M20J

CRUISE POWER SCHEDULE

1. BEST POWER IS 55°C RICH OF PEAK EGT . 2. ECONOMY CRUISE IS 14°C RICH OF PEAK EGT .

PRESSURE ALTITUDE FEET STD. DAY		60% POWER (120 BHP)						55% POWER (110 BHP)						45% POWER (90 BHP)							
	RPM	2200	2300	2400	2500	2600	2700	2200	2300	2400	2500	2600	2700	2000	2100	2200	2300	2400	2500	2600	2700
	FUEL FLOW BEST ECON.	8.4	8.5	8.6	8.7	8.8	9.1	7.8	8.0	8.1	8.2	8.3	8.6	6.5	6.7	6.8	5.9	7.0	7.2	7.3	7.5
	FUEL FLOW BEST POWER	9.8	9.9	10.0	10.2	10.4	10.7	9.2	9.3	9.4	9.6	9.8	10.0	7.7	7.9	8.0	8.2	8.3	8.5	8.6	8.9
	STANDARD TEMP.	MANIFOLD PRESSURE – INCHES OF MERCURY																			
S.L.	15°C	24.2	23.4	22.5	21.5	20.5	19.5	22.5	21.8	21.0	20.0	19.0	18.0	21.0	20.0	19.0	18.3	17.5	16.9	16.3	15.4
2000	11°C	24.0	23.0	22.0	21.1	20.2	19.3	22.2	21.3	20.4	19.6	18.8	18.0	20.5	19.6	18.7	18.0	17.2	16.6	16.0	15.3
4000	7°	23.7	22.7	21.7	20.9	20.1	19.2	22.0	21.1	20.2	19.5	18.7	17.9	20.4	19.5	18.6	17.9	17.1	16.5	15.8	15.3
6000	3°	23.6	22.5	21.3	20.6	19.9	19.1	22.0	20.9	19.8	19.2	18.6	17.8	20.4	19.4	18.3	17.6	16.8	16.3	15.7	15.2
8000	–1°			21.3	20.6	19.8	19.0	22.0	20.9	19.8	19.2	18.6	17.8	20.3	19.3	18.2	17.4	16.5	16.1	15.7	15.1
10000	–5°			21.0	20.4	19.8	18.8			19.5	18.9	18.3	17.6			18.2	17.4	16.5	16.1	15.6	15.0
12000	–9°					19.6	18.8			19.3	18.8	18.2	17.5			18.0	17.2	16.4	16.0	15.5	14.9
14000	–13°											17.9	17.3					16.2	15.8	15.4	14.7

NOTE: ADD .4" M.P. FOR EACH 10°C OAT ABOVE STANDARD DAY TEMPERATURE. SUBTRACT .4" M.P. FOR EACH 10°C OAT BELOW STANDARD DAY TEMPERATURE. IF OAT ABOVE STANDARD PRECLUDES OBTAINING THE DESIRED M.P., USE THE NEXT HIGHER RPM/M.P. WITH APPROPRIATE TEMPERATURE CORRECTION TO M.P.

EXAMPLE:

CRUISE ALT.	6000 FT.
OAT	10°C
POWER	65%
RPM	2600
M.P.	22.0 (7°C correction)

Mooney M20J

CRUISE POWER SCHEDULE

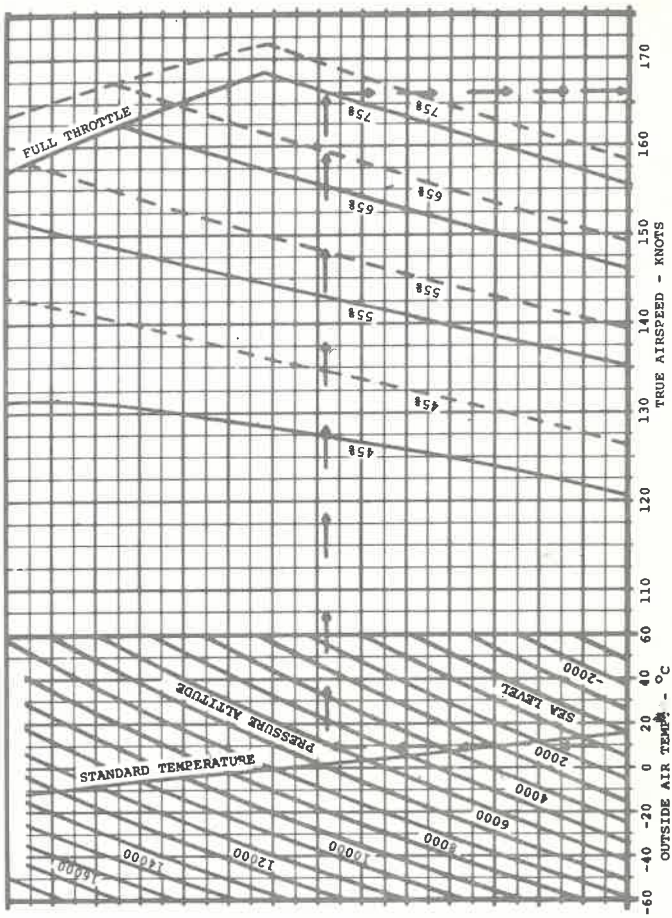
BEST POWER IS 55°C RICH OF PEAK EGT . 2. ECONOMY CRUISE IS 14°C RICH OF PEAK EGT .

NOTE: ADD .4" M.P. FOR EACH 10°C OAT ABOVE STANDARD DAY TEMERATURE. SUBTRACT .4" M.P. FOR EACH 10°C OAT BELOW STANDARD DAY TEMPERATURE. IF OAT ABOVE STANDARD PRECLUDES OBTAINING THE DESIRED M.P. USE THE NEXT HIGHER RPM/ M.P. WITH APPROPRIATE TEMPERATURE CORRECTION TO M.P.

PRESSURE ALTITUDE FEET STD. DAY		75% POWER (150 BHP)				70% POWER (140 BHP)				65% POWER (130 BHP)			
	RPM	2400	2500	2600	2700	2400	2500	2600	2700	2400	2500	2600	2700
	FUEL FLOW BEST ECON.	10.3	10.4	10.5	10.8	9.7	9.8	9.9	10.2	9.2	9.3	9.4	9.6
	FUEL FLOW BEST POWER	12.0	12.2	12.3	12.5	11.3	11.5	11.7	11.9	10.5	10.8	11.0	11.2
	STANDARD TEMP.	MANIFOLD PRESSURE – INCHES OF MERCURY											
S.L.	15°C	27.0	25.8	24.5	23.5	25.5	24.3	23.0	22.0	24.0	22.9	21.7	21.0
2000	11°C	26.8	25.6	24.4	23.3	25.1	24.1	23.0	22.0	23.6	22.6	21.6	20.6
4000	7°			24.4	23.2	24.9	23.9	22.9	21.8	23.3	22.4	21.5	20.5
6000	3°			24.1	23.1	24.4	23.6	22.7	21.7	22.8	22.1	21.3	20.4
8000	−1°				23.6			22.7	21.7			21.2	20.4
10000	−5°								21.4			21.1	20.2
12000	−9°												
14000	−13°												

NOTE: ADD .4" M.P. FOR EACH 10°C OAT ABOVE STANDARD DAY TEMPERATURE. SUBTRACT .4" M.P. FOR EACH 10°C OAT BELOW STANDARD DAY TEMPERATURE. IF OAT ABOVE STANDARD PRECLUDES OBTAINING THE DESIRED M.P., USE THE NEXT HIGHER RPM/M.P. WITH APPROPRIATE TEMPERATURE CORRECTION TO M.P.

SPEED POWER vs ALTITUDE

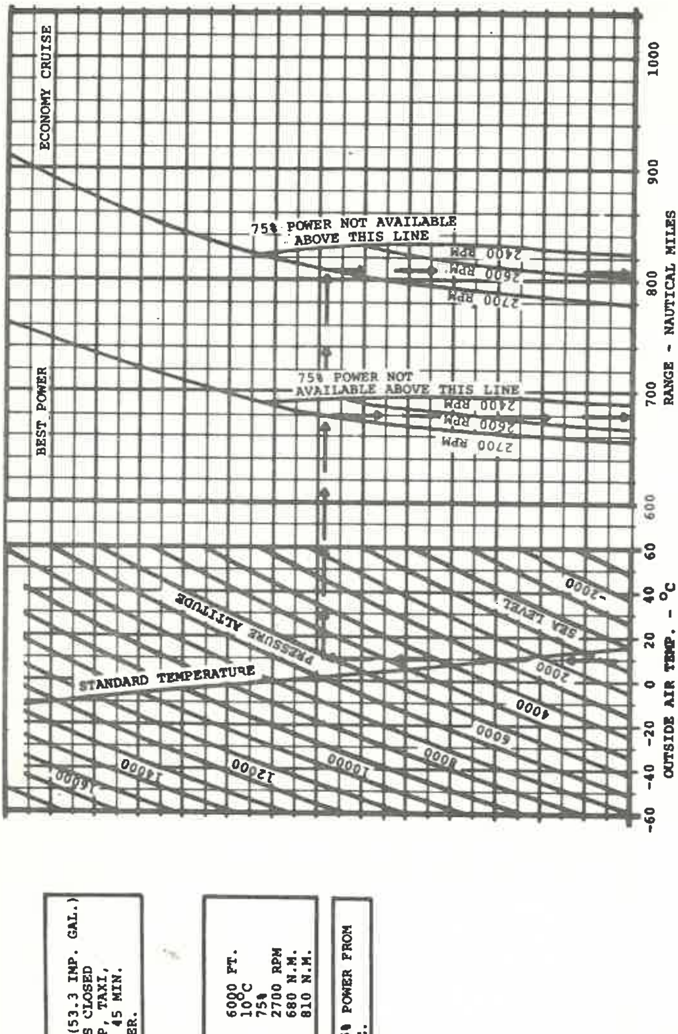


GEAR UP, FLAPS UP, COWL FLAPS CLOSED

——	**2740 LBS (1243 KGS)**
– – –	**2300LBS (1043KGS)**

EXAMPLE:	
GROSS WEIGHT	2740 LBS (1243 KGS)
CRUISE PRESSURE ALTITUDE	6000 FT.
CRUISE OAT	10°C
POWER	75%
TRUE AIRSPEED	166 KTS

RANGE 75% POWER - 2740 LBS(1243 KGS)



CLEAN CONFIGURATION
64 GAL. USABLE FUEL (53.3 IMP. GAL.)
ZERO WIND, COWL FLAPS CLOSED
RANGE INCLUDES WARMUP, TAXI,
TAKEOFF, CLIMB, PLUS 45 MIN.
RESERVE @ CRUISE POWER.

EXAMPLE: ⟶	
CRUISE PRESS. ALT.	6000 FT.
CRUISE OAT	10°C
*POWER	75%
*RPM	2700 RPM
RANGE, BEST POWER	680 N.M.
RANGE, ECON. CRUISE	810 N.M.

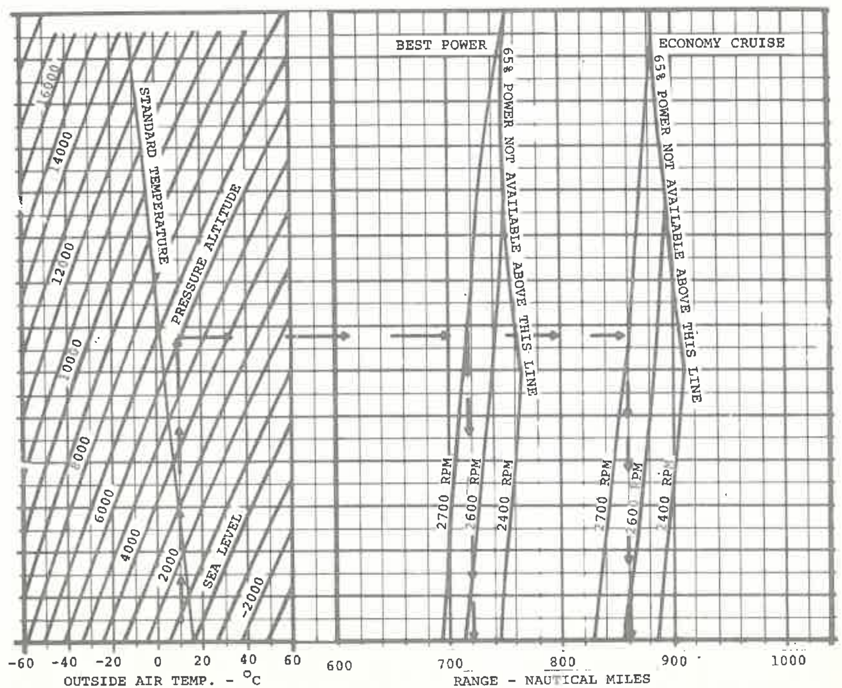
*MP FOR 2700 RPM @ 75% POWER FROM CRUISE POWER SCHEDULE.

RANGE 65% POWER - 2740LBS(1243KGS)

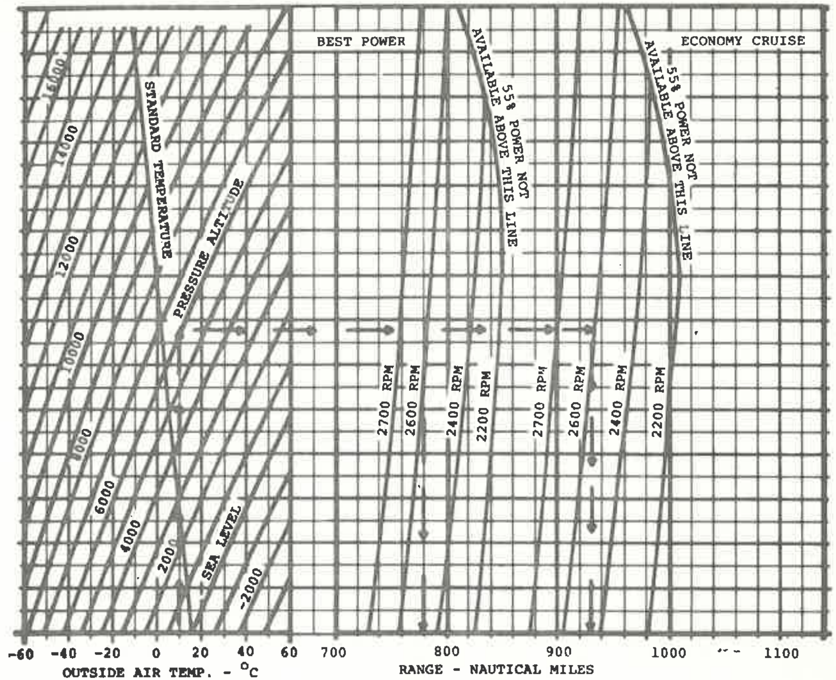
CLEAN CONFIGURATION
64 GAL. USABLE FUEL (53.3 IMP. GAL.)
ZERO WIND, COWL FLAPS CLOSED
RANGE INCLUDES WARMUP, TAXI,
TAKEOFF, CLIMB, PLUS 45 MIN.
RESERVE @ CRUISE POWER

EXAMPLE:	
CRUISE ALT	6000 FT.
CRUISE OAT	10°C
*POWER	65%
*RPM	2700 RPM
RANGE, BEST POWER	719 N.M.
RANGE, ECON. CRUISE	860 N.M.

*MP FOR 2700 RPM @ 65% POWER
FROM CRUISE POWER SCHEDULE



RANGE 55% POWER - 2740 LBS (1243 KGS)



CLEAN CONFIGURATION
64 GAL. USABLE FUEL (53.3 IMP. GAL.)
ZERO WIND, COWL FLAPS CLOSED
RANGE INCLUDES WARMUP, TAXI, TAKEOFF, CLIMB PLUS 45 MIN. RESERVE @ CRUISE POWER

EXAMPLE:

CRUISE ALT.	6000 FT.
CRUISE OAT	10°C
*POWER	55%
*RPM	2600 RPM
RANGE, BEST POWER	782 N.M.
RANGE, ECON. CRUISE	935 N.M.

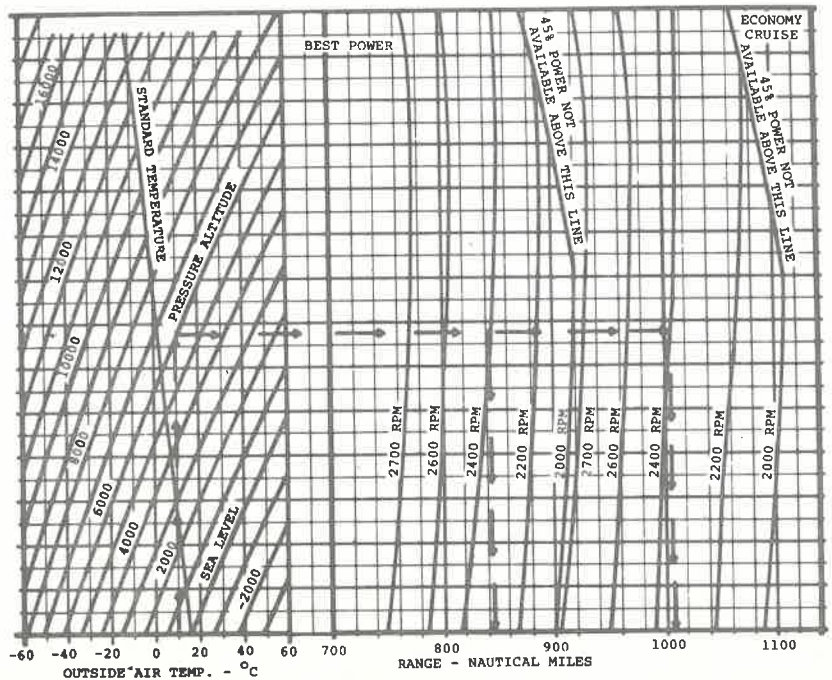
*MP FOR 2600 RPM @ 55% POWER FROM CRUISE POWER SCHEDULE.

RANGE 45% POWER - 2740 LBS(1243 KGS)

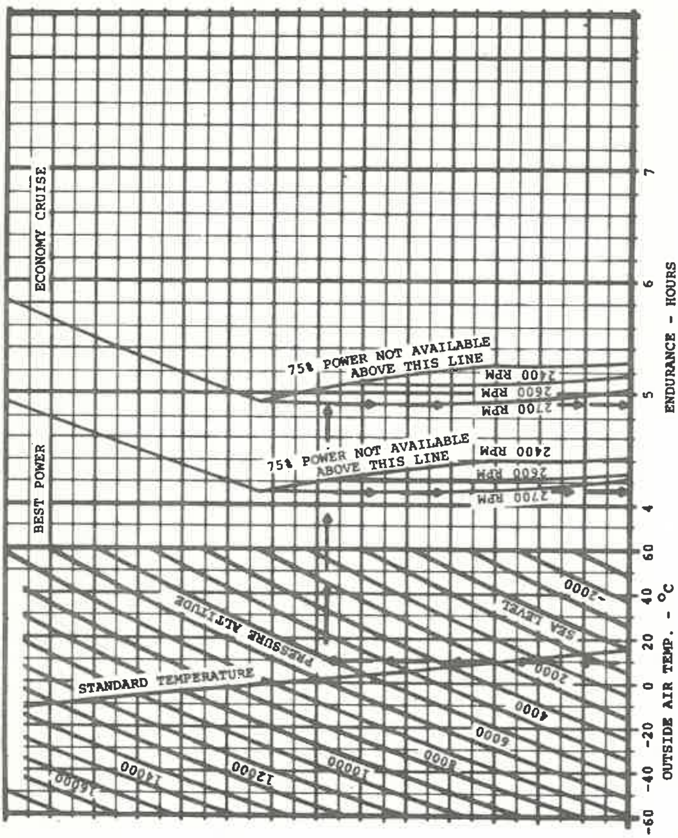
CLEAN CONFIGURATION
64 GAL. USABLE FUEL (53.3 IMP. GAL.)
ZERO WIND, COWL FLAPS CLOSED.
RANGE INCLUDES WARMUP, TAXI,
TAKEOFF, CLIMB PLUS 45 MIN.
RESERVES @ CRUISE POWER.

EXAMPLE: →	
CRUISE ALT	6000 FT.
CRUISE OAT	10°C
*POWER	45%
*RPM	2400 RPM
RANGE, BEST POWER	845 N.M.
RANGE, ECON. CRUISE	1010 N.M.

*MP FOR 2400 RPM @ 45% POWER FROM CRUISE POWER SCHEDULE.



ENDURANCE 75% POWER - 2740 LBS (1243 KGS)



CLEAN CONFIGURATION
64 GAL. USABLE FUEL (53.3 IMP. GAL.)
COWL FLAPS CLOSED, ZERO WIND
ENDURANCE INCLUDES WARMUP, TAXI,
TAKEOFF CLIMB PLUS 45 MIN.
RESERVE @ CRUISE POWER

EXAMPLE:	
CRUISE ALT	6000 FT.
CRUISE OAT	10°C
POWER	75%
RPM	2700 RPM
ENDURANCE, BEST POWER	4.10 HRS.
ENDURANCE, ECON. CRUISE	4.90 HRS.

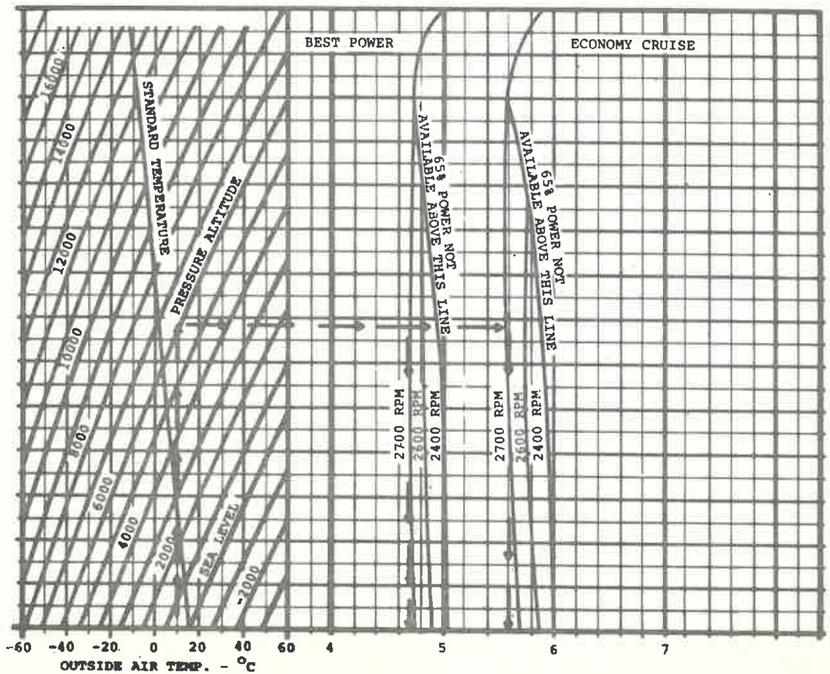
*MP FOR 2700 RPM @ 75% POWER FROM CRUISE POWER SCHEDULE.

ENDURANCE 65% - 2740 LBS (1243 KGS)

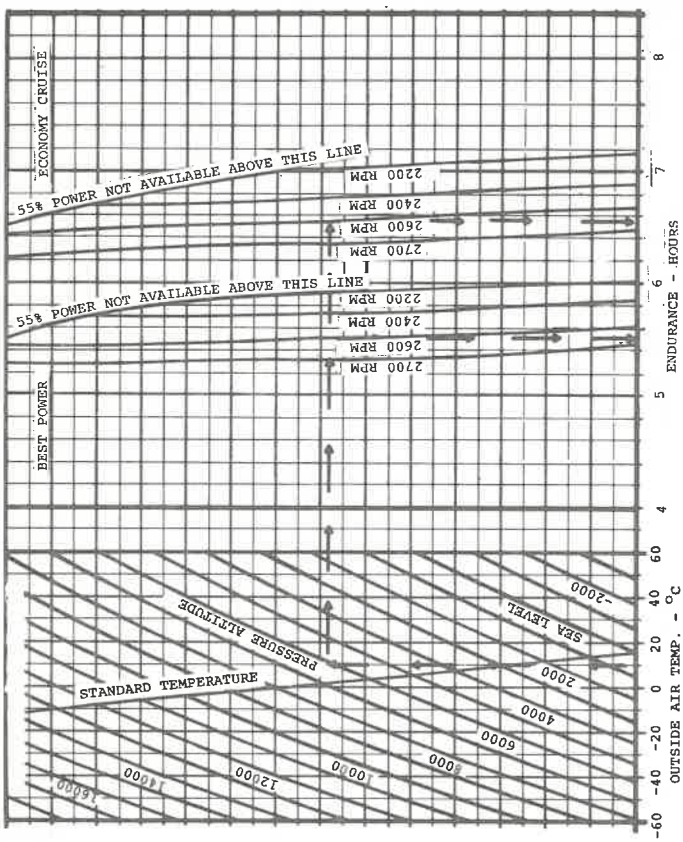
CLEAN CONFIGURATION
64 GAL. USABLE FUEL (53.3 IMP. GAL.)
COWL FLAPS CLOSED, ZERO WIND
ENDURANCE INCLUDES WARMUP, TAXI,
TAKEOFF, CLIMB PLUS 45 MIN.
RESERVE @ CRUISE POWER

EXAMPLE:	
CRUISE PRESS ALT	6000 FT.
CRUISE OAT	10°C
*POWER	65%
*RPM	2700 RPM
ENDURANCE, BEST POWER	4.70 HRS.
ENDURANCE, ECON. CRUISE	5.60 HRS.

*MP FOR 2700 RPM @ 65% POWER FROM CRUISE POWER SCHEDULE.



ENDURANCE 55% POWER - 2740LBS(1243KGS)

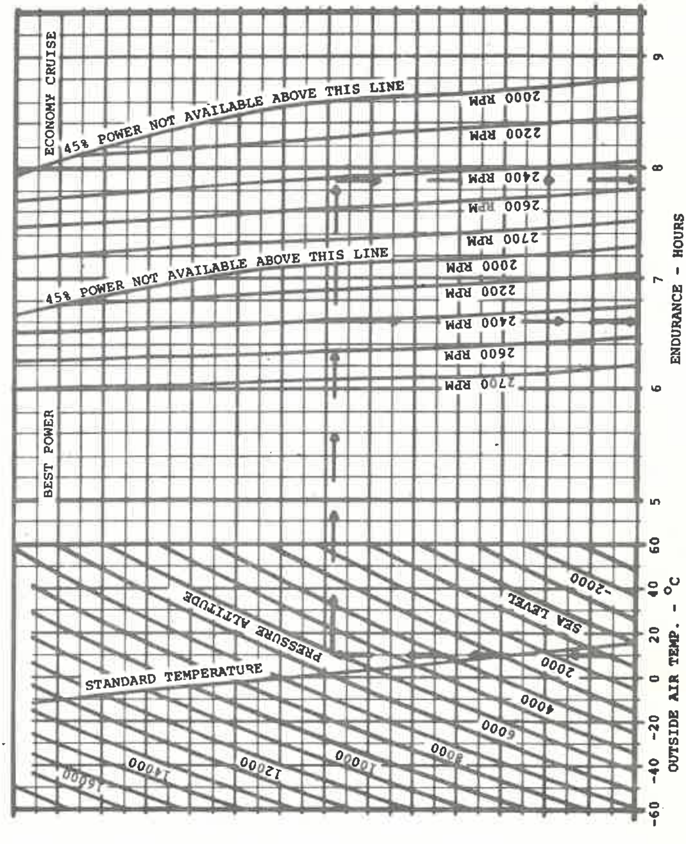


CLEAN CONFIGURATION
64 GAL. USABLE FUEL (53.3 IMP. GAL.)
ZERO WIND, COWL FLAPS CLOSED
ENDURANCE INCLUDES WARMUP, TAXI,
TAKEOFF, CLIMB PLUS 45 MIN.
RESERVE @ CRUISE POWER

EXAMPLE: →	
CRUISE ALT	6000 FT.
CRUISE OAT	10°C
*POWER	55%
*RPM	2600 RPM
ENDURANCE, BEST POWER	5.52 HRS.
ENDURANCE, ECON. CRUISE	6.55 HRS.

*MP FOR 2600 RPM @ 55% POWER FROM CRUISE POWER SCHEDULE

ENDURANCE 45% POWER - 2740 LBS (1243 KGS)



CLEAN CONFIGURATION
64 GAL. USABLE FUEL (53.3 IMP. GAL.)
ZERO WIND, COWL FLAPS CLOSED
ENDURANCE INCLUDES WARMUP,
TAXI, TAKEOFF, CLIMB PLUS 45 MIN.
RESERVE @ CRUISE POWER

EXAMPLE: ⟶	
CRUISE ALT	6000 FT.
CRUISE OAT	10°C
*POWER	45%
*RPM	2400 RPM
ENDURANCE, BEST POWER	6.62 HRS.
ENDURANCE, ECON. CRUISE	7.91 HRS.

*MP FOR 2400 RPM @ 45% POWER FROM CRUISE POWER SCHEDULE.

NORMAL LANDING DISTANCE

LANDING WEIGHT - LBS (KGS)	APPROACH SPEED - KIAS
2740 (1243)	71
2500 (1134)	69
2300 (1043)	65

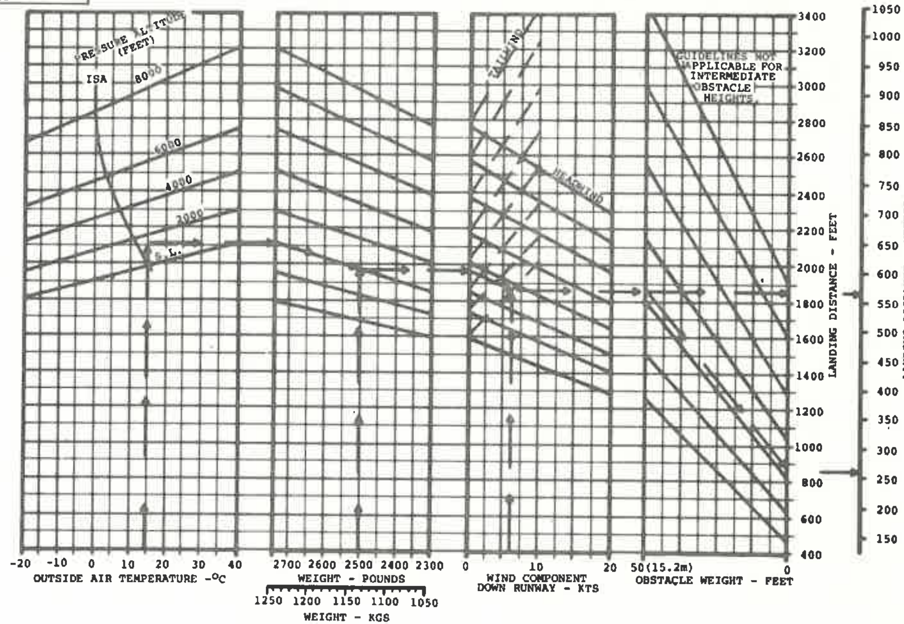
NOTE: MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KNOTS.

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	1500 FT.
WEIGHT	2500 LBS. (1134 KGS)
HEADWIND COMPONENT	6 KTS.
GROUND ROLL DISTANCE	860 FT. (262 m)
TOTAL LANDING DISTANCE (50 FT. OBSTACLE)	1860 FT. (567 m)



MAXIMUM PERFORMANCE LANDING DISTANCE

LANDING WEIGHT - LBS KGS	APPROACH SPEED - KIAS
2740 (1243)	65
2500 (1134)	62
2300 (1043)	59

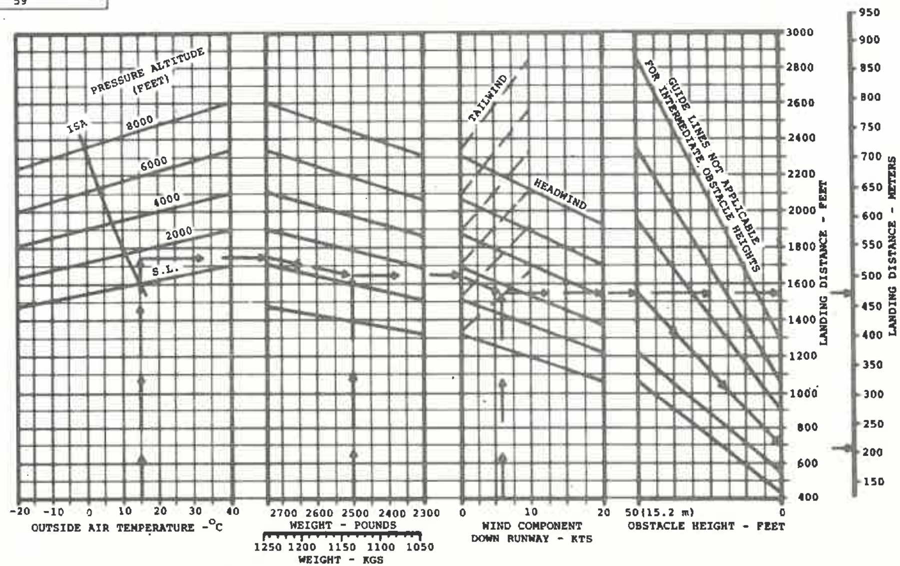
NOTE: MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KNOTS

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	1500 FT
WEIGHT	2500 LBS (1134 KGS)
HEADWIND COMPONENT	6 KTS
GROUND ROLL DISTANCE	680 FT (207m)
TOTAL LANDING DISTANCE (50 FT OBSTACLE)	1550 FT (472m)



NORMAL LANDING DISTANCE-GRASS SURFACE

LANDING WEIGHT - LBS (KGS)	APPROACH SPEED - KIAS
2740 (1243)	71
2500 (1134)	69
2300 (1043)	65

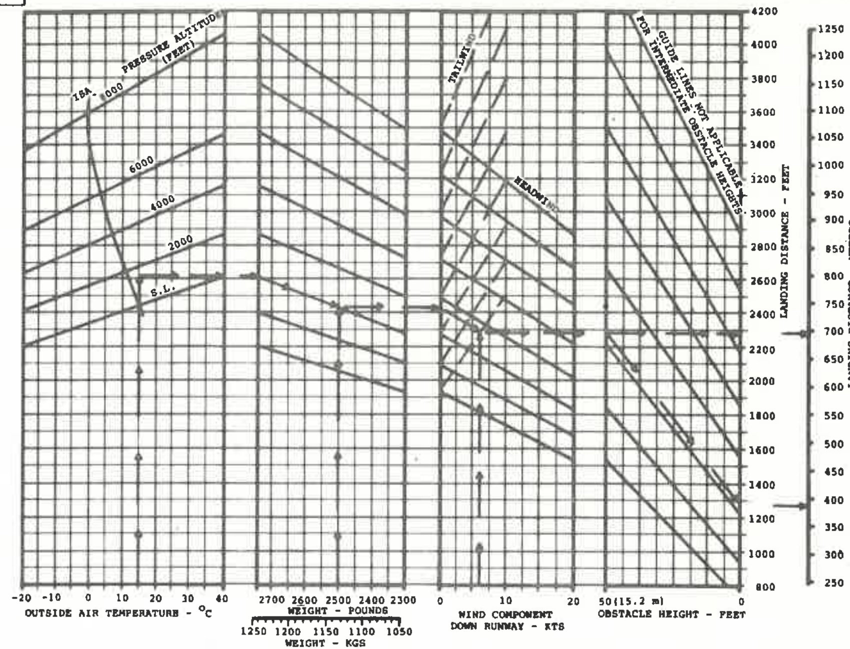
ASSOCIATED CONDITIONS:

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

EXAMPLE:

OAT	15°C
PRESSURE ALTITUDE	1500 FT.
WEIGHT	2500 LBS. (1134 KGS)
HEADWIND COMPONENT	6 KTS.
GROUND ROLL DISTANCE	1270 FT. (387 m)
TOTAL LANDING DISTANCE (50 FT. OBSTACLE)	2280 FT. (695 m)

NOTE: MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KNOTS



MAXIMUM PERFORMANCE LANDING DISTANCE-GRASS SURFACE

LANDING WEIGHT - LBS (KGS)	APPROACH SPEED - KIAS
2740 (1243)	65
2500 (1134)	62
2300 (1043)	59

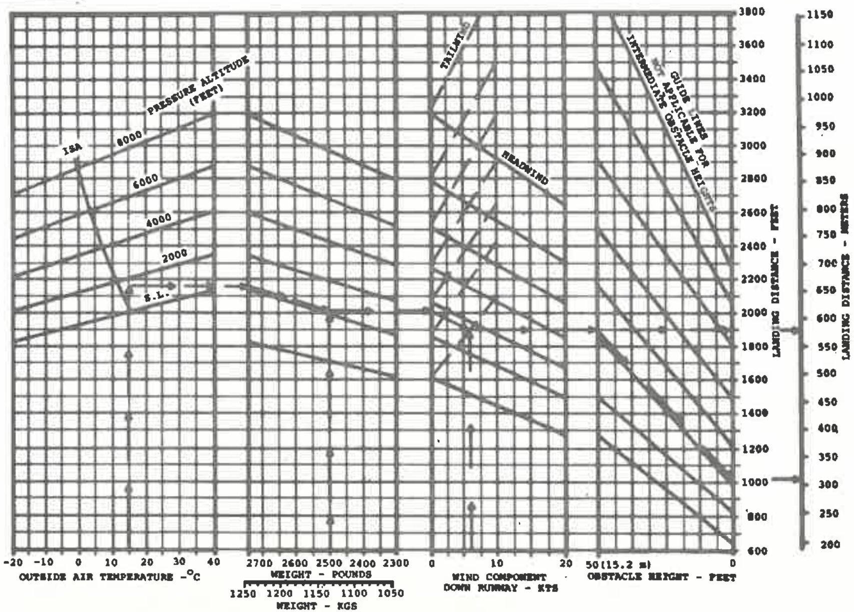
ASSOCIATED CONDITIONS:

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

EXAMPLE: →

OAT	15°C
PRESSURE ALTITUDE	1500 FT.
WEIGHT	2500 LBS. (1134 KGS)
HEADWIND COMPONENT	6 KTS.
GROUND ROLL DISTANCE	1020 FT. (311 m)
TOTAL LANDING DISTANCE (50 FT. OBSTACLE)	1900 FT. (579 m)

NOTE: MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KNOTS



Section VI

Freedom Aviation

Aircraft Weight & Balance Report

Aircraft: N5772R | Type: M20J | S/N: 24-1502
Model: M20J

Prior Empty Weight:	1,902.0	As Of:	7/02/2015	Prior Useful Load:	838.0
Prior Longitudinal Moment:	83,649.9600	Arm:	43.9800		

Items Removed:

Date	Description	Con?	Weight	Longitudinal Arm	Longitudinal Moment
8/11/2020	King KR87 S/N 21494		3.20	17.0000	54.4000
8/11/2020	King KI227 S/N 16915		0.70	15.0000	10.5000
8/11/2020	King KA44B S/N 14535		3.20	113.0000	361.6000
8/11/2020	King KG102A S/N 22095		4.80	116.0000	556.8000
8/11/2020	King KMT112 S/N 24054		0.30	66.0000	19.8000
8/11/2020	King KA51B S/N 2930		0.20	15.0000	3.0000
8/11/2020	King KG258 S/N 8749		3.10	17.4600	54.1260
8/11/2020	King KI525A S/N 23137		4.00	16.8000	67.2000
8/11/2020	Vacuum System		5.68	10.1900	57.8792
	Total of Items Removed:		25.18		1,185.3052

Items Installed:

Date	Description	Con?	Weight	Longitudinal Arm	Longitudinal Moment
8/11/2020	Garmin GI275 S/N 5MZ200713		1.90	16.0000	30.4000
8/11/2020	Garmin GI275 S/N 5MZ100286		1.90	16.0000	30.4000
8/11/2020	Garmin GMU11 S/N 56J017996		0.25	66.0000	16.5000
8/11/2020	Gramin GSB15 S/N 63M055596		0.16	17.0000	2.7200
	Total of Items Installed:		4.21		80.0200

New Final Figures:

Weight:	**1,881.03**	**Useful Load:**	**858.97**
Longitudinal Moment:	**82,544.6748**	**Arm:**	**43.8827**

Note: Items marked 'Y' in the Consolidated column ("Con?") are included in the initial Empty Weight and Moments, and therefore are not added in as new installs or removals.

Date: 8/11/2020, A/C: N5772R, Model: M20J, S/N: 24-1502, Type: M20J
, Tach: 1,019.04, Total: 3,177.04

Removed: King KR87 S/N 21494, King KI227 S/N 16915, King KA44B S/N 14535, King KG102A S/N 22095, King KMT112 S/N 24054, King KA51B S/N 2930, King KG258 S/N 8749, King KI525A S/N 23137, Vacuum System
Installed: Garmin GI275 S/N 5MZ200713, Garmin GI275 S/N 5MZ100286, Garmin GMU11 S/N 56J017996, Gramin GSB15 S/N 63M055596

Installations and removals listed above have been performed in accordance with manufacturer's specs. Aircraft is approved for return to service.

Jason K. Moorefield CRS# BGSR439C

Run: 7/18/2014
8:54AM

Virginia Aviation
Aircraft Weight & Balance Report

Aircraft: N5772R | Type: MOONEY | S/N: 24-1502
Model: M20J

Prior Empty Weight:	1,861.5	As Of:	12/14/1990	Prior Useful Load:	878.5
Prior Longitudinal Moment:	85,926.8400	Arm:	46.1600		

Superceded 7-2-15 N65R439C

Items Removed:

Date	Description	Weight	Arm	Longitudinal Moment
7/18/2014	King KY197 COM1	3.70	14.1000	52.1700
7/18/2014	King KNS80 RNAV	6.50	15.0000	97.5000
7/18/2014	King KMA24	1.70	19.0000	32.3000
	Total of Items Removed:	11.90		181.9700

Items Installed:

Date	Description	Weight	Arm	Longitudinal Moment
7/18/2014	Garmin GA35 GPS Antenna	0.75	82.0000	61.5000
7/18/2014	Garmin GTN650	7.00	15.0000	105.0000
7/18/2014	Garmin GDL88	3.67	121.0000	444.0700
7/18/2014	PS Engineering PMA8000BT	1.50	15.5000	23.2500
	Total of Items Installed:	12.92		633.8200

New Final Figures:

Weight:	**1,862.52**	**Useful Load:**	**877.48**
Longitudinal Moment:	**86,378.6900**	**Arm:**	**46.3773**

Date: 7/18/2014, A/C: N5772R, Model: M20J, S/N: 24-1502, Type: MOONEY
, Hobbs: 0.00, Tach: 0.00, Total: 0.00

Removed: King KY197 COM1, King KNS80 RNAV, King KMA24
Installed: Garmin GA35 GPS Antenna, Garmin GTN650, Garmin GDL88, PS Engineering PMA8000BT

Signed:________________________________#RSUR804H
Jason K. Moorefield

AIRCRAFT WEIGHT & BALANCE

Registration #: N5772R
Make: Mooney
Model: M20J
Serial #: 24-1502

Repair Station: BGSR439C
Work Order: F15-1469
Date: 7-2-15

Supersedes Weight and Balance Dated: 7/1/2013

Aircraft Weight

Actual Weight	Scale Reading	Arm	Moment
Left Main	672	63.98	42994.56
Right Main	681	63.98	43570.38
Nose	549	-5.3	-2909.7
TOTAL	1902	43.98	83655.24

Superseded On 4/13/2020
Freedom AL
CRS# BGSR439C

Items Added or Removed	Weight	Arm	Moment
Totals from Above or Previous W&B			

* Empty Figures Include Full Oil and Unusable Fuel

Aircraft Maximum Weight ....2740 lbs

Aircraft Useful Load..838.0 lbs

Prepared By: Joe Leonard, CRS# BGSR439C

Signature: ____________________

WEIGHT AND BALANCE/EQUIPMENT LIST REVISION

NAME:
AIRCRAFT MAKE/TYPE: Mooney M20J
REGISTRATION #: N5772R

DATE: 30 July 2016
MODEL #: M20J
SERIAL #: 24-1520

PREVIOUS DATE: WEIGHT: 1902 ARM: MOMENT: 85[illegible]

	EQUIPMENT LIST	IN	OUT	WEIGHT	ARM	MOMENT
1	(P/N) 149NL (S/N) FN-151606 (Desc.) SKY-TEC STARTER	X		9.3	-20.3	-188.79
2	Lycoming Starter		X	-18.3	-20.3	371.49
3				-9.0		182.7
4						

AIRCRAFT EMPTY WEIGHT: ~~1893~~ 1893
ARM: 44.28
MOMENT: ~~83791~~ 83837.94
GROSS WEIGHT: ~~[illegible]~~ 2740
USEFUL LOAD: 847

SIGNATURE

A&P 195653940
AUTHORIZATION

NOTE: Weight and balance must be completed and attached to pilot's operating handbook.

Sky-Tec Serial Numbers Beginning w/

Lycoming Starters

(x)N - 9.3 lbs.
(x)NE - 9.3 lbs.
(x)NER - 9.3 lbs.
(x)(y)H - 10.2 lbs.
(x)(x)M - 8.5 lbs.
(x)(x)C - 8.9 lbs.
(x)4E - 8.9 lbs.
(x)(x)L - 8.2 lbs.
(x)(x)P - 8.2 lbs.
(x)(x)T - 6.5 lbs.

Continental Starters

2C - 9.2 lbs.
2CC - 8.9 lbs.
2CCR - 8.9 lbs.
(x)C3 - 6.5 lbs.
(x)C4 - 7.6 lbs.
(x)C5 - 9.4 lbs.

Franklin Starters

(x)F - 9.2 lbs.

SECTION VI
WEIGHT AND BALANCE

MOONEY M20J

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.

MODEL - M20J

AIRCRAFT SERIAL NO. 24-1502

AIRCRAFT REGISTRATION NO. N5772R

10-22-84

Mooney Aircraft Corp. Approval Signature & Date

SECTION VI
WEIGHT AND BALANCE

MOONEY M20J

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 availble 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 FAA CHARGES YOU, the aircraft owner and pilot, with the responsibility of properly loading your aircraft for safe flight. Data presented in this section will enable you to carry out this responsibility sand 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 6-6 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 6-6. 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 6-6, is all of the data needed to compute loading schedules.

The maximum certificated gross weight for the Model M20J under all operating conditions is 2740 pounds (1243 Kg). 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 6-8.

AIRPLANE WEIGHING PROCEDURE

(A) LEVELING: Place a spirit level on the leveling screws above the tailcone 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 tanks with full fuel. Subtract usable fuel 64.0 gal. (242.4 liters, 53.3 Imp. Gal.) @ 6 lb/gal=384.0 lbs. (174.2 Kg.) from total weight as weighed, (use 5.82 lb/gal for 100LL fuel).

OPTIONAL METHOD - Ground aircraft and defuel tanks as follows:

a. Disconnect fuel line at electric boost pump outlet fitting.
b. Connect to output fitting a flexible line that will reach fuel receptacle.
c. Turn fuel selector valve to the tank to be drained, and remove filler cap from fuel filler port.
d. Turn on boost pump until tank is empty. Repeat steps c. and d. to drain the other tank.
e. Replace 1.25 gal. (4.7 liters, 1.0 Imp. Gal.) fuel @ 6.0 lb./gal. into each tank (unusable fuel). (Use 5.82 lb/gal. for 100LL fuel).
f. Replace filler caps.

3. Fill oil to capacity-8 qts. (7.6 liters).
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.

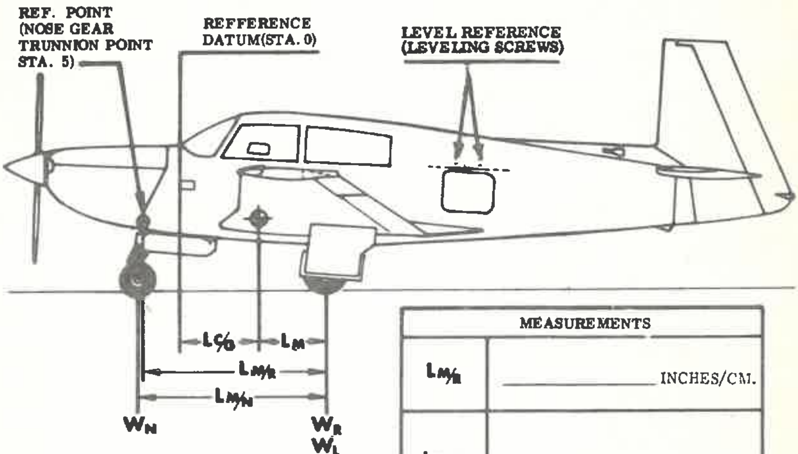
9. Find reference point by dropping a plumb bob from center of nose gear trunnion (retracting pivot axis) to the floor. Mark the point of intersection.

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:

MOONEY M20J



MEASUREMENTS	
$L_{M/R}$	______ INCHES/CM.
$L_{M/N}$	______ INCHES/CM

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, as Weighed (W_T)			

a. CG Forward of Main Wheels:

______ LBS/KG Weight of Nose (W_N) x ______ IN/CM Distance Between Main and Nose Wheel Axle Centers ($L_{M/N}$) ÷ ______ LBS/KG Total Weight of Aircraft (W_T) = ______ IN/CM CG Forward of Main Wheels (L_M)

b. CG Aft of Datum (Station 0):

______ IN/CM Distance from Center Nose Gear Trunion to Center of Main Wheel Axles (Horizontal) ($L_{M/R}$) − 5 IN(12.7 CM) Distance from Nose Gear Trunion to Datum Constant − ______ IN/CM Result of Computation Above (L_M) = ______ IN/CM CG (FUS. STA.) Distance Aft of Datum. (Empty Weight CG) (L_{CG})

OWNERS WEIGHT AND BALANCE RECORD

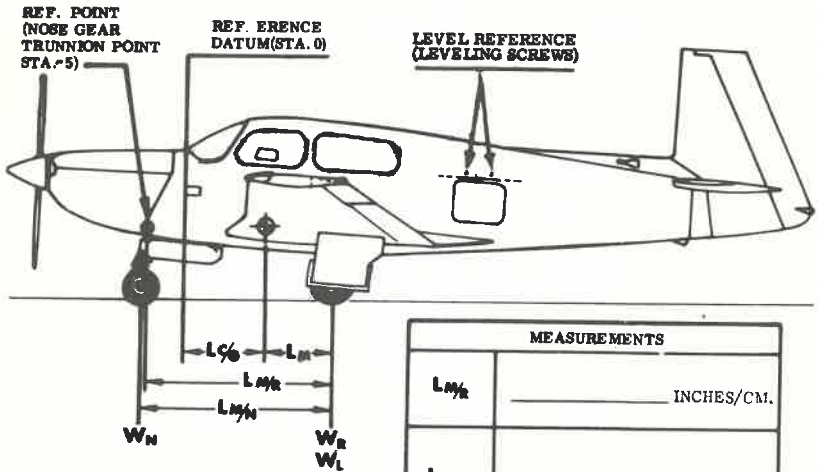
(ENTER BELOW ALL WEIGHT CHANGE DATA FROM AIRCRAFT LOG BOOK)

AIRPLANE MODEL - M20J	SERIAL NUMBER 24-1502	FAA REGISTRATION NO. N5772R

DATE	DESCRIPTION OF MODIFICATION	WEIGHT CHANGE ADDED (+) Wt. (Pounds)	ADDED (+) Arm (Inches)	REMOVED (-) Wt. (Pounds)	REMOVED (-) Arm (Inches)	RUNNING EMPTY WEIGHT Wt. (Pounds)	Moment /1000	Arm (Inches)	Useful Load
10/22/84	BASIC EMPTY WEIGHT AS DELIVERED (W_T) (INCLUDES FULL OIL - 8 QTS)	—	—	—	—	1858	85.91	46.2	882
2 MAR 88	Precise Flt. stby Vac	1.5	-5.00			1859.5	85.90	46.23	880.5
2 MAR 88	KS Avionics TETRA EGT Sys	.9	19.24			1860.4	85.92	46.18	879.6
2 MAR 88	KS Avionics CHT System	.7	19.24			1861.1	85.93	46.17	878.9
~~2-4-90~~	~~Ameri-King AK350 Blind Encoder~~	~~.4~~	~~13.0~~			~~1861.5~~	~~85.93~~	~~46.16~~	~~878.5~~
7/17/14	See 337 dated 7/17/14					1862.5	86.38	46.38	877.48
11-2006	POWERFLOW EXHAUST - 337 Form								
5/2005	AC REPAINT								
7/2015	EDM-830, CLOCK (SEE 337								
7-2-2015	AC REWEIGHED					1902	83.65	43.98	838.0
6-30-15	STRATUX [illegible]			9	-20.3	1893	83.83	44.28	847

Superseded

MOONEY M20J



MEASUREMENTS	
$L_{M/R}$	______ INCHES/CM.
$L_{M/N}$	______ INCHES/CM

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, as Weighed (W_T)			

a. CG Forward of Main Wheels:

______ LBS/KG Weight of Nose (W_N)	X	______ IN/CM Distance Between Main and Nose Wheel Axle Centers ($L_{M/N}$)	÷	______ LBS/KG Total Weight of Aircraft (W_T)	=	______ IN/CM CG Forward of Main Wheels (L_M)

b. CG Aft of Datum (Station 0):

______ IN/CM Distance from Center Nose Gear Trunion to Center of Main Wheel Axles (Horizontal) ($L_{M/R}$)	−	5 IN(12.7 CM) Distance from Nose Gear Trunion to Datum Constant	−	______ IN/CM Result of Computation Above (L_M)	=	______ IN/CM CG (FUS. STA.) Distance Aft of Datum. (Empty Weight CG) (L_{CG})

NOTE: Wing jack points are located at Fus. Sta. 56.658 in. Nose jack point is located at Fus. Sta. 3.415 in.

OWNERS WEIGHT AND BALANCE RECORD

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

AIRPLANE MODEL - M20J | SERIAL NUMBER ______ | FAA REGISTRATION NO. ______

DATE	DESCRIPTION OF MODIFICATION	WEIGHT CHANGE ADDED (+) Wt. (Pounds)	Arm (Inches)	REMOVED (-) Wt. (Pounds)	Arm (Inches)	RUNNING EMPTY WEIGHT Wt. (Pounds)	Moment /1000	Arm (Inches)	Useful Load
	BASIC EMPTY WEIGHT AS DELIVERED (W_T) (INCLUDES FULL OIL - 8 QTS)	—	—	—	—				

SECTION VI
WEIGHT AND BALANCE

MOONEY M20J

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 6-6 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 6-7) 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 the procedure for the co-pilot and enter these weights and moment/1000 values in the proper subcolumns in the Problem Form on page 6-7.

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 2740 Pounds 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 6-8). 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.

PROBLEM FORM

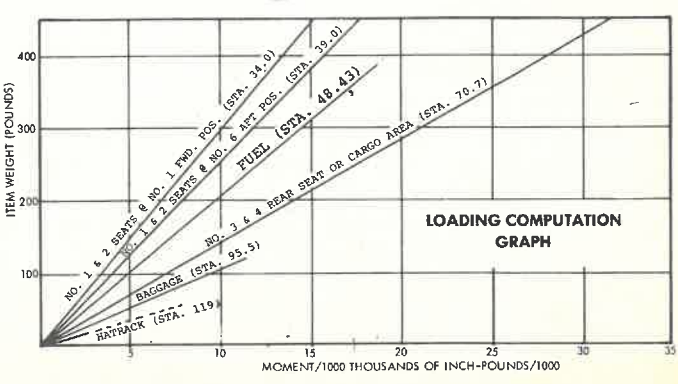
FAA REGISTRATION NO. ______________ M20J SERIAL NO. __________

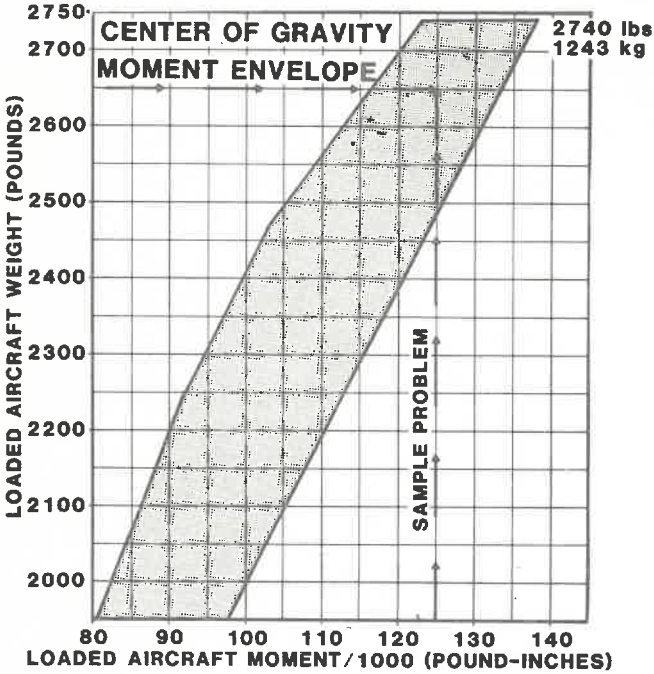
Step	ITEM	Sample Problem Pilot & Two Pass.		Your Problem	
		Weight (LBS)	Moment (LB-INS. /1000)	Weight (LBS)	Moment (LB-INS. /1000)
1	**Aircraft Basic Empty Weight, W_T (From Page 6-5) Includes Full Oil - - -8 QT. @1.875 LBS/QT(Sta - 11.5 (Sump assumed full for all flights)**	**1710.0**	**75.26**		
2	Pilot Seat (#1)*	170.0	6.0 (2nd Pos.)		
	Copilot Seat (#2)*	170.0	5.8 (Fwd. Pos.)		
3	Left-Rear Seat (#3) or Cargo Area	170.0	12.00		
	Right-Rear Seat (#4) or Cargo Area				
4	Fuel (Max. Usable 64 Gal., 384 LBS. @ sta. 48.43) **(242.4 liter, 174.2 Kg)**	312.0	15.11		
5	Baggage (Max. 120 LBS @ Sta 95.5)	110.0	10.23		
	Hat Rack (Max. 10 LBS @ Sta 119.0)	3.0	.36		
6	Loaded Aircraft Weight	2645.0			
	Total Moment/1000		124.76		
7	Refer to Page 6-8, Center-of-Gravity Moment Envelope, to dertmine whether your aircraft loading is acceptable.				

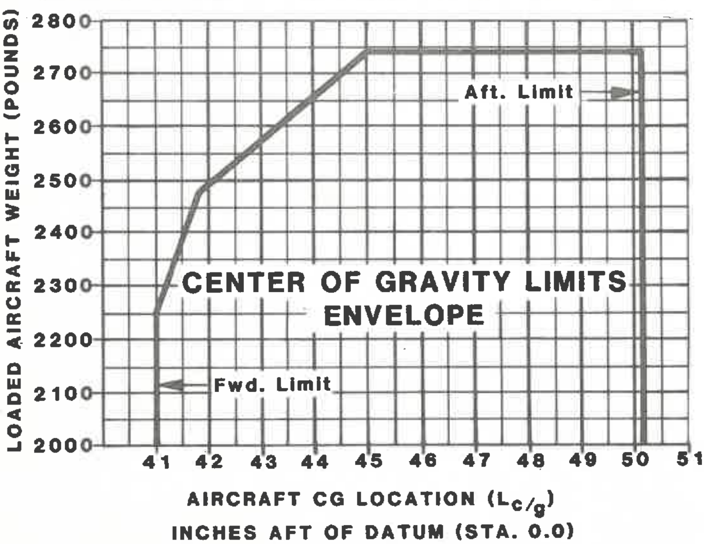
*Obtain the moment/1000 value for each seat position (FWD, MID, or AFT.) from loading computation graph below.

CAUTION

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




CENTER OF GRAVITY
MOMENT ENVELOPE
2740 lbs
1243 kg
SAMPLE PROBLEM
LOADED AIRCRAFT WEIGHT (POUNDS)
2750
2700
2600
2500
2400
2300
2200
2100
2000
80
90
100
110
120
130
140
LOADED AIRCRAFT MOMENT/1000 (POUND-INCHES)


CENTER OF GRAVITY LIMITS
ENVELOPE
Aft. Limit
Fwd. Limit
LOADED AIRCRAFT WEIGHT (POUNDS)
2800
2700
2600
2500
2400
2300
2200
2100
2000
41
42
43
44
45
46
47
48
49
50
51
AIRCRAFT CG LOCATION ($L_{c/g}$)
INCHES AFT OF DATUM (STA. 0.0)

SECTION VI
WEIGHT AND BALANCE

MOONEY M20J

EQUIPMENT LIST

The following equipment list is a listing of all items approved at the time of publication of this manual for the Mooney M20J.

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

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	10			
DAY	22			
YEAR	84			

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	Powerplant and Accessories							
1A	Engine, Lycoming IO360-~~A3B6D~~ (Includes Starter, Prestolite 60 Amp Alternator, and Oil Filter) IO-360-A3B6	600363	330.00*	-15.76*	X			
2A	Oil Radiator (Stewart Warner)	620052	2.4	-3.8	X			
3A	Valve, Oil Quick Drain (Net Change)	600363	0.00	-14.00	X			
4A-1	Propeller - Constant Speed (McCauley - B2D34C214/90DHB-16E)	680031	49.50	-35.50	X			
5A	Governor, Propeller (McCauley C290D5/T17)	660115	2.75	-1.40	X			

EQUIPMENT LIST

					MO	10	3		
					DAY	4	2		
					YEAR	84	88		
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED				
	A. Powerplant and Accessories (CONT).								
6A	Spinner Installation	680031	4.80	-35.00		X			
7A	Induction Air Filter	600355	1.00	-25.50		X			
8A	Fuel Selector Valve	610152	0.9	26.25		X			
4A-2	Propeller - Constant Speed (Hartzell - HC-(C2YK-1BF/F7666A-3Q)	680031	54.25	-35.50					
	Precise Flt Stby Vac Sys.		1.5	-5.00			X		

EQUIPMENT LIST

				MO	10			
				DAY	22			
				YEAR	84			

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	B. Electrical System							
1B	Battery (35 AMP HR.)	800331	27.5	110.80	X			
2B	Regulator	800331	.6	4.00	X			
3B	Heated Pitot Installation	820252	1.15	41.85	X			
4B	Cigarette Lighter	800331	.17	19.50	X			
5B								
6B	Fuel Pump	610152	2.4	15.0	X			
7B	Stall Warning Indicator (Mallory)	800331	1.00	50.00	X			
8B	Gear Warning Indicator (Mallory)	800331	1.00	50.00	X			
9B	Strobe Light, Wingtip Instl	800331	3.08	53.00	X			
10B	Strobe Light, Tail Instl	800331	0.8	215.82	X			
11B	Safety Switch, Air Speed	880013	.20	15.0	X			

EQUIPMENT LIST

MO.	10		
DAY	22		
YEAR	84		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED		
	B. ELECTRICAL SYSTEM (cont)						
12B	Landing Lights	650180	.75	-20.5	X		
13B	Actuator, Flap	750097	5.1	103.12	X		
14B	Fuel Qty. Transmitter, Inbd (2 ea)	610152	.45	48.0	X		
15B	Fuel Qty. Transmitter, Outbd (2 ea)	610152	.45	48.5	X		
16B	Actuator, Landing Gear	560212	11.2	39.0	X		
17B	E.L.T.	810081	2.1	121.0	X		

EQUIPMENT LIST

				MO	10			
				DAY	22			
				YEAR	84			
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	C. WHEELS TIRES & BRAKES							
1C	Two Main Wheel & Brake Assys	520029	13.72*	64.4	X			
	Wheel Assy (2)	520029	11.00	63.98	X			
	Brake Assy (2)	520029	2.72	65.98	X			
2C	Nose Wheel Assy	540000	2.60	-5.3	X			
3C	Two Main Wheel Tire Assys (6-Ply Rating Tires, 6.00X6 , Type III, with regular tubes)	520029	17.0	63.98	X			
4C	Nose Wheel Tire Assy (6-ply rating tire, 5.00 X 5 Type III, with regular tube)	540000	7.00	-5.3	X			

EQUIPMENT LIST

				MO.	10		
				DAY	22		
				YEAR	84		
ITEM NO.	**ITEM DESCRIPTION**	**REF. DRAWING**	**WEIGHT (POUNDS)**	**ARM (INCHES)**	**MARK IF INSTALLED**		
	C. WHEELS TIRES & BRAKES (cont)						
5C	Brake Master Cylinder (2ea)	850109	3.0	8.3	X		
6C	Hydraulic Reservoir	850109	.3	108.75	X		
7C	Valve,Parking Brake	850109	.6	-1.45	X		

EQUIPMENT LIST

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING OR PART NO.	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED MO 12 DAY 22 YEAR 84			
	D. Instruments							
1D	Attitude Gyro	820309	2.28	17.46				
2D	Directional Gyro	820309	2.44	16.80				
3D	Clock-Electric	820309	.4	19.60	X			
4D	Gage OAT/EGT	820309	.54	18.50	X			
5D	Indicator - Vertical Speed	820309	.90	18.50	X			
6D	Turn Coordinator	820309	2.40	16.50	X			
7D	Manifold Press.	820309	1.00	18.48	X			
8D	Altimeter	820309	1.00	18.70				
9D	Airspeed Indicator	820309	.66	18.80	X			
10D	Magnetic Compass	820230	.50	21.9	X			
11D	Cluster Gauge	820309	1.16	19.3	X			

EQUIPMENT LIST

					MARK IF INSTALLED			
				MO	10			
				DAY	22			
				YEAR	84			
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)				
	D. Instruments (cont.)							
12D	Tachometer, Electric (2 In.)	880002	.8	18.0	X			
13D	Alternate Static Air Source	820252	.25	18.5	x			
14D	Annunciator Panel	820309	.70	17.5	x			
15D	Hour Meter Instl.	950229	.29	18.50	X			
16D	Fuel Flow Instl.	600363	.88	1.95	x			

EQUIPMENT LIST

					MO	10			
					DAY	22			
					YEAR	84			
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED				
	E. Vacuum System								
1E	Vacuum System Instl	860052	6.30*	10.19		X			
	Vacuum Pump	860052	2.0	-5.00		X			

EQUIPMENT LIST

MO	10		
DAY	22		
YEAR	84		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	F. Cabin Accommodations							
1F	Sun Visors	130291	1.0	33.00	X			
2F	Shoulder Harness. Front & Back (Set of four)	140205	8.4	76.48	X			
3F	Belt Assy. Rear Occupant Lap (2)	130291	2.0	71.00	X			
4F	Belt Assy. Front Occupant Lap(2)	130291	2.0	35.00	X			

EQUIPMENT LIST

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INS.)	MARK IF INSTALLED			
				MO	10	12		
				DAY	22	14		
				YR	84	90		
	G. Avionics & Autopilots							
1G	KING KX 165 w/GS	810081	6.15	+14.43	X			
2G	KING KY 197	810081	3.7	+14.1	X			
3G	KING KNS 80 w/GS	810081	6.5	+15.0	X			
4G	KING KI 206	810081	1.60	+15.0	X			
5G	KING KR 87 w/ KI 227	810081	6.90	+52.94	X			
6G	KING KT 76A	810081	3.9	+19.24	X			
7G	KING KMA 24	810081	1.7	+19.0	X			
8G	United Instrument Encoder	810081	1.9	+14.0	X			
9G	KING KAP 150 Autopilot	830125	23.2	+75.0	X			
10G	AK 350 Blind Encoder	Doc # IM-350/001	.4	13.0		X		
11G								

EQUIPMENT LIST

MO	10			
DAY	12			
YEAR	84			

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	G. Avionics & Autopilots (cont...)							
12G								
13G								
14G								
15G								
16G								
17G								
18G								
19G								
20G								
21G								
22G								

EQUIPMENT LIST

				MO	10			
				DAY	22			
				YEAR	84			
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	H. Auxiliary Equipment							
1H	Tow Bar (Stowed)	010001	2.12	95.5	X			
2H	Jack Points (Stowed)	010000	.10	119.0	X			
3H	Wing Tie Down Rings (Stowed)	010002	.10	119.0	X			
4H	Fuel Sampler Cup (Stowed)	610010	.05	119.0	X			
5H	Engine Operators Manual (Avco-Lycoming)	010025	.75	119.0	X			
6H	Aircraft P.O.H./AFM	010025	1.50	119.0	X			
7H	Cargo "D" Rings	010027	.16	119.0	X			
8H	Cargo Restraint Belts	140233	1.0	119.0	X			

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
				MO	10			
				DAY	22			
				YEAR	84			
	I. Optional Equipment							
1I	Oxygen System Installation	870007	37.2	125.0				
2I	**Curtains**	950193	2.9	64.00				
3I	Headrest Assy-FRONT	140267	1.56	45.00	X			
4I	HEADREST ASSY.-REAR	140267	1.56	80.00	X			
5I	Aux. Power Receptacle Instl	950086	2.60	111.00	X			
6I								
7I	Rotating Beacon Installation	800331	1.68	168.00				
8I'	Brake Instl, Dual	950239	3.00	15.0				
9I	Fire Extinguisher Instl	950251	5.25	60.5	X			
10I	Fixed Step Assy	840071	2.16	108.0	X			

EQUIPMENT LIST

				MO	10			
				DAY	22			
				YR	84			
ITEM NO.	ITEM DESCRIPTION	REF DRAWING	WEIGHT (POUNDS)	ARM (INS.)	MARK IF INSTALLED			
	I. Optional Equipment (Cont)							
11I	Seat, Pilot, Vert. Adjust. NET	140215	+3.0	**				
12I	Seat, Copilot, Vert. Adjust. CHG.	140215	+3.0	**				
13I	Seat, Pilot, Special Edition NET	140235	+3.25	**	x			
14I	Seat, Copilot, Special Edition CHG	140235	+3.25	**	x			
15I	Prop De-Ice Boots	690000	4.4	18.2				
16I								
17I								
18I	Rudder Pedal Extension	720115	5	15.00	x			
19I								
20I	AM/FM/Cassette System	810081	4.05	14.06				

EQUIPMENT LIST

MO.	10			
DAY	22			
YEAR	84			

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	I. Optional Equipment (Cont.)							
21I	Oxygen Refill Hose Adapter	870025	4.5	***				
22I	Aux. Power Cable Adapter	880042	6.8	***	X			
23I	Standby Vacuum Pump Instl.	860060	12.04	98.4				

**ARM WILL VARY WITH SEAT POSITION BETWEEN STA. 34.0 AND 39.0

***ARM WILL VARY WITH LOCATION STORED. THE PILOT IS RESPONSIBLE TO COMPUTE WEIGHT AND BALANCE DATA IF THESE ITEMS ARE STORED IN THE AIRCRAFT DURING FLIGHT.

EQUIPMENT LIST

Item No.	Item Description	Ref. Drawing	Weight (Pounds)	Arm (Ins.)	Mark If Installed			
				MO	10	3		
				DAY	22	2		
				YR	84	88		
	I. Optional Equip. (Cont.)							
26I	Wing Tip Recognition Lights	210410	2.0	53.0	✗			
27I	Tow Bar (Folding)	010034	2.6	95.5				
28I	Inboard Arm Rest Instl.	140296	.8	34.5				
29I	Lumbar Support	140300	.75	35.0	✗			
30I								
31I								
	KS Avionics Tetra EGT sys.		.9	19.24		X		
	KS Avionics 4 probe CHT sys.		.7	19.24		X		

EQUIPMENT LIST

MO	10			
DAY	22			
YR	84			

Item No.	Item Description	Ref. Drawing	Weight (Pounds)	Arm (Ins.)	Mark If Installed			
	I. Optional Equip. (Cont.)							

Section VII

SECTION VII
AIRPLANE AND SYSTEMS DESCRIPTION

MOONEY M20J

TABLE OF CONTENTS

SECTION VII
AIRPLANE AND SYSTEMS DESCRIPTION

MOONEY M20J

SECTION VII
AIRPLANE AND SYSTEMS DESCRIPTION

MOONEY M20J

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 for you, the pilot, to 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 M20J 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 is of semi-monocoque construction.

Seating in the cabin is provided for the pilot and three passengers.

The M20J has a tapered wing that is a full-cantilever-laminar-flow type. The airfoil varies from a NACA 63 (sub 2) -215 at the wing root to a NACA 64 (sub 1) -412 at the wing tip.

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 leading edge.

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 prov'e pitch attitude trim.

The tricycle landing gear allows max' vision and ground maneuvering. Hyd brakes and a steerable nose wheel aid in positive directional control during taxiing and crosswind landings.

The landing gear is electrically retracted and extended. A gear 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 for use 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.

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. Lead counterweights balance the system.

Elevator System

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

Trim System

To provide pitch trim control, the entire empennage pivots around its main hinge points. The system consists of a manually 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 a pointer located on the lower console. This indicator is geared to the trim control wheel mechanism and indicates stabilizer position relative to the aircraft thrust line.

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. Also located on the control console is a flap position indicator which shows full up, takeoff (15 degrees) and full down positions. A cable attached to the flap jackshaft operates 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.

MOONEY M20J

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. The radio console and annunciator panel is at the center of the instrument panel. Power plant instruments are grouped on the co-pilot's panel. Flap and stabilizer position indicators are on the lower center console.

FLIGHT PANEL & INSTRUMENTS

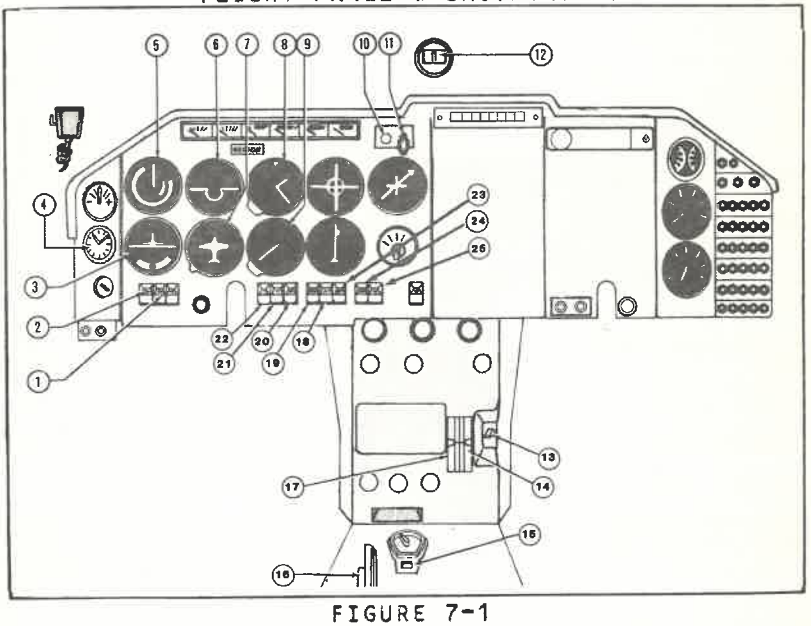


FIGURE 7-1

1. RADIO MASTER

The Radio Master Switch/Circuit Breaker operates a relay supplying power to the radio bus bars. Since the relay is energized to cut the power to the radio bus, failure of the relay coil will still allow power to the radio bus. Energizing the starter automatically energizes the relay and disconnects the radios from the bus.

2. MASTER SWITCH

The master switch operates the battery relay which controls battery power to the main ship bus bar. This switch also cuts the alternator field power from main bus to the alternator. This cuts off all ship power except the cabin light and electric clock.

3. TURN COORDINATOR (if installed)

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

4. CLOCK

The electric clock with a sweep second hand, may be set by the pilot by pulling the knob and turning either left or right.

5. AIRSPEED INDICATOR

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

6. ATTITUDE INDICATOR (if Installed)

The vacuum-powered attitude indicator indicates aircraft attitude relative to straight- and-level flight. Bank attitude is presented by a pointer at the top of the indicator relative to the bank scale which is marked in increments of 10 degrees, 20 degrees, 30 degrees, 45 degrees, 60 degrees and 90 degrees either side of the center mark. Pitch attitude is presented by an airplane silhouette in relation to the horizon bar. The knob at the bottom of the instrument is provided for adjustment of the silhouette to the horizon bar for a more accurate flight attitude indication. Vacuum pressure for satisfactory operation is 4.25 +/- .25 to 5.50 + .2/ - .0 IN Hg. Various styles may be installed at this position.

7. GYROSCOPIC HEADING INDICATOR (Directional Gyro) (If Installed) The directional gyro displays airplane heading on a compass card in relation to a fixed simulated airplane image and index. The directional indicator will precess slightly over a period of time. Therefore, the compass card should be set in accordance with the magnetic compass just prior to takeoff, and occasionally re-adjusted 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. Vacuum pressure for satisfactory operation is the same as the artificial horizon/attitude indicator.

8. 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, behind a small window in the face of the main dial, to indicate local barometric pressure and to correct the altimeter reading for prevailing conditions.

9. VERTICAL SPEED INDICATOR

The vertical speed indicator converts baro- metric 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. The recessed, slotted screw at the lower left of the instrument case is used to "zero" the indicator when the aircraft is on the ground.

10. GEAR SAFETY OVERRIDE SWITCH

The gear safety override switch is a manual means of electrically bypassing the Airspeed Safety Switch. In the event the gear control switch is inadvertently place in the gear-up position, the gear airspeed safety switch prevents the gear being retracted before takeoff speed of approximately 65 + 7/- 5 KTS is reached. Should it be necessary to retract at a lower airspeed the gear safety by pass switch may be pressed until the gear is completely retracted.

CAUTION

The activation of the gear safety override switch overrides the safety features of the airspeed switch and can cause the gear to start retracting while on the ground.

11. GEAR SWITCH

The electric gear switch, identifiable by its wheel shaped knob, is a two-position switch. Pulling aft and lowering the knob lowers the landing gear while pulling aft and raising the knob raises the gear.

NOTE

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

12. MAGNETIC COMPASS

The magnetic compass is liquid-filled, with expansion provisions to compensate for temperature changes. 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 compass except an occasional check on a compass rose with adjustment of the compensation card, if necessary, and replacement of the lamp.

13. FLAP SWITCH

The flap switch, in a recess on the right of the console, operates the electrically-actuated wide span wing flaps. Holding the spring-loaded switch in the FLAPS DOWN position lowers the flaps to the desired angle of deflection. A pointer in the center console indicates flap position. 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 FLAPS 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

Pushing the switch to the switch to the UP position retracts the flaps completely.

14. FLAP POSITION INDICATOR

Wing flap position is mechanically indicated thru a cable mounted directly to the flap jackshaft. A pointer in the flap position indicator indicates flap position. The intermediate mark in the pointer range is the flap TAKEOFF setting (15 deg.).

15. GEAR POSITION INDICATOR (FLOORBOARD)

The illuminated gear-down position indicator at the back of the fuel selector pan, aft of the center console, has two marks that align when the gear is down and illuminates when the green GEAR DOWN light is on. A RED-WHITE striped decal shows when landing gear is not in the down position.

16. TRIM CONTROL WHEEL

Rotating the trim control wheel forward lowers the nose; rearward rotation raises the nose of the aircraft.

17. TRIM POSITION INDICATOR

Stabilizer trim position indicator is mechanically activated thru a cable assembly attached to the trim wheel mechanism. Trim position indications are shown on the console.

18. PITOT HEAT SWITCH/CIRCUIT BREAKER

Pushing ON the pitot heat combination switch circuit breaker turns on the heating elements within the pitot tube. Should a short occur the combination switch/circuit breaker will automatically trip to the OFF position.

19. LANDING LIGHT SWITCH/CIRCUIT BREAKER

Pushing ON the landing light combination switch/circuit breaker turns on the landing light. Should a short occur the combination switch/circuit breaker will automatically trip to the OFF position. The landing light should not be operated when the engine is not running to preclude overheating of the lamp.

20. RECOGNITION LIGHT SWITCH/CIRCUIT BREAKER (if installed)

Pushing ON the recognition light combination switch/ circuit breaker turns on the recognition light. Should a short occur the combination switch/circuit breaker will automatically trip to the OFF position.

21. NAVIGATION LIGHT SWITCH/CIRCUIT BREAKER

Pushing ON the navigation light combination rocker switch/circuit breaker turns on the wing tip and tail navigation lights. Should a short occur the combination switch/circuit breaker will automatically trip to the OFF position.

22. STROBE LIGHT SWITCH/CIRCUIT BREAKER

Pushing ON the strobe light combination switch/ circuit breaker turns on the wing tip and tail strobe lights. Should a short occur the combination switch/circuit breaker will . ,on automatically trip to the OFF position.

23. Prop De-Ice Switch/Circuit Breaker (If Installed)

24. Weather Scout Radar Switch/Circuit Breaker (If Installed)

25. Electric Trim Switch (If Installed).

ENGINE INSTRUMENTS AND CONTROLS

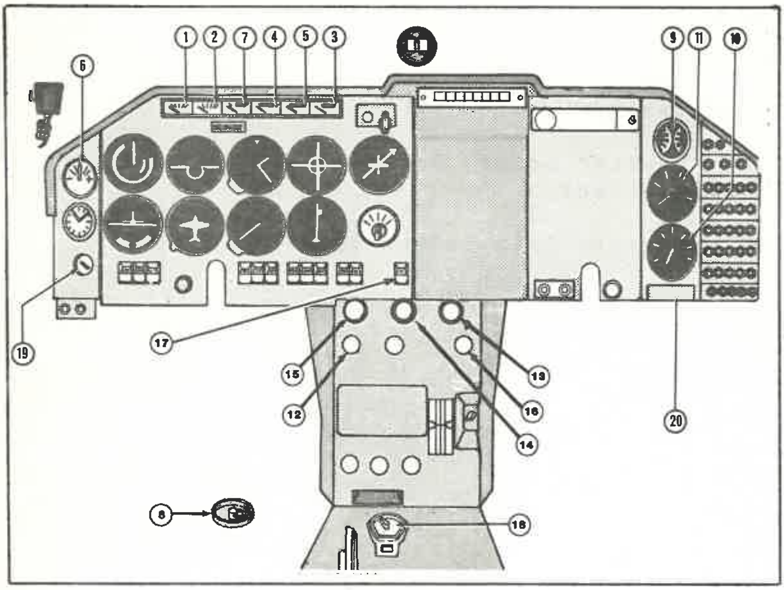


FIGURE 7-2

1 & 2. FUEL QUANTITY INDICATORS

The fuel quantity indicators are used in conjunction with two float-operated variable-resistance transmitters in each fuel tank. The tank-full position of the transmitter float produces a maximum resistance through the transmitters, permitting minimum current flow through fuel quantity indicator and maximum pointer deflection. The instruments are calibrated in gallons of fuel.

3. CYLINDER HEAD TEMPERATURE (CHT)

The cylinder head temperature indications are controlled by an electrical resistance type temperature probe installed in the number three cylinder, and receives power from the aircraft electical system. The instrument is calibrated in degree F.

4. OIL PRESSURE GAUGE

The electric oil pressure gauge uses a transducer which varies resistance with pressure, as reference.

5. OIL TEMPERATURE GAUGE

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

6. AMMETER

The ammeter indicates current flow, in amperes, from the alternator to the battery, or from the battery to the electrical system. With the engine operating, and master switch "ON", the ammeter indicates the rate of charge beinge applied to the battery. In the event of an alternator malfunction, or if the electrical load demand exceeds the alternator output, the ammeter will indicate the discharge rate ofe the battery.

Two 5 amp fuses protect the two circuits,stem battery and alternator indication. These are located underneath the circuit breaker panel approximately 6 inches forward of panel face.

7. FUEL PRESSURE GAUGE

The fuel pressure gauge is of the electric type, using a transducer as reference, and is calibrated in pounds per square inch and indicates the pressure to the fuel injector.

8. GASCOLATOR

The gascolator, located to the left of the console on the floorboard, allows the pilot to drain condensed water or any sediment from the lowest point in the fuel line. To activate the gascolator drain pull the ring upward, to stop drainage release the ring.

9. EGT/OAT GAUGE

The EGT/OAT gauge is located to the right of the radio panels and above the engine tachometer. A thermocouple probe in the number 3 exhaust pipe transmits temperature variations to the indicator mounted in the instrument panel. The indicator serves as a visual aid to the pilot when adjusting mixture. Exhaust gas temperature varies with fuel-to-air ratio, power and RPM. The OAT gauge provides the pilot with the free stream outside air temperature in degrees centigrade.

10. MANIFOLD PRESSURE

The manifold pressure gauge is of the direct reading type and is mounted below the engine tachometer. The gauge is calibrated in inches of mercury and indicates the pressure in the induction air manifold.

11. TACHOMETER

The tachometer is an electronic meter which counts ignition pulses. The instrument is calibrated in revolutions per minutes (RPM).

12. RAM AIR CONTROL

Pulling the ram air control allows the use of unfiltered air. The use of ram air must be limited to clean dust-free air and must not be used during any ground operations.

13. MIXTURE CONTROL

The mixture control allows the pilot to adjust the fuel-air ratio (mixture) of the engine. Pushing the control forward richens the mixtue. Pulling the control aft leans the mixture and pulling the control full aft closes the idle cutoff valve 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 richens the mixture, counterclockwise leans.

14. PROPELLER CONTROL

Pushing the propeller control forward increases engine RPM; pulling the control aft decreases the engine RPM. The control is of the vernier type and fine adjustments or RPM's can be obtained by turning the knob: clockwise increases RPM's, counterclockwise decreases RPM's.

15. THROTTLE CONTROL

Pushing the throttle control forward increases the manifold pressure thereby increasing the engine power. Pulling the control aft decreases the manifold pressure thereby decreasing the engine power. A friction lock is provided to prevent creeping at cruise settings.

16. COWL FLAP CONTROL

Pulling the cowl flap control full aft opens the cowl flap doors allowing additional airflow to properly cool the engine on the ground and during low speed high power climbs. During cruise the cowl flaps may be partially opened, (control pulled aft approximately three inches) if necessary, to maintain oil and cylinder head temperatures within the normal operating range.

17. FUEL BOOST PUMP SWITCH/CIRCUIT BREAKER

Pushing ON the fuel boost pump combination switch/circuit breaker turns on the fuel boost pump. Use of the fuel boost pump should be limited to starting, takeoff, switching fuel tanks, landing, and emergency situations.

The fuel boost pump is capable of supplying fuel to the engine at the rated quantities and pressures to permit the engine to develop rated power.

18. FUEL SELECTOR VALVE

The fuel selector valve located on he floor- board 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.

19. 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 MAG 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. In the OFF position both magnetos are grounded. At the R position the left magneto grounds. At the L position the right magneto grounds. At either the START position or the BOTH position both magnetos are hot and the ignition system is ON.

20. FUEL FLOW

The fuel flow gauge is an electric instrument which operates from information provided by a transducer. The gauge is digital and indicates fuel flow and/or gallons used.

The fuel flow gauge IS NOT to be used as a reference for leaning the engine during manual operation; use the EGT gauge for this reference.

MISCELLANEOUS INSTRUMENTS, CONTROLS AND INDICATORS

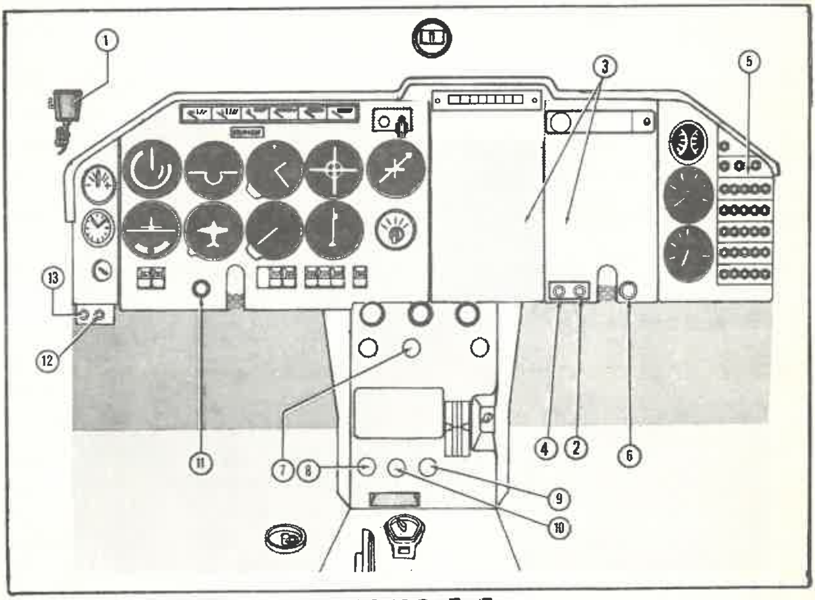


FIGURE 7-3

1. RADIO MICROPHONE (If Installed)

2. RADIO LIGHT SWITCH AND DIMMER

Turning the radio light switch knob clockwise turns ON the radio and indicator lights. Continued turning clockwise increases light intensity.

3. RADIO PANELS

Adequate space is provided for installation of optional avionics.

4. PANEL LIGHT SWITCH AND DIMMER

Turning the panel light switch knob clockwise turns ON the instrument lights located in the glareshield. Continued turning clockwise increases the lighting intensity.

5. CIRCUIT BREAKER PANEL

Push-to-reset and push-pull circuit breakers automatically break the electrical current flow if a system receives an overload.

6. CIGAR LIGHTER

7. 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.

8. DEFROST CONTROL

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

9. CABIN VENT CONTROL (Fresh Air)

Pulling the cabin vent control aft opens the cabin vent, located on the right side of the airplane. Optimum use of the cabin vent control is described in the Cabin Environment Section.

10. 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.

11. ALTERNATE STATIC SOURCE VALVE

Pulling the alternate static source valve to the aft position changes the sousrce of static air for the altimeter, airspeed indicator and rate-of-climb indicator from the outside of the aircraft to the cabin interior. Airspeed and altimeter readings are affected slightly when alternate static source is used. (Refer to

Section V).

12. HEADSET JACK

13. MICROPHONE JACK

NOTE

Spare fuses are located aft of and adjacent to the ammeter fuses. There are 5 amp fuses to replace either ammeter or instrument light control box fuses as needed.

MOONEY M20J

ANNUNCIATOR AND SWITCH PANELS

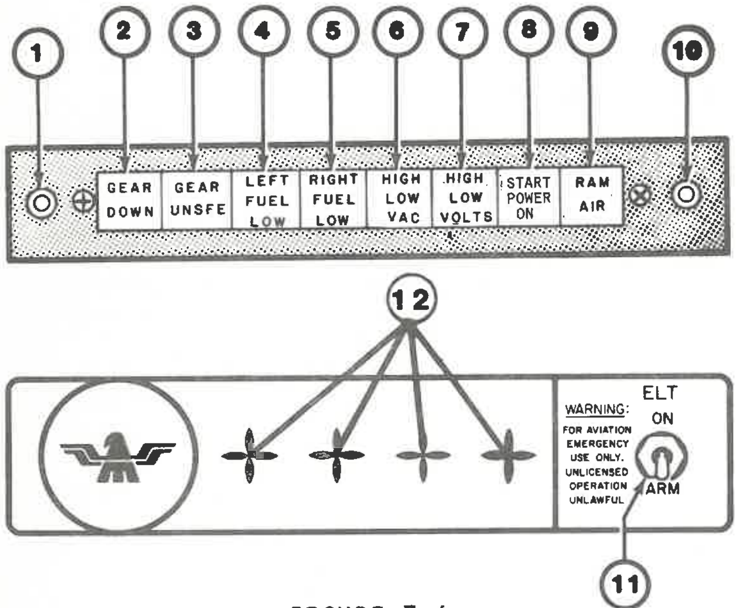


FIGURE 7-4

1. PRESS-TO-TEST SWITCH

Pressing the red press-to-test switch with the master switch ON will illuminate all annunciator light bulbs, excluding START POWER ON indicator Defective bulbs should be replaced prior to the next flight.

2 & 3. GEAR SAFETY INDICATOR

The green GAER DN light and a red GEAR UNSFE light provide visual gear position signals. The green light (GEAR DN) shows continuously when the gear is fully extended. With the navigation lightss on, the GEAR DN light is dim for night operation. All gear lights are out when the gear is fully retracted. GEAR UNSFE light is on between gear fully extended and gear fully retracted position.

4 & 5. FUEL LOW INDICATORS

LEFT and/or RIGHT, red, FUEL LOW annunciator light comes on when there is 2-1/2 to 3 gallons of usable fuel remaining in the respective tanks. Press to Test switch must be held for 3-5 seconds for LOW FUEL warning circuit to activitate.

6. VACUUM MALFUNCTION INDICATOR (VAC-HIGH/LOW)

The red VAC annunciator light indicates a malfunction of improper adjustment of air suction system. Air suction is available for operation of the attitude gyro, and also the directional gyro, and will be shown in inches of mercury. The designated suction range is 4.25 to 5.5 inches of mercury. The VAC light will blink when suction is below 4.25 inches of mercury and gives a steady light when suction is above 5.5 inches of mercury. In either case the gyros should not be considered reliable during this warning time.

7. VOLTAGE IRREGULARITY INDICATOR (VOLTS-HIGH/LOW)

The red VOLTS annunciator light comes on designating improper voltage supply. A red blinking light designates low, or no voltage from the alternator; a steady light indicates over voltage or a trippage of the voltage relay.

8. START POWER ON INDICATOR

The START POWER ON light illuminates 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. This light does not illuminate when Press-to-Test switch is pushed.

9. RAM AIR POSITION INDICATOR

The amber RAM AIR annunciator light is a reminder that ram air system is in operation when the gear comes down and should be turned off to reroute air through air filter.

10. 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.

11. EMERGENCY LOCATOR TRANSMITTER SWITCH

The ELT switch manually activates the emergency locator transmitter located in the tailcone. To activate the system pull the switch out and raise. Failure to pull out can result in a breakage of the switch. Reference should be made to the Emergency Locator Transmitter description in this section for proper and lawful usage of the ELT.

12. FUEL FLOW MEMORY SWITCH

The "Fuel Totalizer" memory is connected to the aircraft battery through the "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. Some optional "Fuel Totalizer" systems do not contain a memory switch.

13. OPTIONAL EQUIPMENT CONTROL SWITCHES

Refer to Section IX for description and operation of optional equipment installed in this aircraft.

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 41 feet 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 14 degrees from center. Adjustable steering stops are incorporated on nose gear leg assembly.

CAUTION

Exceeding the swivel angle limits may cause structural damage.

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. 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, mounted to the back of 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 65 +7, -4 KIAS). 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 bypass 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 12 inches or less manifold pressure. 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 41 feet. Adjustable steering stops have been incorporated on nose gear leg assembly.

CAUTION

> The nose wheel must not be swiveled beyond 14 degrees either side 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 17 cubic feet of baggage or cargo space. A maximum of 120 pounds may be loaded in this area. There are two pairs of floor tiedown straps provided. Children should not be allowed to occupy this space unless the optional childs seat is provided. Additional cargo space may be made available by rear seat back cushion (fold seat back forward and slide cover up and off frame; store as desired) then fold rear seat back down. Both seats can be folded down together or independent of each other. The hat rack compartment is restricted to 10 pounds.

The cargo tiedown rings are to be inserted in 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 7-5 for typical restraint.

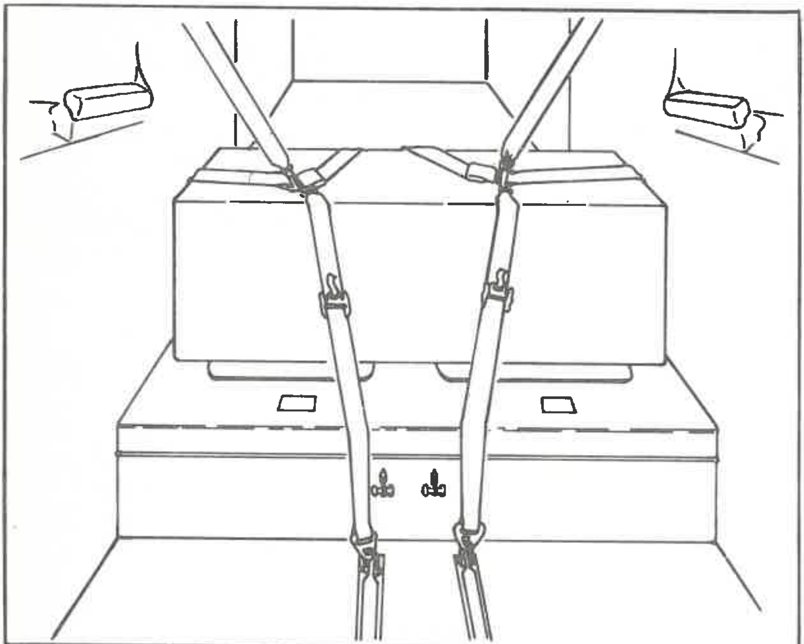


FIGURE 7-5

CAUTION

Proper loading and retention of cargo is mandatory. See Loading Computation Graph, page 6-7.

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 centerline on forward spar. This allows adjustment from approximately 10 degrees to 40 degrees recline position.

SEAT BELTS

Safety belts, if worn properly, keep occupants firmly in their seats in rough air and during maneuvers. The belts are mechanically simple and comfortable to wear. They are attached to the seat, which can be moved without readjusting the belt. Shoulder harnesses are provided for front and rear seat occupants and MUST be fastened for take-off and landing operations.

SAFETY HARNESS

The single diagonal type 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. Care should be taken to conform with this location in adjusting the chest strap and inboard belt length. This diagonal configuration places the body center-of-gravity inside the triangle formed by the chest strap and lap belt. The lap belt should be adjusted comfort- ably 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 7-6 for proper seat belt/harness adjustment.

FIGURE 7-6

DOORS, WINDOWS & EXITS

CABIN DOOR

Access to the cabin is provided by a door located on the right side of the fuselage. This door has inside and outside operating handles. The 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 the door and one at the aft, center of the door.

Should the door come open in flight the flying qualities of the aircraft will not be affected. Procedures for closing the door in flight are contained in Section III.

PILOT'S WINDOW

A fresh air pilot's window is located in the left main cabin window. This window is generally used for fresh air for prolonged ground operations. 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 an emergency exists where a probable crash landing will occur, the door should be unlatched latched to prevent jamming of the door during the crash.

The baggage compartment access door can be used as a means of auxiliary exit. The door can be opened from the inside even though locked. To open, pull off cover, pull the white knob and lift up red handle. To verify re-engagement of outside latch mechanism; open outside handle fully, close inside handle to engage pin in cam slide of latch mechanism; push in on white button until it snaps in place in hole. Replace cover. Operate outside handle in normal method.

ENGINE

GENERAL

The engine installed in this aircraft is an AVCO-Lycoming Model IO-360-A3B6D. The IO series engine is a four cylinder direct drive, horizontally opposed, air cooled engine of 361 cubic inches displacement.

The engine incorporates a Bendix D4LN-3021 dual magneto and a RSA-5AD1 Bendix fuel injector.

This engine is normal rotation (clockwise) as viewed from the rear of the engine. A detailed specification listing of the engine is contained in Section I.

ENGINE CONTROLS

The engine controls are centrally located, between the pilot and co-pilot, on the engine control console The throttle knob regulates manifold pressure. Pushing the knob forward increases the setting; pulling the knob aft decreases the setting.

The propeller control, with its crowned blue knob, controls engine RPM through the propeller governor. Pushing the knob forward increases engine RPM; pulling the knob aft decreases RPM.

The mixture control, with its red fluted knob, establishes the fuel-air ratio (mixture). Pushing the knob full forward sets the mixture to full-rich, pulling the knob aft leans the mixture, and pulling the knob to its maximum aft travel position closes the idle cutoff valve, shutting down the engine. Precise mixture settings can be established by observing the EGT gauge on the pilot's right hand instrument panel while adjusting the mixture control.

The propeller and mixture controls are vernier type and fine adjustments can be made by turning the knobs clockwise or counter-clockwise. The vernier controls should not be turned closer than 1/8" to the panel nut face. The throttle has an integral friction device.

Engine cooling is controlled by the use of the cowl flap control located beneath the engine controls. Pulling the control to its most rear position opens the cowl flaps. The cowl flaps are located on the lower aft part of the engine cowl.

The ram air control located directly below the throttle control, allows the selection of filtered induction air or unfiltered direct ram air.

Using ram air will increase the manifold pressure by allowing engine induction air to partially bypass the induction air filter. The use of ram air must be limited to clean, dust-free air. The engine will operate on direct unfiltered air when the ram air control is pulled on. When ram air is on, allowing unfiltered air to enter the engine, the ram air annunciator light located above the center radio panel will illuminate when the landing gear is down. Should the induction air filter clog, a spring-loaded door in the induction system will open by induction vacuum to allow alternate air to enter the engine.

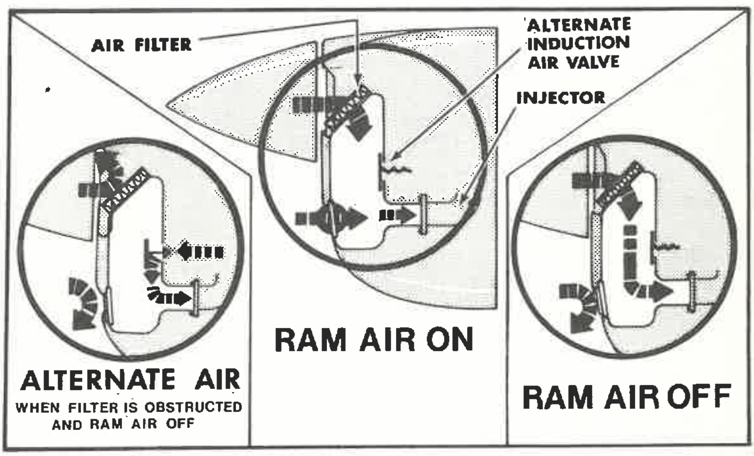


FIGURE 7-7
ENGINE AIR INDUCTION SYSTEM

ENGINE INSTRUMENTS

Engine instruments operate electrically, except manifold pressure and tachometer, 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 magneto pulses via the ignition switch.

Cylinder head temperature, oil pressure, and oil temperature gauges are located above the flight instruments. EGT, tachometer, manifold pressure and fuel flow are located to the right of the radio panel. Color arcs on instrument faces mark operating ranges. Proper interpretation of engine instrument readings is essential for selectin optimum control settings and for maintaining maximum cruise fuel economy. (Refer to Section II for Limitations).

ENGINE OPERATION AND CARE

The life of the 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 oil temperatures within the required limits. Servicing of the engine should be accomplished by qualified personnel. Refer to AVCO LYC. Overhaul and Service Manuals.

The engine receives a run-in operation befor leaving the factory. Therefore, no break-in schedule need be followed. Straight mineral oil (MIL-C-6082) should be used for the first 50 hours or until oil consumption has stabilized.

The minimum grade aviation fuel for this engine is 100/130 or 100 LL. In case the grade required is not available, use a higher rating. Never use a lower rated fuel. Only aviation gasolines compounded to specifications ASTM-910 or MIL-G-5572E are approved.

Operational procedures for adverse environmental conditions can be found in the engine operator's manual.

OIL SYSTEM

The engine has a full-pressure wet sump oil syste with an 8 quart (7.6 liters) capacity. A conventional dip stick is provided for determining the oil quantity.

An automatic bypass control valve routes oil flow around the oil cooler when operating temperatures are below normal or when the cooling radiator is blocked. 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 the propeller shaft to reach the propeller.

IGNITION SYSTEM

The magneto ignition system features two electrically independent ignition circuits in one housing. The right magneto fires the lower right and upper left spark plugs, and the left magneto fires the lower left and upper right spark plugs. The magneto/starter switch has five positions: OFF, R (right), L (left), BOTH, and START. In the OFF position both magnetos are grounded. At the R position the left magneto grounds. At the L position the right magneto grounds. At the BOTH position both magnetos are HOT and the ignition system is on. For safety the ignition switch must be OFF and key removed when the engine is not running. Turning the ignition switch to start and pushing in closes the starter solenoid, engages the starter and allows the impulse coupling to automatically retard the magneto until the engine is at its retard firing position. The spring action of the impulse is then released to spin the rotating magnet and produce the spark to fire the engine. After the engine starts, the impulse coupling flyweights do not engage due to centrifugal action. The coupling then acts as a straight drive and the magneto fires at the normal firing position of the engine. The magneto/starter switch is spring loaded to return from START to the BOTH position when released.

CAUTION

Do not operate the starter in excess of 30 seconds or re-engage the starter without allowing it time to cool.

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

Do not turn the propeller when the magnetos are NOT grounded. Ground the magneto points before removing switch wires or electrical plugs. All spark plug leads can be removed as an alternate safety measure.

ENGINE COOLING

The down-draft engine cooling system provides ground and inflight power plant cooling. Engine baffling directs air over and around the cylinders and out the cowl flap openings. Opening the cowl flap doors allows proper air flow on the ground and during low-speed high-power climbs. Pull the cowl flap control full aft to open the cowl flaps. The cowl flaps should be partially opened, (control pulled aft approximately one to two inches), if necessary to maintain the oil and cylinder head temperature within the normal operating range.

ENGINE STARTING SYSTEM

Engine starting power is provided by a 12 V starter. Ignition is provided by impulse coupled magnetos. A starter engaged warning light (START POWER ON) is incorporated as standard equipment in the annunciator panel.

ACCESSORIES

VACUUM PUMP

An engine-driven vacuum pump supplies suction for the vacuum-operated gyroscopic flight instruments. Air entering the vacuum-powered instruments is filtered; hence, sluggish or erratic operation of vacuum-driven instruments may indicate that a clogged vacuum filter element is preventing adequate air intake. A vacuum annunciator light is provided to monitor system operation.

ALTERNATOR

Electrical power is supplied by an engine driven 12 V, 60 ampere alternator.

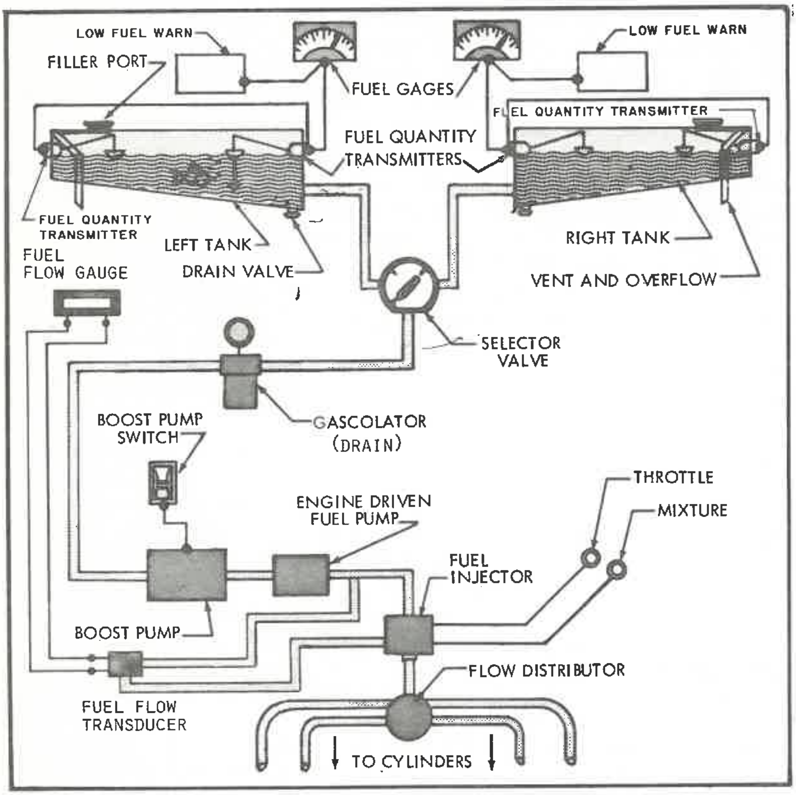
PROPELLER

The propeller is an all metal, two blade, constant speed unit. Constant propeller rotational speed (RPM) is maintained by a balance of air load and engine rotational forces. The propeller governor regulates the flow of 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 works against the piston and a spring to increase propeller blade pitch, thus decreasing propeller and engine RPM. Centrifugal twisting moments on the propeller blades work to decrease propeller blade pitch and increase RPM. Control of these and other forces to maintain a constant RPM is provided by the propeller control lever in the cockpit.

The propeller control lever, linked by cable to the propeller governor, determines a wide range of in-flight RPM. Pushing the lever forward selects higher RPM. Pulling the lever aft selects lower RPM. When in flight the RPM should not fluctuate significantly, regardless of throttle setting.

The propeller may be operated within the full range of RPM indicated by the tachometer, up to the red radial line. In cruise, always use the power setting charts provided. On cold days during run-up, exercise the propeller several times to flow warm oil into the propeller hub. This assures propeller governing for takeoff.

FUEL SYSTEM



FUEL SYSTEM SCHEMATIC
FIGURE 7-8

Fuel is carried in two integral sealed sections of the forward inboard area of the wings. Total usable fuel capacity is 64 gallons (242.4 liters)(53.3 Imp. Gal.). Both tanks have fuel level indicators visible through the filler ports. These indicators show the 25-gallon (94.7 liters)(20.8 Imp. Gals.) level in each tank. 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 handle aft of the console on the floor allows the pilot to set the selector valve to LEFT tank, RIGHT tank, or OFF position. The gascolator, located to the left of the selector valve in the floorboard, is for draining condensed water and sediment from the lowest point in the fuel lines before the first flight of the day and after each refueling.

Fuel feeds from one tank at a time to the selector valve and through the electric fuel pump (boost pump) enroute to the engine-driven pump and the fuel injector unit. The electric fuel pump is capable of supplying sufficient pressure and fuel flow for rated engine performance should the engine driven pump fail.

Electric fuel-level transmitters in the tanks operate the fuel gauges. The master switch actuates the fuel quantity indicator system to maintain an indication of fuel remaining in each tank. The fuel pressure gauge registers fuel pressure in the line to the injector. Vents in each fuel tank allow for overflow and ventilation.

The optional, visual fuel quantity indicators located in each wing tank are to be used for PARTIAL FUEL LOADING only and not for preflight inspection purpose.

Fuel Flow is presented digitally and indicates volume of fuel being used in GPH (pounds or liters optional) and/or total fuel used. Optional fuel flow systems are available and each depicts its information differently. Refer to appropriate operational procedure for specific data. A "Fuel Flow Memory" switch (FT-101 System) is located in the top of the right hand radio panel to shut off the memory circuit if the aircraft is to be stored for long periods of time.

ELECTRICAL SYSTEM

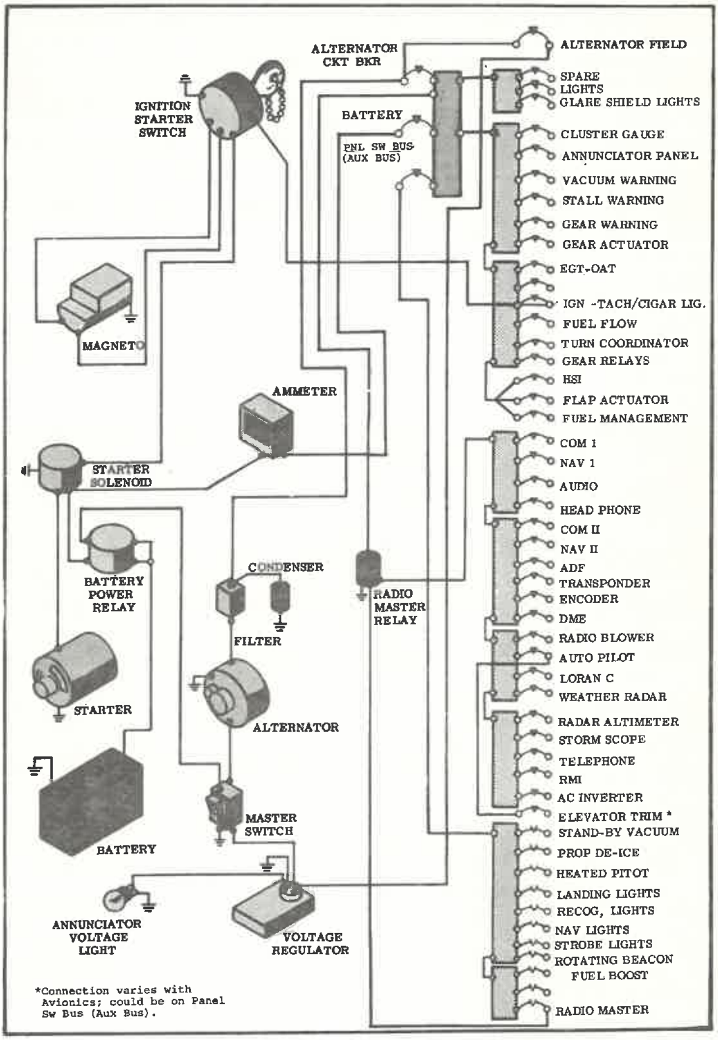
ALTERNATOR & BATTERY

A 12-volt, 35-ampere-hour storage battery (in the tailcone) and a 60 ampere self-rectifying alternator supply electrical power for equipment operation. The ammeter in the engine instrument display indicates battery charge/discharge rate. A power loss in the alternator or voltage regulator will be shown as a discharge reading on the ammeter; a discharged battery will be indicated as a high-charge reading.

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 and flashes when the voltage is low.

CAUTION

Starting with an external power source should not be done while the battery is completely depleted. It will not accept the high charge rate from the alternator and electrical failure may result.



SCHEMATIC
FIGURE 7-9

CIRCUIT BREAKER PANEL

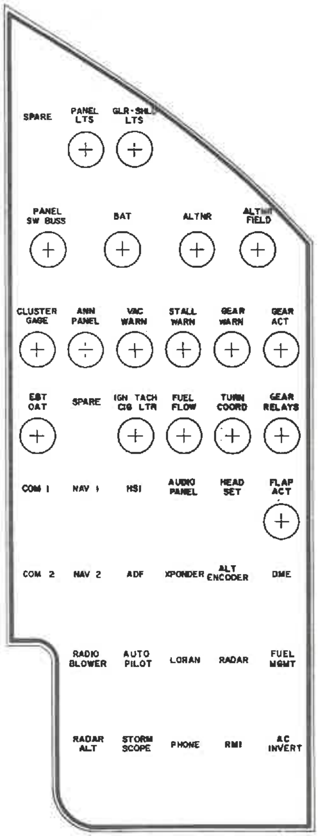


FIGURE 7-10

Push-pull, or rocker switch-circuit breakers automatically break the electrical current flow if the system or unit receives an overload, thus preventing 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. All rocker switch-circuit breakers are at the bottom of the flight panel.

The alternator push-pull circuit breaker on the main breaker panel furnishes an emergency overload break between the alternator and the main buss. Since the alternator is incapable of output in excess of the circuit breakers capacity, a tripped breaker normally indicates a fault within the alternator. Since the alternator is then cut out of the power circuit, the storage battery supplies electrical power in steadily diminishing output with the master switch on.

The alternator field 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 the regulator output voltage exceeds limits, the red voltage warning light illuminates steadily.

Turning off the radio master switch and then turning master switch OFF and ON, will reset the voltage regulator. The overvoltage annunciator light should remain out. If the overvoltage light comes on again, pulling out the alternator-field circuit breaker cuts the alternator out of the power circuit. Once again the battery is the only source of electrical power; therefore, all electrical equipment not essential for flight should be turned off and the flight terminated as soon as practical to correct the malfunction.

NOTE

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

ANNUNCIATOR PANEL

The landing gear lights, low fuel lights, voltage light, vacuum warning light, starter engaged light and ram air light are grouped in the annunciator. A test switch and dim switch, are also found in the panel and 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. There are two rheostat knobs on the right hand radio panel. The left control regulates the intensity of the placard lighting. The right control provides avionic and instrument lighting. Rotating the knobs clockwise turns on and increases light intensity.

MAP LIGHT

The map light switch is located on the center of the pilot's control wheel (co-pilot's optional). The right hand rheostat controls the map light intensity.

CABIN LIGHTING

Four headliner lights illuminate the cabin. The forward lights are controlled by the BRIGHT-OFF-DIM switch located in the headliner above the co-pilot. The rear cabin lights are controlled by another BRIGHT-OFF-DIM switch located above the rear seat, easily accessible from the baggage door for assistance with night loading. These are connected directly to battery.

EXTERIOR LIGHTING

Conventional navigation and high intensity strobe lights are installed on the wing tips and on the rudder trailing edge. A landing or taxi light is installed in the lower engine cowling. All exterior lights are controlled by rocker type switches on the lower right hand portion of the pilots 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.

Optional recognition lights may be installed in the wing tips for use when requested by ATC.

CABIN ENVIRONMENT

HEATING & VENTILATION SYSTEMS

Three ventilating systems provide cabin environmental conditions controlled to individual pilot and passenger preferences. Fresh air heated by the engine exhaust muff and cool air from an airscoop on the co-pilot side, can be individually controlled and mixed to the desired temperature. The side fresh-air system has adjustable outlets near the pilot's and co-pilot's knees.

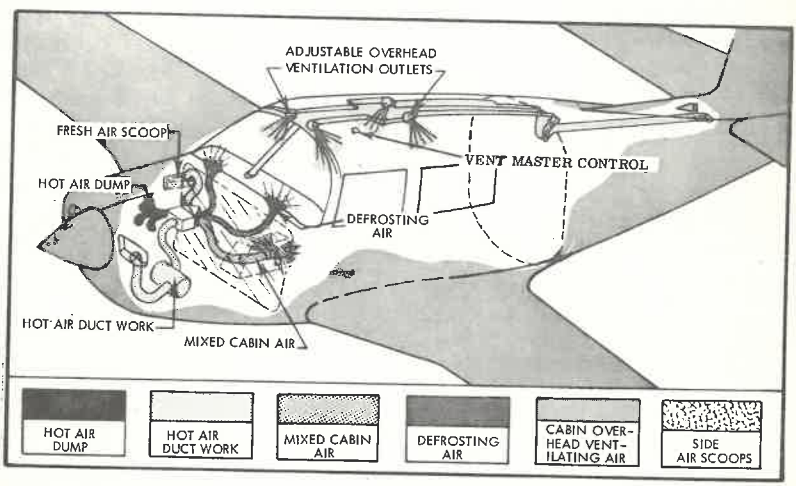


FIGURE 7-11

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 each seat. A master air vent control regulates flow of air through the individual overhead outlets. This control is located above the pilots seat back on the overhead panel.

The cabin heat control is marked CABIN HEAT. Pulling the cabin heat control aft supplies heat to the cabin and defroster system. The cabin vent control is marked VENT. Pulling the vent control aft supplies fresh air to the lower cabin and the defrost system. Hot and cold air may be mixed by adjusting both heat and vent controls. These controls may be adjusted between full open and full closed. The right side airscoop has outlets under the side panel for installation of radio cooling ducts. Cabin heat will be more effective with the cowl flaps closed.

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 just outboard of the wing 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 tailcone access door. An alternate static pressure source valve is installed in the flight panel just to the left of the pilots control column. 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 4.4 to 8.7 Knots 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.

EMERGENCY LOCATOR TRANSMITTER

The Emergency Locator Transmitter (ELT) is located in the tailcone and is accessible by removing the radio access panel on the left side of the fuselage. 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 annual inspections.

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 replacement date is marked on the transmitter label.

On the unit itself is a three position selector switch placarded "OFF", "ARM", "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 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 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 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.

Section VIII

SECTION VIII
HANDLING, SERVICE & MAINTENANCE

MOONEY M20J

TABLE OF CONTENTS

SECTION VIII
HANDLING, SERVICE & MAINTENANCE

MOONEY M20J
INTRODUCTION

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

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

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, when the inspections are repetitive, to take appropriate steps to prevent inadvertent noncompliance.

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 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 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.

SECTION VIII
HANDLING, SERVICE & MAINTENANCE

MOONEY M20J

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. 78028. Telephone: Area Code 512-896-6000.

All correspondence regarding your airplane should include the MODEL and SERIAL NUMBER. These numbers can be found on an identification place located on the lower aft portion of the left side of the tailcone. The model and serial number must also be used when consulting either the Service & Maintenance Manual or Parts Manual.

Service & Maintenance and Parts Manuals may be obtained for your airplane from your Mooney Marketing or Service Center.

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: (1) on the wing leading edges, and (2) on the inboard portion of propeller blades adjacent to the propeller hub. 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 14 degrees either side of center. Exceeding the turn limits shown on the turn indicator may cause structural damage.

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. Use a yoke-frame jack under propeller 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

Integral sealed tanks in the forward inboard sections of the wings carry the fuel. With the aircraft standing on level ground, service each fuel tank after flight with 100/130 or 100LL octane aviation-grade gasoline. The visual quantity gauge located on top of each tank should be used as a reference for partial refueling only.

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

CAUTION

Never use aviation fuel of a lower grade than 100/130 or 100 LL octane. Aviation fuel grades can be distinguished by their color: 80 octane is red, 100 LL octane is blue, 100/130 octane is green.

Fuel samples from the sump drain of each tank should be taken before the first flight of the day to check for water or sediment 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 selector valve drain 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 in 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 will remain on top. Continue taking fuel samples until all water is purged from the tank.

The fuel tank gascolator control is on the cabin floor forward of the pilot's seat. To flush the gascolator sump and the lines leading from the wing tanks to the selector valve, turn the selector handle to the left, and pull the fuel drain control for about five seconds. Repeat the procedure for the right tank, being sure that the fuel drain control ring is returned to the closed position and that the drain valve is not leaking.

ENGINE LUBRICATION

Operate the new engine at full power within the limitations given in Section II. Before every flight, check the engine oil level and replenish as necessary.

Check engine oil level after engine has been stopped long enough for oil to drain back into sump. The oil filler cap access door is located in the top cowling. Any lubricating oil, either straight mineral or compounded, must conform with AVCO Lycoming Spec No. 301F to be acceptable for use in engines. New or newly overhauled engines should be operated on aviation grade straight mineral oil during the first 50 HOURS of operation or until oil consumption has stabilized. The aircraft is delivered from Mooney with multi-viscosity mineral oil.

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 AVCO Lycoming specifies the following grades of oil to use for various ambient air temperatures.

VISCOSITY CHART

Average Ambient Air Temperature	MIL-L-6082	MIL-22851
Above 80 Deg. F	SAE 60	SAE 60
Above 60 Deg. F	SAE 50	SAE 40 or SAE 50
30 Deg. to 90 Deg. F	SAE 40	SAE 40
0 Deg. to 70 Deg. F	SAE 30	SAE 30, SAE 40 or SAE 20W-40
0 Deg. to 90 Deg. F	-----	SAE 20W-50
Below 10 Deg. F	SAE 20	SAE 30 or SAE 20W-30

*Refer to the latest edition of AVCO Lycoming Service Instruction No. 1014.

Your Mooney Service Center has 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 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. Unbolt filter element and remove.
    c. Direct a jet of air against down or clean side of filter (opposite to normal airflow). Keep air nozzle at least two

inches from filter element. Cover entire filter area with air jet.

CAUTION

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

d. After cleaning, inspect filter and gasket for damage. Discard a ruptured filter or broken gasket.

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. (82 Deg. C) for filter drying.

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

SECTION VIII
HANDLING, SERVICE & MAINTENANCE

MOONEY M20J
GEAR & TIRE SERVICE

The aircraft is equipped with 6-ply standard-brand tires and tubes. Keep the main gear tires inflated at 30 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.

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 at about 12inches manifold pressure.

BATTERY SERVICE

The 12-volt 35-ampere-hour electrical storage battery is located in the tailcone, aft of baggage compartment bulkhead, accessible through tailcone access panel. Check battery fluid level every 25 FLIGHT HOURS or each 30 DAYS whichever comes first.

To service the battery, remove the battery box cover and check the 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 degrees
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 box 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 lines free of obstruction.

HYDRAULIC BRAKE RESERVOIR SYSTEM

The brake system hydraulic reservoir is located in the tailcone above the battery. To service, remove the tailcone access panel and check fluid level every 50 HOURS of operation. Fluid level should be no higher than two (2) inches 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

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 polished out 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 and is no cause for concern if the total movement at the blade tip does not exceed .12 inches. 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 oily cloth to clean off grass and bug stains. NEVER USE AN ALKALINE

CLEANER ON THE BLADES; remove grease and dirt with tetrachloride or Stoddard solvent. McCauley recommends the propeller be removed and overhauled every 1500 HOURS of operation. Hartzell recommends the optional propeller be removed and overhauled every 1500 HOURS of operation.

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 anti-static plexiglas cleaner is good 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, rugs, upholstery panels, and headliner to remove as much surface dust and dirt as possible. Occasionally wash the leather or vinyl upholstery and kick panels with a mild soap solution to prevent dirt from working into the surface. Wipe clean with a slightly damp cloth and dry with a soft cloth. NEVER APPLY FURNITURE POLISHES. Foam-type shampoos and cleaners for vinyl, leather, textiles, and plastic materials are good for removing stains and reconditioning the entire interior. Spray dry cleaners are also recommended. Grease spots on fabric should be removed with a jelly-type spot lifter.

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~ CAUTION ~
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Never use denatured alcohol, benzene, carbon tetrachloride, acetone, or gasoline for cleaning plexiglas or interior plastics. 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; the 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.

Section IX

SECTION IX
SUPPLEMENTAL DATA

MOONEY M20J

SUPPLEMENT INSERTED	DATE
KING 150 Autopilot	11/30/81
KING KNS 80	12/21/78
Precise Flt. Stby VAC Sys.	2MAR88
JPI EGT	6-22-2015
Garmin GDL 88	
Garmin GTN	
Garmin G1275	

SECTION IX
SUPPLEMENTAL DATA

MOONEY M20J

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SECTION IX
SUPPLEMENTAL DATA

MOONEY M20J

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.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

MOONEY MODEL M20J OR M20K

WITH INCORPORATION OF

MOONEY SERVICE INSTRUCTION M20-82
BAGGAGE DOOR INSIDE LATCH MODIFICATION

REG. NO 5772R

SERIAL NO. 24-1502

This Supplement must be attached to the applicable FAA Approved Airplane Flight Manual when the aircraft is modified per Mooney Service Instruction M20-82. The information contained herein 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

for L. B. Andriesen, Manager
Aircraft Certification Division
FEDERAL AVIATION ADMINISTRATION
Southwest Region
Fort Worth, Tx. 76101

Date 3-17-88

The following POH/AFM's have a portion of the listed pages affected by data contained in this Supplement and are superseded by the data shown within the Section Numbers of the basic POH/AFM.

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved*	Date

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

* L.B. Andriesen, Manager, Aircraft Certification Division

THE FOLLOWING POH/AFM'S ARE AFFECTED FOR M20J AND M20K AIRCRAFT THAT MAY BE MODIFIED PER THIS SERVICE INSTRUCTION. THE POH/AFM NUMBER(AND REVISION IF APPLICABLE) ARE SHOWN ALONG WITH THE PAGES OF THE VARIOUS SECTIONS OF THE MANUAL THAT A PORTION OF WILL BE MADE OBSOLETE IF S.I. 20-82 IS INCORPORATED INTO AN AIRCRAFT THAT USES THE MANUAL:

POH/AFM NO	SECTION II PAGE	SECTION III PAGE	SECTION VII PAGE
1221 D	2-12	N/A	7-32
1223 F	2-12	N/A	7-35/7-36BLANK
1225 D	2-12	N/A	7-33/7-34BLANK
1227 C	2-12	3-11	7-34
1229 A	2-12	3-11	7-24
1231 A	2-15	3-15	7-31
1233 A	2-13	3-19	7-29
1233 B	2-12	3-15	7-21

- THE UPPER GROUP OF POH/AFM'S ARE FOR M20J AIRCRAFT -

POH/AFM NO	SECTION II PAGE	SECTION III PAGE	SECTION VII PAGE
1224 F	2-12	N/A	7-26
1226 E	2-12	N/A	7-26
1228 D	2-12	3-18	7-27
1230 B	2-12	3-17	7-27
1232	2-16	3-19	7-30
1234 C	2-13	3-24	7-32
1236	2-13	3-27	7-32
1236 A	2-12	3-22	7-25

- THE LOWER GROUP OF POH/AFM'S ARE FOR M20K AIRCRAFT -

SECTION I - GENERAL

NO CHANGE

SECTION II - LIMITATIONS

New placard required:

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

LOCATED:
ABOVE INSIDE BAGGAGE DOOR HANDLE

SECTION III - EMERGENCY PROCEDURES

EMERGENCY EXIT OF AIRCRAFT

CABIN DOOR
PULL latch handle AFT; OPEN door and exit aircraft.

BAGGAGE DOOR
Fold rear seat backs forward(if applicable), 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 LATCH MECHANISM:
OPEN outside handle fully. CLOSE inside Red handle to engage pin into cam slide of latch mechanism. PLACE latch Pin in hole to hold Red handle down. REPLACE cover. CHECK and operate outside handle in normal manner.

SECTION IV THRU VI

NO CHANGE

SECTION VII

EMERGENCY EXITS

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

The baggage compartment access door can be used as a means of auxiliary exit. The door can be opened from the inside even though locked. To open, pull off small ABS cover, PULL out the latch pin and lift UP Red handle.
To verify re-engagement of latching mechanism: insert latching pin into hole to hold Red handle down. Replace ABS cover. Operate outside handle in normal manner.

SECTION VIII THRU X

NO CHANGE

MOONEY AIRCRAFT CORPORATION
P.O. Box 72
Kerrville, Texas

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

MOONEY MODELS M20J & M20K

WITH

KING 150 SERIES FLIGHT CONTROL SYSTEM

REG. NO. N5772R
SER. NO. 24-1502

The information contained in this manual is FAA Approved material which, along with the FAA Approved Airplane Flight Manual, placards and instrument markings, is applicable to the operation of the airplane when modified by the installation of the King 150 Series Automatic Flight Control System as per Mooney Drawing 830125.

FAA APPROVED: D. D. Castle
for Don P. Watson, Chief
Engineering and Mfg. Branch
FEDERAL AVIATION ADMINISTRATION
Southwest Region, Forth Worth, TX

DATE: NOV 2 0 1981

Revision A
Date: 4-15-82

MOONEY AIRCRAFT CORPORATION
P. O. Box 72
Kerrville, Texas 78028

LOG OF REVISIONS

Revision Number	Revised Pages	Description of Revision	FAA Approved*	Date
A	Signature Page	Eliminate M20J S/N Restrictions.	D D Castle	4-15-82
	6	Reworded General I, No. 14.		
	6, 11	Deleted Reference to CWS Annunciator.		
	8, 10	Changed KDG 107 to KG 107		
	12	Deleted Reference to Altitude Command Limits.		
	12	Reworded Procedures III, A. and A.1.		
	14	Reworded Procedures IV, A.5.a.		
	20	Reworded Procedures IV, B.10.b., B10.c. and B.10.d.		

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

***Don P. Watson, Chief, Engineering & Manufacturing Branch**

MOONEY MODELS M20J & M20K

FAA APPROVED

AUTOPILOT FLIGHT MANUAL SUPPLEMENT

006-0396-01

TABLE OF CONTENTS

SECTION I - GENERAL

This manual is provided to acquaint the pilot with the limitations as well as normal and emergency operating procedures of the King 150 Series Automatic Flight Control Systems. The limitations presented are pertinent to the operation of the 150 System as installed in the Mooney Models M20J & M20K airplanes; the Flight Control Systems must be operated within the limitations herein specified.

The 150 Series AFCS is certified in this airplane with 2 axis control, pitch and roll. The various instruments and the controls for the operation of the 150 System are described in Figure 1.

The 150 Series AFCS has electric pitch trim system which provides autotrim during autopilot operation and manual electric trim for the pilot. The trim system is designed to withstand any single inflight malfunction. Trim faults are visually and aurally annunciated.

A Lockout device prevents autopilot engagement until the system has been sucessfully preflight tested.

The following conditions will cause the Autopilot to automatically disengage:

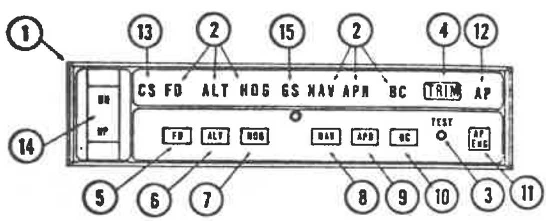
A. Power failure.

B. Internal Flight Control System failure.

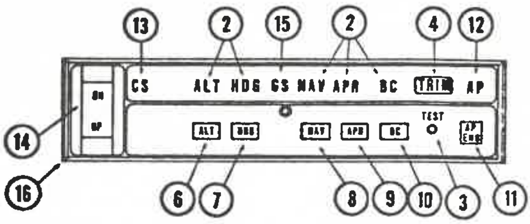
C. With the KCS 55A Compass System, a loss of compass valid (displaying HDG flag) disengages the Autopilot when a mode using heading information is engaged. With the HDG flag present, the Autopilot may be re-engaged in the basic wings level mode along with any vertical mode.

D. Roll rates in excess of 14° per second will cause the autopilot to disengage except when the CWS switch is held depressed.

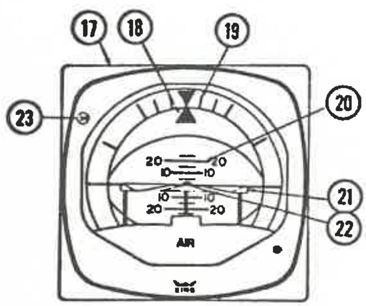
E. Pitch rates in excess of 8° per second will cause the autopilot to disengage except when the CWS switch is held depressed.



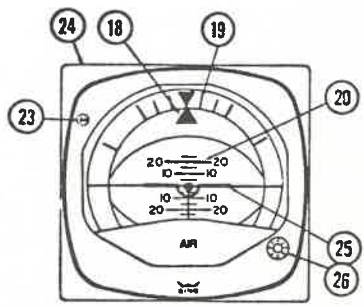
KC 192 AUTOPILOT & FLIGHT DIRECTOR COMPUTER



KC 191 AUTOPILOT COMPUTER



KI 256 FLIGHT COMMAND INDICATOR



KG 258 VERTICAL GYRO

FIGURE 1 KING 150 AUTOPILOT SYSTEM
COMPUTERS AND ATTITUDE GYROS

1. KFC 150 SYSTEM KC 192 AUTOPILOT COMPUTER - Complete Flight Director and Autopilot computer to include system mode annunciators and system controls.

2. Mode Annunciators - Illuminate when a mode is selected by the corresponding mode selector button (PUSH ON - PUSH OFF) or when the glideslope (GS) mode is automatically engaged.

3. Preflight Test (TEST) Button - When momentarily pushed, initiates preflight test sequence which automatically turns on all annunciator lights, tests the roll and pitch rate monitors, tests the autotrim fault monitor, checks the manual trim drive voltage and tests all autopilot valid and dump logic. If the preflight is successfully passed,

3. Cont...
the AP annunciator light will flash for approximately 6 seconds (an aural tone will also sound simultaneously with the annunciator flashes). The autopilot can not be engaged until the preflight test is successfully passed.

4. TRIM WARNING LIGHT (TRIM) - Illuminates continuously whenever trim power is not on or the system has not been preflight tested. The Trim Warning Light flashes and is accompanied by an audible warning whenever a manual trim fault is detected. The TRIM warning Light will illuminate steady and be accompanied by a steady audible tone whenever an autotrim failure occurs. The autotrim system is monitored for the following failures: trim servo running without a command; trim servo not running when commanded to run; trim servo running in the wrong direction. The trim power switch may be cycled off to silence the continuous tone but the trim fail light will remain on. The manual electric trim may be used but the autopilot should not be engaged.

5. Flight Director (FD) Mode Selector Button - When pushed will select the Flight Director mode (with KC 292 Autopilot Computer only), bringing the Command Bar in view on the KI 256 and will command wings level and pitch attitude hold. The FD mode must be selected prior to Autopilot engagement.

6. Altitude Hold (ALT) Mode Selector Button - When pushed will select the Altitude Hold mode, which commands the airplane to maintain the pressure altitude existing at the moment of selection. Engagement may be accomplished in climb, descent, or level flight. In the APR mode, altitude hold will automatically disengage when the glideslope is captured.

7. Heading (HDG) Mode Selector Button - When pushed will select the Heading mode, which commands the airplane to turn to and maintain the heading selected by the heading bug on the DG or HSI. A new heading may be selected at any time and will result in the airplane turning to the new heading with a maximum bank angle of about 20^o. Selecting HDG mode will cancel NAV, APR or BC track modes.

8. Navigation (NAV) Mode Selector Button - When pushed will select the Navigation mode. The mode provides all angle intercept (with HSI) or a fixed angle intercept of 45^o (with DG), automatic beam capture and tracking of VOR, RNAV or LOC signals. The NAV annunciator will flash until the automatic capture sequence is initiated.

9. Approach (APR) Mode Selector Button - When pushed, will select the Approach mode. This mode provides all angle intercept (with HSI) or a fixed angle intercept of 45^o (with

FIGURE 1 KING 150 AUTOPILOT SYSTEM
COMPUTERS AND ATTITUDE GYROS

Section I (Continued)

(DG), automatic beam capture and tracking of VOR, RNAV or LOC signals plus Glideslope coupling in the case of an **ILS**. The tracking gain of the APR mode is greater than the gain in the NAV mode. The APR annunciator will flash until the automatic capture sequence is initiated.

10. Back Course Approach (BC) Mode Selector Button - When pushed will select the Back Course Approach mode. This mode functions identically to the approach mode except that response to LOC signals is reversed. Glideslope coupling is inhibited in the Back Course Approach mode.

11. Autopilot Engage (AP ENG) Button - When pushed, engages autopilot if all logic conditions are met.

12. Autopilot Annunciator (AP) - Illuminates continuously whenever the autopilot is engaged. Flashes approximately 12 times whenever the autopilot is disengaged (an aural alert will also sound for 2 seconds).

13. Not Used.

14. Vertical Trim Control - A spring loaded to center rocker switch which will provide up or down pitch command changes: while in ALT will adjust altitude at rate of 500 fpm; when not in ALT will adjust pitch attitude at a rate of .7 deg/sec. Will cancel GS couple. The aircraft must pass through the glideslope again to allow GS recouple.

15. Glideslope Annunciator (GS) - Illuminates continuously whenever the autopilot is coupled to the glideslope signal. The GS annunciator will flash if the glideslope signal is lost (GS flag in CDI or absence of glideslope pointers in KI 525A). The autopilot reverts to pitch attitude hold operation. If a valid glideslope signal returns within six seconds, the autopilot will automatically recouple in the GS mode. If the valid signal does not return within six seconds, the autopilot will remain in pitch attitude hold mode until such time that a valid glideslope returns and the aircraft passes thru the glideslope. At that point GS couple will re-occur.

16. KAP 150 System KC 191 Autopilot Computer - Complete Autopilot computer. Includes system mode annunciators and system controls.

17. KI 256 FLIGHT COMMAND INDICATOR (FCI) - Displays airplane attitude as a conventional attitude gyro and displays commands for flight director operation. The gyro is air driven.

FIGURE 1 KING 150 AUTOPILOT SYSTEM
COMPUTERS AND ATTITUDE GYROS

18. ROLL ATTITUDE INDEX - Displays airplane roll attitude with respect to the roll attitude scale.

19. ROLL ATTITUDE SCALE - Scale marked at 0, ±10, 20, 30, 60 and 90 degrees.

20. PITCH ATTITUDE SCALE - Moves with respect to the symbolic airplane to present pitch attitude. Scale graduated at 0, ±5, 10, 15, 20 and 25 degrees.

21. COMMAND BAR - Displays computed steering commands referenced to the symbolic airplane. The command bar is visible only when FD mode is selected. The command bar will be biased out of view whenever the system is invalid or a Flight Director mode is not engaged.

22. FCI SYMBOLIC AIRPLANE - Airplane pitch and roll attitude is displayed by the relationship between the fixed symbolic airplane and the movable background. During flight director operation, the symbolic airplane is flown to align it with the command bar to satisfy the flight director commands.

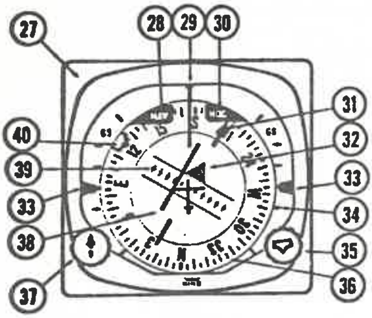
23. DECISION HEIGHT (DH) ANNUNCIATOR LIGHT - Optional light for use with the aircraft's optional radar altimeter.

24. KG 258 Vertical Gyro - Displays airplane attitude as a conventional attitude gyro. The gyro is air driven.

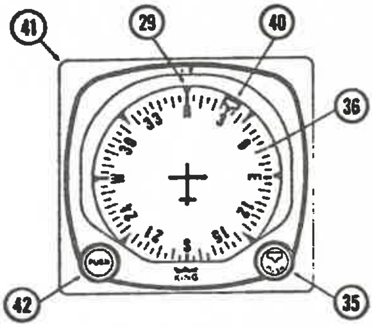
25. SYMBOLIC AIRPLANE - Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed symbolic aircraft and the movable background.

26. SYMBOLIC AIRCRAFT ALIGNMENT KNOB - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.

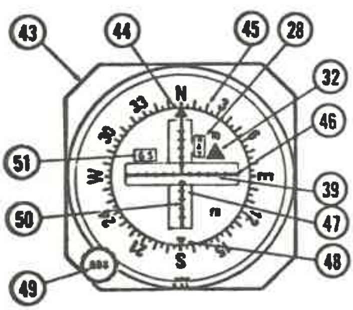
FIGURE 1 KING 150 AUTOPILOT SYSTEM
COMPUTERS AND ATTITUDE GYROS



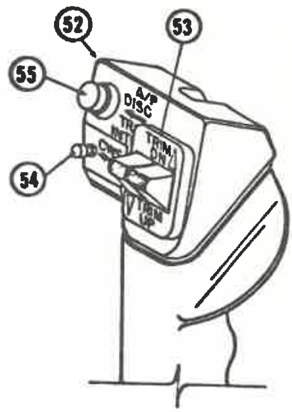
KI 525A HORIZONTAL
SITUATION INDICATOR



KG 107 NON-SLAVED
DIRECTIONAL GYRO



KI 204/206 VOR/LOC/GLIDESLOPE
INDICATOR (TYPICAL)



AUTOPILOT CONTROL
WHEEL SWITCH CAP

FIGURE 1 KING 150 AUTOPILOT SYSTEM
INDICATORS AND CONTROLS

Section (Continued)

27. KI 525A HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials or localizer beams. It also displays glideslope deviations and gives heading reference with respect to magnetic north.

28. NAV FLAG - Flag is in view when the NAV receiver signal is inadequate. When a NAV flag is present in the navigation indicator (CDI or KI 525A) the autopilot operation is not affected. The pilot must monitor the navigation indicators for NAV flags to insure that the Autopilot and/or Flight Director are tracking valid navigation information.

29. LUBBER LINE - Indicates aircraft magnetic heading on compass card (36).

30. HEADING WARNING FLAG (HDG) - When flag is in view the heading display is invalid. If a HDG flag appears and a lateral mode (HDG, NAV, APR or APR BC) is selected, the autopilot will be disengaged. The Autopilot may be re-engaged in the basic wings level mode along with any vertical mode. The CWS switch would be used to maneuver the aircraft laterally.

31. COURSE BEARING POINTER - Indicates selected VOR course or localizer course on compass card (36). The selected VOR radial or localizer heading remains set on the compass card when the compass card (36) rotates.

32. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.

33. DUAL GLIDESLOPE POINTERS - Indicate on glideslope scale (34) aircraft displacement from glideslope beam center. Glideslope pointers in view indicate a usable glideslope signal is being received. The glideslope pointers will bias out of view if the glideslope signal is lost.

34. GLIDESLOPE SCALES - Indicate displacement from glideslope beam center. A glideslope deviation bar displacement of 2 dots, represents full scale (0.7°) deviation above or below glideslope beam centerline.

35. HEADING SELECTOR KNOB ( ) - Positions heading bug (40) on compass card (36) by rotating the heading selector knob. The Bug rotates with the compass card.

36. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (29) on HSI or DG.

37. COURSE SELECTOR KNOB - Positions course bearing pointer (30) on the compass card (36) by rotating the course selector knob.

FIGURE 1 KING 150 AUTOPILOT SYSTEM
INDICATORS AND CONTROLS

38. COURSE DEVIATION BAR (D-BAR) - The center portion of omni bearing pointer moves laterally to pictorally indicate the relationship of aircraft to the selected course. It indicates degrees of angular displacement from VOR radials and localizer beams, or displacement in nautical miles from RNAV courses.

39. COURSE DEVIATION SCALE - A course deviation bar displacement of 5 dots represents full scale (VOR = $\pm 10^\circ$, LOC = $\pm 2\ 1/2^\circ$, RNAV = 5NM, RNAV APR = 1 1/4NM) deviation from beam centerline.

40. HEADING BUG - Moved by knob (35) to select desired heading.

41. KG 107 NON-SLAVED DIRECTIONAL GYRO (DG) - Provides a stable visual indication of aircraft heading to the pilot. The gyro is air driven.

42. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (36) to correspond with the magnetic heading indicated by the magnetic compass. The unslaved compass card must be manually reset periodically to compensate for precessional errors in the gyro.

43. VOR/LOC/GLIDESLOPE INDICATOR - Provides rectilinear display of VOR/LOC and Glideslope deviation.

44. COURSE INDEX - Indicates selected VOR course.

45. COURSE CARD - Indicates selected VOR course under course index.

46. GLIDESLOPE DEVIATION NEEDLE - Indicates deviation from ILS glideslope.

47. GLIDESLOPE SCALE - Indicates displacement from glideslope beam center. A glideslope deviation needle displacement of 5 dots, represents full scale (0.7°) deviation above or below glideslope beam centerline.

48. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.

49. OMNI BEARING SELECTOR (OBS) KNOB - Rotates course card to selected course.

50. COURSE DEVIATION NEEDLE - Indicates course deviation from selected omni course or localizer centerline.

51. GLIDESLOPE (GS) FLAG - Flag is in view when the GS receiver signal is inadequate.

FIGURE 1 KING 150 AUTOPILOT SYSTEM INDICATORS AND CONTROLS

Section I (Continued)

52. AUTOPILOT CONTROL WHEEL SWITCH CAP - Molded plastic unit mounted on the left horn of the pilot's control wheel which provides mounting for three switch units associated with the autopilot and manual electric trim systems.

53. MANUAL ELECTRIC TRIM CONTROL SWITCHES - A split switch unit in which the left half provides power to engage the trim servo clutch and the right half to control the direction of motion of the trim servo motor. Both halves of the split trim switch must be actuated in order for the manual trim to operate in the desired direction. When the autopilot is engaged, operation of the manual electric trim will automatically disconnect the autopilot.

54. CONTROL WHEEL STEERING (CWS) BUTTON - When depressed, allows pilot to manually control the aircraft (disengages the servos) without cancellation of any of the selected modes. Will engage the Flight Director mode if not previously engaged. Automatically synchronizes the Flight Director/Autopilot to the pitch attitude present when the CWS switch is released, or to the present pressure altitude when operating in the ALT hold mode. Will cancel GS couple. The aircraft must pass through the glideslope again to allow GS recouple.

55. AUTOPILOT DISCONNECT/TRIM INTERRUPT (A/P DISC/TRIM INTER) SWITCH - When depressed and released will disengage the autopilot and cancel all operating Flight Director modes. When depressed and held will interrupt all electric trim power (stop trim motion), disengage the autopilot, and cancel all operating Flight Director modes.

FIGURE 1 KING 150 AUTOPILOT SYSTEM INDICATORS AND CONTROLS

The airplane MASTER SWITCH function is unchanged and can be used in an emergency to shut off electrical power to all flight control systems while the problem is isolated.

The RADIO MASTER switch supplies power to the avionics bus bar of the radio circuit breakers and the autopilot circuit breaker.

The following circuit breakers are used to protect the following elements of the King 150 Series Autopilot:

LABEL	FUNCTION
AUTOPILOT	Supplies power to the KC 192 or the KC 191 Computer, the autopilot pitch and roll servos, and the Elev Trim Switch/Circuit Breaker.
RADIO MASTER	Switch/circuit breaker supplies power to the avionics buss.

Section I (Continued)

LABEL	FUNCTION
ELEV TRIM	Switch/circuit breaker supplies power to the autotrim and manual electric pitch trim systems.
HSI	Supplies power to the optional KCS 55A Comapss System.

SECTION II - LIMITATIONS

A. During autopilot operation, a pilot with seat belt fastened must be seated at the left pilot position.

B. The autopilot must be OFF during takeoff and landing.

C. The system is approved for Category I operation only (Approach mode selected).

D. Do not operate autopilot with flaps extended beyond the take-off position.

E. Autopilot airspeed limitations: Maximum 180 KIAS; minimum 80 KIAS.

NOTE

IN ACCORDANCE WITH FAA RECOMMENDATION, USE OF "ALTITUDE HOLD" MODE IS NOT RECOMMENDED DURING OPERATION IN SEVERE TURBULENCE.

Placards:

NONE

SECTION III - EMERGENCY PROCEDURES

A. In case of Autopilot malfunction: (Accomplish Items 1. and 2. simultaneously.)

1. Airplane Control Wheel - GRASP FIRMLY and regain aircraft control.

2. A/P DISC/TRIM INTER Switch - PRESS and HOLD.

Section III (Continued)

3. A/P DISC/TRIM INTER Switch - RELEASE while observing pitch trim wheel. If pitch trim wheel is in motion, follow the Electric Trim Malfunction Procedure.

B. In case of Electric Trim Malfunction (either manual electric or autotrim):

1. A/P DISC/TRIM INTER Switch - PRESS and HOLD throughout recovery.

2. ELEV TRIM Switch - OFF.

3. Aircraft - RETRIM manually.

CAUTION

WHEN DISCONNECTING THE AUTOPILOT AFTER A TRIM MALFUNCTION, HOLD THE CONTROL WHEEL FIRMLY; UP TO 45 POUNDS OF FORCE ON THE CONTROL WHEEL MAY BE NECESSARY TO HOLD THE AIRCRAFT LEVEL.

Maximum Altitude losses due to autopilot malfunction:

Configuration	Alt Loss
Cruise, Climb, Descent	400
Maneuvering	90
APPR	90

SECTION IV - NORMAL PROCEDURES

A. Preflight (Perform prior to each flight)

1. GYROS - Allow 3-4 minutes for gyros to come up to speed.

2. RADIO MASTER - ON.

3. ELEV TRIM - ON.

4. PREFLIGHT TEST BUTTON - PRESS momentarily and NOTE:

   a. All annunciator lights on (TRIM annunciator flashing).

   b. After approximately 5 seconds, all annunciator lights off except AP which will flash approximately 12 times and then remain off.

NOTE

IF TRIM WARNING LIGHT STAYS ON THEN THE AUTOTRIM DID NOT PASS PREFLIGHT TEST. THE AUTOPILOT CIRCUIT BREAKER SHOULD BE PULLED. MANUAL ELECTRIC TRIM CAN NOT BE USED.

Section IV (Continued)

5. MANUAL ELECTRIC TRIM - TEST as follows:

   a. Actuate left side of split switch unit to the fore and aft positions. The trim wheel should not move on its own. Rotate the trim wheel manually against the engaged clutch to check the pilots trim overpower capability.

   b. Actuate right side of split switch unit to the fore and aft positions. Trim wheel should not move on its own and normal trim wheel force is required to move it manually.

   c. Press the A/P DISC/TRIM INTER switch down and hold. Manual Electric Trim should not operate either nose up or nose down.

6. FLIGHT DIRECTOR (KFC 150 ONLY) - ENGAGE by pressing FD button.

7. AUTOPILOT - ENGAGE by pressing AP ENG button.

8. CONTROL WHEEL - MOVE fore, aft, left & right to verify that the autopilot can be overpowered.

9. A/P DISC/TRIM INTER Switch - PRESS. Verify that the autopilot disconnects and all flight director modes are canceled.

10. TRIM - SET to take off position.

B. AUTOPILOT OPERATION

1. Before takeoff

   a. A/P DISC/TRIM INTER Switch - PRESS.

2. Autopilot Engagement

   a. FD Mode Selector Button (KFC 150 Only) - PRESS.

   b. AP ENG Button - PRESS. Note AP annunciator on. If no other modes are selected the autopilot will operate in wings level and pitch attitude hold.

3. Climb or Descent

   a. Using CWS

      1) CWS Button - PRESS and MOVE aircraft nose to the desired attitude.

      2) CWS Button - RELEASE. Autopilot will maintain aircraft pitch attitude up to the pitch limits of $+15^{\circ}$ or -10°.

b. Using Vertical Trim

1) VERTICAL TRIM Control - PRESS either up or down to modify aircraft attitude at a rate of .7 deg/sec. up to the pitch limits of $+15^{\circ}$ or -10°.

2) VERTICAL TRIM Control - RELEASE when desired aircraft attitude is reached. The autopilot will maintain the desired pitch attitude.

4. Altitude Hold

a. ALT Mode Selector Button - PRESS. Note ALT mode annunciator ON. Autopilot will maintain the selected pressure altitude.

b. Change selected altitudes

1) Using CWS (recommended for altitude changes greater than 100 ft.)

a) CWS Button - PRESS and fly aircraft to desired pressure altitude.

b) CWS Button - RELEASE when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.

2) Using Vertical Trim (Recommended for altitude changes less than 100 ft.)

a) VERTICAL TRIM Control - PRESS either up or down. Vertical Trim will seek an altitude rate of change of 600 $\pm$100 fpm.

b) VERTICAL TRIM Control - RELEASE when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.

5. Heading Changes

a. Manual Heading Changes

1) CWS Button - PRESS and MANEUVER aircraft to the desired heading.

2) CWS Button - RELEASE. Autopilot will maintain aircraft in wings level attitude.

NOTE

AIRCRAFT HEADING MAY CHANGE IN THE WINGS LEVEL MODE DUE TO AN AIRCRAFT OUT OF TRIM CONDITION.

b. Heading Hold

1) Heading Selector Knob - SET BUG to desired heading.

2) HDG Mode Selector Button - PRESS. Note HDG mode annunciator ON. Autopilot will automatically turn the aircraft to the selected heading.

c. Command Turns (Heading Hold mode ON)

1) HEADING Selector Knob - MOVE BUG to the desired heading. Autopilot will automatically turn the aircraft to the new selected heading.

6. NAV Coupling

a. When equipped with HSI.

1) Course Bearing Pointer - SET to desired course.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE DESIRED COURSE.

2) HEADING Selector Knob - SET BUG to provide desired intercept angle.

3) NAV Mode Selector Button - PRESS.

a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with the NAV annunciator flashing; when the computed capture point is reached the HDG will disengage, the NAV annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the NAV annunciator will illuminate steady and the capture/track sequence will automatically begin.

B. When equipped with DG

1) OBS Knob - SELECT desired course.

Section IV - (Continued)

2) NAV Mode Selector Button - PRESS.

3) Heading Selector Knob - ROTATE BUG to agree with OBS course.

NOTE

WHEN NAV IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE AUTOMATICALLY ESTABLISHED BASED ON THE POSITION OF THE BUG.

a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode and NAV flashing; when the computed capture point is reached the HDG annunciator will go out, the NAV annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the NAV annunciator will illuminate steady and the capture/track sequence will automatically begin.

7. Approach (APR) Coupling

a. When equipped with HSI

1) Course Bearing Pointer - SET to desired course.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE DESIRED COURSE.

2) HEADING Selector Knob - SET BUG to provide desired intercept angle.

3) APR Mode Selector Button - PRESS.

a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with the APR annunciator flashing; when the computed capture point is reached the HDG will disengage, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting APR mode; the APR annunciator will illuminate steady and the capture/track sequence will automatically begin.

b. When equipped with DG

1) OBS Knob - SELECT desired approach course.

2) APR Mode Selector Button - PRESS.

3) Heading Selector Knob - ROTATE Bug to agree with OBS course.

NOTE

WHEN APR IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE AUTOMATICALLY ESTABLISHED BASED ON THE POSITION OF THE BUG.

a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode and APR flashing; when the computed capture point is reached the HDG annunciator will go out, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting APR mode; the APR annunciator will illuminate steady and the capture/track sequence will automatically begin.

8. BC Approach Coupling

a. When equipped with HSI

1) Course Bearing Pointer - SET to the ILS front course inbound heading.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE ILS FRONT COURSE INBOUND HEADING.

2) HEADING Selector Knob - SET BUG to provide desired intercept angle.

3) BC Mode Selector Button - PRESS.

a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with BC annunciated steady and APR annunciator flashing; when the computed capture point is reached the HDG will disengage, and the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the APR BC annunciator will illuminate steady and the capture/track sequence will automatically begin.

b. When equipped with DG

1) OBS Knob - SELECT the ILS front course inbound heading.

2) BC Mode Selector Button - PRESS.

3) Heading Selector Knob - ROTATE Bug to the ILS front course inbound heading.

NOTE

WHEN BC IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE ESTABLISHED BASED ON THE POSITION OF THE BUG.

a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG and BC modes with APR flashing; when the computed capture point is reached the HDG annunciator will go out, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting BC mode; the APR BC annunciator will illuminate steady and the capture/track sequence will automatically begin.

9. Glideslope Coupling

NOTE

GLIDESLOPE COUPLING IS INHIBITED WHEN OPERATING IN NAV OR APR BC MODES. GLIDESLOPE COUPLING OCCURS AUTOMATICALLY IN THE APR MODE.

a. APR Mode - ENGAGED.

b. At glideslope centering - NOTE GS annunciator ON.

NOTE

AUTOPILOT CAN CAPTURE GLIDESLOPE FROM ABOVE OR BELOW THE BEAM WHILE OPERATING IN EITHER PITCH ATTITUDE HOLD OR ALT HOLD MODES.

Section IV - (Continued)

10. Missed Approach

   a. A/P DISC/TRIM INTER Switch - PRESS to disengage AP.

   b. Missed Approach - Execute.

   c. CWS Button - PRESS (KFC 150 only) as desired to activate FD mode during go-around maneuver.

   d. AP ENG BUTTON - PRESS (If AP operation is desired). Note AP annunciator ON.

NOTE

IF IT IS DESIRED TO TRACK THE ILS COURSE OUTBOUND AS PART OF THE MISSED APPROACH PROCEDURE, USE THE NAV MODE TO PREVENT INADVERTANT GS COUPLING.

11. Before Landing

   a. A/P DISC/TRIM INTER Switch - PRESS to disengage AP.

C. FLIGHT DIRECTOR OPERATION (KFC 150 Systems Only)

NOTE

THE FLIGHT DIRECTOR MODES OF OPERATION ARE THE SAME AS THOSE USED FOR AUTOPILOT OPERATIONS EXCEPT THE AUTOPILOT IS NOT ENGAGED AND THE PILOT MUST MANEUVER THE AIRCRAFT TO SATISFY THE FLIGHT DIRECTOR COMMANDS.

SECTION V - PERFORMANCE

There is no change to the aircraft performance when this avionics equipment is installed.

Mod Works Inc.
8250 Skylane Way
Punta Gorda FL 33982

FAA-APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
FOR
MOONEY M20J
REG. NO. N5772R
SER. NO. 24-1507

This supplement must be attached to the FAA approved Airplane Flight Manual dated ______ when the engine and or propeller conversion is installed in accordance with STC SA250GL. The information contained in this document supplements or supersedes the basic manual only in those areas listed. For limitations, procedures, performance, and loading information not contained in this supplement, consult the basic airplane flight manual.

FAA-Approved ______

for Manager, Aircraft Certification Office
Federal Aviation Administration
Atlanta, GA

Date JAN 1 9 1996

Mod Works Inc.
8250 Skylane Way
Punta Gorda FL 33982

SUPPLEMENT TO THE PILOT OPERATING HANDBOOK

TABLE OF CONTENTS

Mod Works Inc.
8250 Skylane Way
Punta Gorda FL 33982

SECTION I. GENERAL DESCRIPTION

DESIGN FEATURES

POWER PLANT

The original Lycoming IO-360-A1B6D or IO-360-A3B6D power plant has been replaced by a Lycoming IO-360-A1B6, IO-360-A3B6 rated at 200 hp. There is no change in noise emissions due to this conversion

SPECIFICATIONS OUTLINE

POWER PLANT

ENGINE

NUMBER OF ENGINES		1
ENGINE MANUFACTURER		LYCOMING
MODEL		IO-360-A1B6
	OR	IO-360-A3B6

ALL OTHER INFORMATION UNCHANGED

PROPELLER

NUMBER		1
MANUFACTURER		McCAULEY
MODEL NUMBER		B2D34C214/90HB-16E
	OR	B2D34C214/90HB-16EP

EACH PROPELLER IS APPROVED FOR EACH ENGINE LISTED ABOVE

FUEL & OIL

NO CHANGES ARE MADE TO THIS SECTION

WEIGHT & LOADING

REFER TO THE NEW WEIGHT AND BALANCE DETERMINED AS PART OF THIS STC

FAA APPROVED
DATE JAN 19 1996

Mod Works Inc.
8250 Skylane Way
Punta Gorda FL 33982

SECTION V OPERATING LIMITATIONS

POWER PLANT

NUMBER OF ENGINES		1
ENGINE MANUFACTURER		LYCOMING
ENGINE MODEL NUMBER		IO-360-A1B6
	OR	IO-360-A3B6

ALL LIMITATIONS ARE THE SAME AS THE ORIGINAL EQUIPMENT ENGINE EXCEPT:

AVOID CONTINUOUS OPERATION BETWEEN 1500 AND 1950 RPM BELOW 15 INCHES MANIFOLD PRESSURE

PROPELLER MANUFACTURER		McCAULEY
MODEL NUMBER		B2D34C214/90HB-16E
	OR	B2D34C214/90HB-16EP
DIAMETER		Max. 74.0 in. (187.9 cm) Min. 73.0 in. (185.4 cm)
TYPE		CONSTANT SPEED
GOVERNING		HYDRAULICALLY CONTROLLED BY ENGINE OIL
BLADE ANGLES @30 in. sta.:		
LOW		13.9 deg. +/- .2 deg.
HIGH		33.0 deg. +/- .5 deg.
PROPELLER OPERATING LIMIT		2700 RPM

TACHOMETER:

YELLOW ARC - CAUTION	1500 to 1950 RPM
GREEN ARC - NORMAL	1950 to 2700 RPM
RED LINE - MAXIMUM	2700 RPM

PLACARDS: AVOID CONTINUOUS OPERATION BETWEEN 1500 AND 1950 RPM BELOW 15 INCHES MANIFOLD PRESSURE

FAA APPROVED
DATE JAN 1 9 1996

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the

Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System

as installed in

Mooney M20J

Make and Model Airplane

Registration Number: N5772R Serial Number: 24-1502

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

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved by: Erik Frisk

Erik Frisk
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 2-NOV-2017

LOG OF REVISIONS				
	Page			
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1	03/18/11	All	Complete Supplement	*Robert Grove* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *03 18 2011*
2	12/18/12		See Revision 3	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *12 18 2012*
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LOG OF REVISIONS				
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		12	Section 2.7 • MMC additions	
		12	Section 2.8 • Added reference to section 2.29	
		18	Section 2.28 • Fixed error	
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LOG OF REVISIONS				
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7	10/17/17	6-8	Sections 1.5 • New definitions	See Page i
		9	Section 2.1 • Updated CRG Revisions	
		10	Section 2.4 • Updated FDE compliance text	
		12	Section 2.6 • Updated software grid	
		13	Section 2.10 • Renamed section	
		19-20	Section 2.32-2.33 • New sections	
		22	Section 3.2.1-2 • Updated text	
		32	Section 7.27 • Updated PG Revisions	
		45	Section 7.27 • New section	

Table of Contents

Section 1. General

1.1 Garmin GTN Navigators

The Garmin GTN navigation system is a GPS system with a Satellite Based Augmentation System (SBAS), comprised of one or more Garmin TSO-C146c GTN 625, 635, 650, 725, or 750 navigator(s) and one or more Garmin approve GPS/SBAS antenna(s). The GTN navigation system is installed in accordance with AC 20-138A.

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

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

Table 1 – GTN Functions

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

Figure 1 - GTN 750 Control and Display Layout

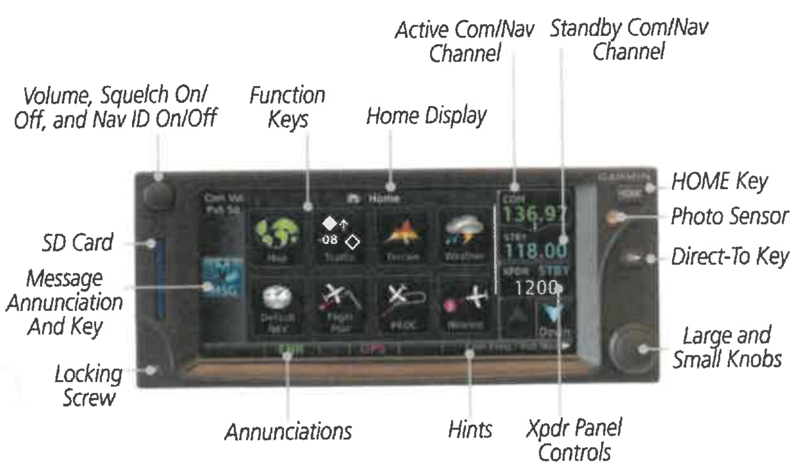


Figure 2 - GTN 635/650 Control and Display Layout

1.2 System Capabilities

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

NOTE

In sections which contain a square checkbox (□) the installer will have placed an "X" in the boxes next to the capabilities applicable to the installation.

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

☒ VHF Communication Radio
☒ Primary VHF Navigation
☒ Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below
☒ Primary GPS Approach Capability with Vertical Guidance (LNAV/VNAV, LPV) – See below
☐ TSO-C151c Terrain Awareness and Warning System – See section 2.15

GPS/SBAS TSO-C146c Class 3 Operation

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

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures including procedures with RF legs subject to the limitations herein. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-100A for RNAV 2 and RNAV 1 operations. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 and RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

Applicable to dual installations consisting of two Garmin GNSS units: The Garmin GNSS navigation system has been found to comply with the requirements for GPS Class II oceanic and remote navigation (RNP-10) without time limitations in accordance with AC 20-138A and FAA Order 8400.12A. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. This does not constitute an operational approval.

The Garmin GNSS navigation system has been found to comply with the navigation requirements for GPS Class II oceanic and remote navigation (RNP-4) in accordance with AC 20-138A and FAA Order 8400.33. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. Additional equipment may be required to obtain operational approval to utilize RNP-4 performance. This does not constitute an operational approval.

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system consists of one or more TSO-C146c Class 3 approved Garmin GTN Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

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

Navigation information is referenced to the WGS-84 reference system.

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

Advanced RNP Capabilities

The GTN includes 3 out of 6 of the features required for operations in airspace requiring Advance RNP based on the *ICAO document 9613 Performance Based Navigation (PBN) Manual, fourth edition, 2013* and is therefore not approved for Advanced RNP operations. The following table describes the six Advanced RNP capabilities and the GTN capabilities.

Advanced RNP Feature	GTN Capability
RF legs	Available if enabled for installation. See Section 2.12 for limitations.
Parallel offsets	Available.
Scalable RNP	GTN provides CDI scalability in compliance with TSO-C146c. RNP scalability is not available.
RNAV holding	Available.
Fixed radius transitions	Not available in GTN.
Time of arrival control (TOAC)	Not available in GTN.

1.3 Electronic Flight Bag

The GTN 750/725 are operationally suitable as Class 3 Hardware, Type B Software in accordance with AC 120-76B EFB electronic aeronautical information when using current FliteChart or ChartView data.

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

1.4 Electronic Checklists

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

1.5 Definitions

The following terminology is used within this document:

ADF:	Automatic Direction Finder
ADS-B:	Automatic Dependent Surveillance Broadcast
AEG:	Aircraft Evaluation Group (FAA)
APR:	Approach
CDI:	Course Deviation Indicator
DME:	Distance Measuring Equipment
ECAC:	European Civil Aviation Conference
EFB:	Electronic Flight Bag
EGNOS:	European Geostationary Navigation Overlay Service
EHSI:	Electronic Horizontal Situation Indicator
FIS-B:	Flight Information Services Broadcast
GAGAN:	GPS Aided GEO Augmented Navigation
GNSS:	Global Navigation Satellite System
GPA:	Glidepath Angle
GPS:	Global Positioning System
GPSS:	GPS Roll Steering
GTN:	Garmin Touchscreen Navigator
HOT:	Hazardous Obstacle Transmission wires
HSI:	Horizontal Situation Indicator
IAP:	Instrument Approach Procedure
IFR:	Instrument Flight Rules
ILS:	Instrument Landing System

IMC:	Instrument Meteorological Conditions
LDA:	Localizer Directional Aid
LNAV:	Lateral Navigation
LNAV +V:	Lateral Navigation with advisory Vertical Guidance
L/VNAV:	Lateral/Vertical Navigation
LOC:	Localizer
LOC-BC:	Localizer Backcourse
LP:	Localizer Performance
LPV:	Localizer Performance with Vertical Guidance
LP +V:	Localizer Performance with Advisory Vertical Guidance
MLS:	Microwave Landing System
MMC:	Multi-Media Card
NOTAM:	Notice to Airmen
OBS:	Omni Bearing Selector
PED:	Portable Electronic Device
RAIM:	Receiver Autonomous Integrity Monitoring
RF Leg:	Radius-To-Fix Leg of a Charted Instrument Procedure
RMT:	Remote
RNAV:	Area Navigation
RNP:	Required Navigational Performance
SAR:	Search and Rescue
SBAS:	Satellite Based Augmentation System
SD:	Secure Digital
SDF:	Simplified Directional Facility
SUSP:	Suspend
TACAN:	Tactical Air Navigation System
TAS:	Traffic Awareness System
TAWS:	Terrain Awareness and Warning System
TCAS:	Traffic Collision Avoidance System
TCH:	Threshold Crossing Height
TFR:	Temporary Flight Restriction
TIS:	Traffic Information Service
VHF:	Very High Frequency
VFR:	Visual Flight Rules
VGSI:	Visual Glide-Slope Indicator
VLOC:	VOR/Localizer
VMC:	Visual Meteorological Conditions

VOR:	VHF Omnidirectional Range
VRP:	Visual Reporting Point
WAAS:	Wide Area Augmentation System
WFDE:	WAAS Fault Data Exclusion
XFR:	Transfer

Section 2. LIMITATIONS

2.1 Cockpit Reference Guide

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide, part number and revision listed below (or later revisions), *must* be immediately available to the flight crew whenever navigation is predicated on the use of the GTN.

- GTN 6XX Cockpit Reference Guide P/N 190-01004-04 Rev L
- GTN 7XX Cockpit Reference Guide P/N 190-01007-04 Rev K

2.2 Kinds of Operation

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

2.3 Minimum Equipment

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

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

Table 2 – Required Equipment

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

Single engine piston aircraft under 6,000 lbs. maximum takeoff weight:

Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator

All other aircraft:

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

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

2.4 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability. An acceptable means of compliance for FDE prediction programs is to use a certified service which meets the requirements of FAA AC 20-138 and FAA AC 90-105A for prediction.

.ie following table describes some of the available RAIM prediction programs.

Prediction Program	Internet address or program details	Coverage Area
Garmin RAIM Prediction Tool	https://fly.garmin.com/fly-garmin/support/raim/	Worldwide
Garmin WFDE Prediction program	PC-based program included in GTN trainer v3.00 – 6.30. Instructions provided via Garmin part number 190-00643-01	Worldwide
FAA Service Availability Prediction Tool	http://sapt.faa.gov	US Only
Flight Service Station	1-800-WXBRIEF https://www.1800wxbrief.com	US Only
AUGER GPS RAIM 'rediction Tool	http://augur.ecacnav.com/augur/app/home	ECAC Airspace Only

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

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

pplicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), Standard Terminal Arrival (STAR), and enroute RNAV "Q" and RNAV "T" routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

2.5 System Use

In installations with two GTNs and an external GPS annunciator (See Table 2) the GTN connected to the external GPS annunciator must be used as the navigation source for all IFR operations.

The only approved sources of course guidance are on the external CDI, HSI, or EHSI display. The moving map and CDI depiction on the GTN display are for situational awareness only and are not approved for course guidance.

2.6 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main and GPS software versions are displayed on the start-up page immediately after power-on. All software versions displayed in Table 3 can be viewed on the System – System Status or Connext Setup pages.

Software Item	Software Version *(or later FAA Approved versions for this STC)*
Main SW Version	6.41
GPS SW Version	5.2
Com SW Version	2.20
Nav SW Version	6.03
Flight Stream 210	2.70
Flight Stream 510	2.30

Table 3 - Software Versions

2.7 MMC / SD Database Cards

It is required that the SD database card or Flight Stream 510 (MMC) be present in the GTN at all times. The SD or MMC device must not be removed or inserted during flight or while the GTN is powered on.

NOTE

Removal of the SD or MMC device will result in certain features and databases not being available and may slow system performance.

2.8 Navigation Database

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

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

See Section 2.29 for limitations regarding database update procedures.

2.9 Ground Operations

Do not use SafeTaxi or ChartView functions as the basis for ground maneuvering. SafeTaxi and ChartView functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and ChartView are to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

2.10 Instrument Approaches

a) Instrument approaches using GPS guidance may only be conducted when the GTN is operating in the approach mode. (LNAV, LNAV +V, L/VNAV, LPV, LP, or LP +V)
b) When conducting instrument approaches referenced to true North, the NAV Angle on the System -Units page must be set to **True**.
c) The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA SDF, MLS, VOR, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title. When using the Garmin VOR/LOC/GS receivers to fly the final approach segment, VOR/LOC/GS navigation data must be selected and presented on the CDI of the pilot flying.
d) Advisory vertical guidance deviation is provided when the GTN annunciates LNAV + V or LP +V. Vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions.
e) Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GTN system flight plan by its name. Pilots are prohibited from flying any approach path that contains manually entered waypoints.
f) IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GTN and/or the CDI.

2.11 Barometric Setting

The barometric altimeter setting used for any barometric corrected altitude source interfaced to the GTN must be set appropriate to the altitude type depicted on the procedure (QNH or QFE).

2.12 RF Legs

This STC does not grant operational approval for RF leg navigation for those operators requiring operational approval. Additional FAA approval may be required for those aircraft intending to use the GTN as a means to provide RNP 1 navigation in accordance with FAA Advisory Circular AC 90-105.

The following limitations apply to procedures with RF legs:

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

2.13 Autopilot Coupling

The flight crew may fly all phases of flight based on the navigation information presented to the flight crew; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes.

This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

It is possible to create flight plan waypoint sequences, including Search and Rescue patterns, which exceed the autopilot's bank angle capabilities. The pilot shall monitor autopilot performance with regard to flight path deviation.

2.13.1 RNP 1.0 RF Leg Types

AC 90-105 states that procedures with RF legs must be flown using either a flight director or coupled to the autopilot.

This STC has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the GTN installation complies with limitation set forth in Section 2.12 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

2.14 Terrain Proximity Function (All Units)

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

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

NOTE

Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.15 TAWS Function (Optional)

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

TAWS shall be inhibited when landing at an airport that is not included in the airport database.

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

NOTE

Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.16 Polar Operations

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

2.17 Datalink Weather Display (Optional)

This limitation applies to datalink weather products from SiriusXM via a GDL 69/69A, FIS-B via a GDL 88 or GTX 345, and Connext via a GSR 56.

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products ɪy not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GTN.

Datalink text weather is decoded for the convenience of the pilot, however it is possible that the decoding may be affected by anomalies in the data or differences in the units of measure between the decoding system and the text weather source. All text weather displayed on the GTN also includes the raw weather text for pilot review.

ˉ18 Traffic Display (Optional)

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

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

2.19 StormScope® Display (Optional)

StormScope® lightning information displayed by the GTN 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 ʼrces.

When the GTN StormScope® page is operating without a heading source, as indicated by the "HDG N/A" label at the upper right corner of the StormScope® page, strikes must be cleared after each heading change.

2.20 Flight Planner/Calculator Functions

The Fuel Planning page uses Fuel on Board or Fuel Flow as received from an on board fuel totalizer, as entered by the pilot at system startup, or as entered by the pilot when on the Fuel Planning page. This *is not* a direct indication of actual aircraft fuel flow or fuel on board and those values are only used for the Fuel Planning page. The fuel required to destination is only a calculated and predicted value based on the data entered into the planner. It is not a direct indication of how much fuel the aircraft will have upon reaching the destination.

2.21 Fuel Range Rings

The fuel range rings displayed on the moving map are intended for situational awareness and do not represent a direct indication of endurance or fuel remaining. The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes by default. The reserve value can be changed from the GTN map setup menu.

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

2.22 Glove Use / Covered Fingers

No device may be used to cover fingers used to operate the GTN unless the Glove Qualification Procedure located in the Pilot's Guide/Cockpit Reference Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GTN 725, 750 or GTN 625, 635, 650 combinations.

2.23 Demo Mode

Demo mode may not be used in flight under any circumstances.

2.24 Active Weather Radar

Radar is broadcasting energy while in Weather or Ground mapping modes. If the GTN 750/725 system is configured to control an airborne weather radar unit, observe all safety precautions, including:

- Do not operate in the vicinity of refueling operations.
- Do not operate while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.

CAUTION

If a radar system is installed, it generates microwave radiation and improper use, or exposure, may cause serious bodily injury. Do not operate the radar equipment until you have read and carefully followed the safety precautions and instructions in the weather radar user manual and/or pilot's guide.

2.25 Telephone Audio

Telephone audio must not be distributed to the pilot or co-pilot unless a phone call is active.

CAUTION

Failure to turn off telephone audio when the telephone is not in use may result in telephone ringer or text message aural notifications being received during critical phases of flight.

2.26 Multi Crew Aircraft (GMA 35 Only)*

For aircraft type certified with more than one required pilot, or operations requiring more than one pilot, the "Group Co-Pilot with Passenger" audio panel option shall not be activated. This option is found in the Intercom Setup Menu when a Garmin GMA 35 audio panel is installed.

2.27 Wire Obstacle Database

Only the "Obstacle/HOT Line" database may be used. Use of the "Obstacle/Wire" database is prohibited. The database version can be viewed on the start-up database verification or System- System Status pages.

2.28 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 Flight Stream interface and data provided to a portable electronic device is not approved to replace any aircraft display equipment, including navigation or traffic/weather display equipment.

2.29 Database Updates

Database updates via MMC / SD card or Flight Stream wireless transfers must be done while the aircraft is on the ground and stationary. In-flight database transfers or updates are prohibited in flight unless part of the Database SYNC function that occurs in the background to move databases from one LRU to another.

2.30 Charts Database (Dual GTN7XX)

When the aircraft installation includes 2 GTNs capable of displaying charts (GTN 700, 725 or 750) and crossfill is enabled between the GTNs, the GTNs must have identical charts types (ChartView or FliteCharts) and charts cycles installed. Failure to have identical charts could affect the chart lookup features and automatic chart selection.

2.31 Automatic Speech Recognition

Pilots may not use the ASR function to operate the GTN/GMA unless they have completed the ASR Qualification Procedure located in the GTN Cockpit Reference Guide successfully. The ASR Qualification Procedure is specific to each pilot / headset / aircraft combination.

2.32 OBS Mode

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

* Includes GMA 35 and GMA 35c Audio Panels

2.33 Advisory Visual Approaches

All advisory visual approaches shall be conducted in VMC. Advisory visual approaches are intended to be used as an aid to situational awareness and do not guarantee terrain or obstruction clearance along the approach path. Use of advisory visual approaches in IMC is prohibited.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

3.1.1 TAWS WARNING

Red annunciator and aural "PULL UP":
Autopilot .... **DISCONNECT**
Aircraft Controls .... **INITIATE MAXIMUM POWER CLIMB**
Airspeed .... **BEST ANGLE OF CLIMB SPEED**

After Warning Ceases:
Altitude .... **CLIMB AND MAINTAIN SAFE ALTITUDE**
Advise ATC of Altitude Deviation, if appropriate.

NOTE

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

NOTE

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

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

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

If the LOI annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight. If LOI occurs while the GTN is in the ENR or OCN phase of flight, it may also display DR.

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

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

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

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation .... **USE GTN**

NOTE

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

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

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

NOTE

All information derived from GPS will be removed.

NOTE

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

3.2.2 GPS APPROACH DOWNGRADE

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

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

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:
Communications .... **USE ALTERNATE COM**

If no alternate COM is available:
COM RMT XFR key (if installed)....... **PRESS AND HOLD FOR 2 SECONDS**

NOTE

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

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

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

NOTE

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

† Includes GMA 35 and GMA 35c Audio Panels

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

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

NOTE

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

3.2.6 TAWS INHIBIT

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

To Inhibit TAWS:

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

3.2.7 TER N/A and TER FAIL

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

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

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

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

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

3.2.9 ASR (VOICE COMMAND) SYSTEM FAILURES

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

To Disable ASR:

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

3.2.10 LOSS OF GTN TOUCH CONTROL

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

To Disable ASR:

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

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

Without a barometric corrected altitude source to the GTN, the following features will not operate:

- Automatic leg sequencing of legs requiring an altitude source. The flight crew must manually sequence altitude legs, as prompted by the system.

3.2.12 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

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

3.2.13 IN-AIR RESTART OF GTN

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

Section 4. NORMAL PROCEDURES

Refer to the GTN Cockpit Reference Guide defined in Section 2.1 of this document or the Pilot's Guide defined in Section 7.1 for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, VHF communication and navigation, traffic, data linked weather, StormScope®, TAWS, and Multi-Function Display information.

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

4.1 Unit Power On

Databases .... **REVIEW DATES**
Self-Test .... **VERIFY OUTPUTS TO NAV INDICATORS**
Self-Test - TAWS Remote Annunciator:

- PULL UP .... **ILLUMINATED**
- TERR .... **ILLUMINATED**
- TERR N/A .... **ILLUMINATED**
- TERR INHB .... **ILLUMINATED**

Self-Test - GPS Remote Annunciator:

- VLOC .... **ILLUMINATED**
- GPS .... **ILLUMINATED**
- LOI or INTG .... **ILLUMINATED**
- TERM .... **ILLUMINATED**
- WPT .... **ILLUMINATED**
- APR .... **ILLUMINATED**
- MSG .... **ILLUMINATED**
- SUSP or OBS .... **ILLUMINATED**

4.2 Before Takeoff

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

4.3 HSI and EHSI Operation

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

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

CAUTION

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

See Section 4.5 for RF leg capabilities related to EHSI.

4.4 Autopilot Operation

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

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

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

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

CAUTION

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

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

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

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

4.5 Coupling the Autopilot during approaches

CAUTION

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

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

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

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

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

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

Autopilot.. **ENGAGE APPROACH MODE**

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

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

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

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

The GTN allows for the utilization of IFR procedures that include RF (Radius to Fix) legs as part of RNP 1.0 capabilities.

- ☐ This installation is equipped to support coupled RF leg navigation up to RNP 1.0.
- ☐ This installation is equipped to support *un-coupled* RF leg navigation up to RNP 1.0.
- ☒ This installation *does not* support RF leg navigation.

4.6 Coupling the Autopilot during Search and Rescue Operations

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

4.7 Database Conflict Resolution

When a conflict occurs between databases on different GTNs that are utilizing Database SYNC the pilot should resolve that conflict by pressing the "Resolve Conflict" button on the GTN that has the desired databases. This would be the GTN with the newest database on the SD card or Flight Stream 510. After initiating the conflict resolution, the pilot can view the SYNC status of the database on the other GTN by viewing the System -> Standby Database page. Once the database SYNC is complete, the receiving GTN must be restarted to tall the new database and complete the conflict resolution process.

NOTE

The databases on the receiving LRU will be overwritten by the databases from the LRU from which the "Resolve Conflicts" action was initiated.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

The Garmin GTN 6XX or GTN 7XX Pilot's Guide, part number and revision listed below, contain additional information regarding GTN system description, control and function. The Pilot's Guides *do not* need to be immediately available the flight crew.

• GTN 6XX Pilot's Guide	P/N 190-01004-03 Rev L or later
• GTN 7XX Pilot's Guide	P/N 190-01007-03 Rev N or later

7.2 Leg Sequencing

The GTN supports all ARINC 424 leg types. Certain leg types require altitude input in order to sequence (course to altitude, for example). If a barometric corrected altitude source is not interfaced to the GTN, a popup will appear prompting the flight crew to manually sequence the leg once the altitude prescribed in the procedure is reached.

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

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

7.3 Auto ILS CDI Capture

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

7.4 Activate GPS Missed Approach

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

☐ This installation *will not* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed. The pilot must manually switch from VLOC to GPS if GPS guidance is desired after the missed approach point.

7.5 Terrain Proximity and TAWS

CAUTION

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

NOTE

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

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

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

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

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

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

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

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

e Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN ..X or GTN 7XX Pilot's Guide provides additional information regarding terrain and obstacle colors and grouped obstacle icons.

7.6 GMA 35/35c Audio Panel (Optional)

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

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

7.7 Traffic System (Optional)

This system is configured for the following type of traffic system. The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding the functionality of the traffic device.

- ☐ No traffic system is interfaced to the GTN.
- ☐ A TAS/TCAS I traffic system is interfaced to the GTN.
- ☐ A TIS traffic system is interfaced to the GTN.
- ☐ A TCAD traffic system is interfaced to the GTN.
- ☒ A Garmin ADS-B traffic system is interfaced to the GTN.
- ☐ A Garmin ADS-B traffic system is interfaced to the GTN. The ADS-B traffic system is also interfaced to an on board traffic system.

7.8 StormScope® (Optional)

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

Heading Up mode:

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

Heading Not Available mode:

If the GTN system is not receiving valid heading information, either because a compatible heading system is not installed, or the interfaced heading system has malfunctioned, the StormScope® page will continue to operate without a heading source and indicate "HDG N/A" in the upper right corner of the GTN display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft but *is not* automatically rotated to the correct relative position as the aircraft turns. When operating in this mode, StormScope® strikes must be cleared after each turn the aircraft performs.

7.9 Power

- Power to the GTN is provided through a circuit breaker labeled NAV/GPS (1/2).
- Power to the optional GTN COM is provided through a circuit breaker labeled COM (1/2).
- Power to the optional GMA 35 is provided through a circuit breaker labeled AUDIO.
- Power to the optional Flight Stream 210 is provided through a circuit breaker labeled BT LINK.
- Power to the optional Flight Stream 510 is provided through the GTN MMC/SD card slot and protected via the GTN circuit breaker.

7.10 Databases and Flight Plan Waypoints/Procedures

Database versions (or cycles) and effective dates are displayed on the start-up database verification page immediately after power-on for those databases with an effective or expiration date. Databases with no effective or expiration date (e.g. - terrain database) are considered effective upon installation in the GTN. Database information can also be viewed on the System – System Status page.

The Obstacle Database has an area of coverage that includes the United States and Europe, and is updated as frequently as every 56 days. The HOT Line wire database only includes the continental United States and portions of Canada/Mexico.

Only the Obstacle/HOT Line wire database may be used in accordance with the limitation found in Section 2.27.

If a stored flight plan contains a waypoint or procedure that does not correspond to a waypoint or procedure in the navigation database in use, the waypoint or procedure will become locked (depicted as "lockd") in the flight plan. Flight plans with locked waypoints may be placed in the active flight plan portion of the system but no navigation will be provided. The locked waypoint/procedure must be resolved by removing or replacing it with the correct waypoint/procedures in the flight plan before the system will provide navigation.

7.11 External Switches

External switches may be installed and interfaced to the GTN. These switches may be stand alone, or integrated with a TAWS or GPS annunciator. Table 4 lists the switches and function they perform:

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

Table 4 – External Switches

7.12 Airspace Depiction and Alerts

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

NOTE

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

7.13 Garmin ADS-B Traffic System Interface (Optional)

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

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

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

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

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

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

7.14 GWX 70 Weather Radar (Optional)

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

NOTE

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

7.15 Charts (Optional)

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

7.16 Transponder Control (Optional)

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

7.17 Telephone Audio (Optional)

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

7.18 Depiction of Obstacles and Wires

7.18.1 Dedicated Terrain Page

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

NOTE

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

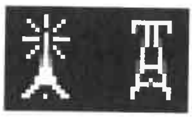


Figure 3 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.18.2 Map Page

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

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

NOTE

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

NOTE

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

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

7.19 Flight Stream 210/510 (Optional)

The Flight Stream product line uses a wireless transceiver to provide data to and from a GTN to personal electronic devices (PEDs).

The Flight Stream 210 is a remotely mounted unit that provides the capability to interface Portable Electronic Devices (PEDs) to the GTN via Bluetooth. The Flight Stream 510 is mounted in the GTN SD card slot and includes a Bluetoo[th] and Wi-Fi transceiver.

Data such as traffic, flight plan, datalink weather, entertainment audio information, and attitude information is sent from the Flight Stream to the PED. The PED is capable of sending flight plans and databases (510 only) to the Flight Stream which will then be available on the GTN. Limitations regarding database operations are found in Section 2.29.

Garmin provides a list of tested and compatible devices that can be used with the Flight Stream. Connection to the Flight Stream may be possible with devices other than those on the supported device list, but 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

7.20 Map Page

7.20.1 Configuration

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

7.20.2 Flight Plan Depiction

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

7.20.3 Fuel Range Ring

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

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

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

7.21 User Defined Waypoints

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

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

7.22 Times and Distances

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

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

7.23 GTN-GTN Crossfill

Certain data will sync between GTNs when installed in a dual GTN configuration. The following data will crossfill between the two GTNs with CROSSFILL ON or OFF:

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

The following unit changes will crossfill:

- Temperature
- NAV Angle
- Fuel

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

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

7.24 Direct-To Operations

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

7.25 Automatic Speech Recognition (ASR)

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

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

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

Audio Panel commands are available to switch audio sources.

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

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

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

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

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

Prior to using ASR, the pilot must complete the ASR Qualification Procedure from the GTN Cockpit Reference Guide.

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

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

7.26 European Visual Reporting Points

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

7.27 Advisory Visual Approaches

The GTN will provide advisory visual approaches to many runways in the aviation database. Lateral guidance for the visual approach is aligned with the runway bearing. Vertical guidance is provided for those runways with VGSI information for distances up to 4.0NM from the runway. If a terrain database is installed in the GTN, the GTN provides vertical guidance up to 28NM from the runway end unless the computed glideslope would impact terrain or obstacles from the database. If the projected impact point is under 28NM and greater than 4NM, the flight plan line for the approach is shortened to indicate where verti guidance is active for the approach. If the terrain impact point is less than 4NM from the runway and there is no VGSI data available, vertical guidance is not provided for that approach. Lateral guidance is still available when vertical guidance is removed.

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

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

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

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the

Garmin GDL 84/88 ADS-B Transceiver

as installed in

Mooney M20J

Make and Model Airplane

Registration Number: N5772R Serial Number: 24-1502

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 SA02119SE for the installation and operation of the Garmin GDL 84/88 ADS-B Transceiver. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA APPROVED 22-OCT-2015

Michael Warren
ODA STC Unit Administrator
GARMIN International, Inc
ODA-240087-CE

LOG OF REVISIONS		
Revision Number	Date	Description
1	12/18/2012	Complete Supplement
2	01/07/2015	Updated document to include "GDL 84" where applicable.
3	10/22/2015	Updated document to include data for the following: • GDL 88 software v3.32 • Single lamp ADS-B annunciator • Added Barometric Altitude Source to required equipment table • Removed External ADS-B annunciators from GDL 84 required equipment table • Removed ABNORMAL PROCEDURE steps to verify valid position when GDL 84/88 annunciates a loss of position data • Clarified System Descriptions • Changed labeling for circuit breakers and switches.

Table of Contents

Section 1. GENERAL

1.1 Garmin GDL 84/88 UAT Transceiver

The Garmin GDL 84/88 UAT Transceiver is an ADS-B system comprised of a Garmin TSO-C154c GDL 84/88, one or two UAT/1090 antenna(s), optional Garmin approved GPS/SBAS antenna, optional Garmin GPS/SBAS position source, and other interfaces as shown in the following block diagram.

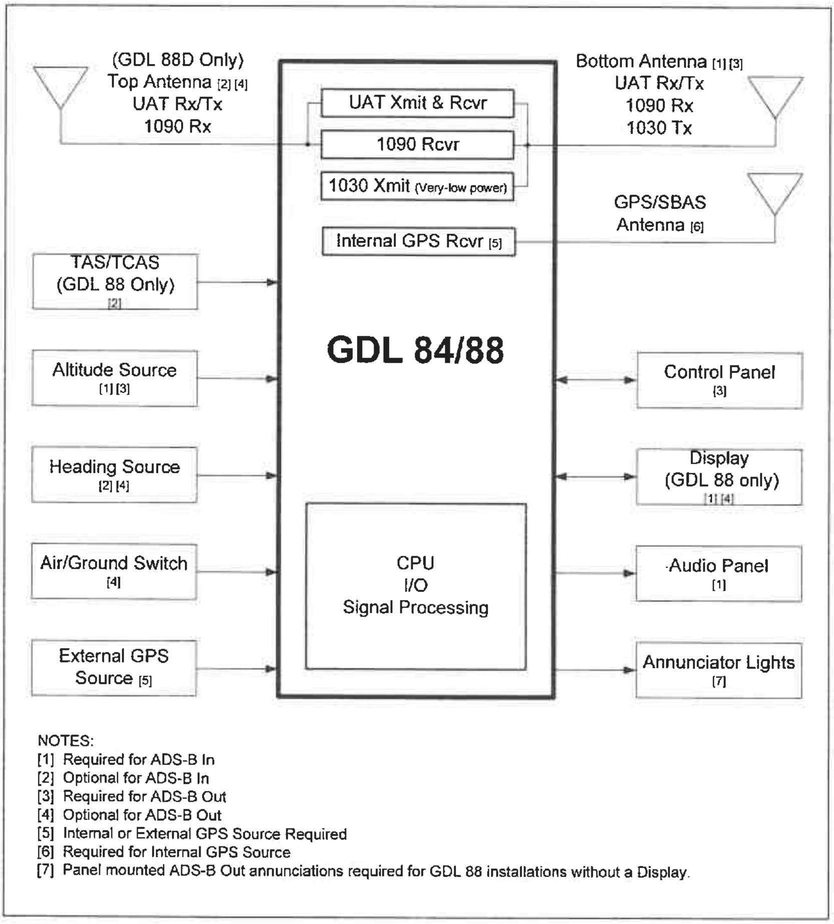


Figure 1 – GDL 84/88 Block Diagram

The GDL 84/88 system performs following functions:

- Transmission of ADS-B out data on UAT (978 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 code, IDENT, and emergency status
  - Anonymous Mode (When not installed in conjunction with a Mode S transponder)
  - Pressure Altitude Broadcast Inhibit
- 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)
- 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)
- Provide traffic alerting to the pilot via an optional annunciator lamp and audio output.

The GDL 88 system performs the following additional functions:

- Provide traffic information and alerting to the pilot via an optional display
  - Correlation and consolidation of traffic data from multiple traffic sources
    - Output of traffic data to an external display
    - Aural and visual traffic alerting
- Provide FIS-B data to the pilot via an optional display
  - Processing and output of FIS-B data to an external display
    - Graphical and textual weather products
      - NEXRAD
      - PIREPs
      - AIRMET/SIGMETs
      - METARs
      - TAFs
      - Winds Aloft

- Aviation Data
    - TFRs
    - NOTAMs

The GDL 84/88 may be installed as a stand-alone ADS-B Out system. The GDL 88 may be, optionally, integrated with a compatible display for the display and control of traffic, FIS-B weather, and aviation data. Capabilities of the interfaced display determines which of the above listed functions are provided.

1.2 Capabilities

The GDL 84/88 ADS-B OUT system meets the equipment requirements of 14 CFR 91.227 when operating in accordance with Sections 2.1 and 2.2 of this supplement.

As installed in this aircraft, the Garmin GDL 84/88 system complies with the requirements of AC 20-165A.

The GDL 84/88 meets the requirements of TSO-C154c for ADS-B Out operation.

> ***Applicable to installations consisting of a GDL 88 interfaced with one or more GTNs with software version 3.00 or later:***
>
> The GDL 88 meets the requirements of TSO-C195a Class C1, C2, C3, C5, TIS-B Services TSO-C166b Class A1, and FIS-B TSO-C157a for ADS-B In Operation and AC 20-172A for Airworthiness Approval for ADS-B In Systems and Applications

1.3 Installation Configuration

This aircraft is equipped with a GDL 84/88 system with the following interfaces/ features:

Equipment Installed:

☐ GDL 84

☒ GDL 88

Interfaced Active Traffic System (GDL 88 Only):

☒ None

☐ TCAD

☐ TAS/TCAS I

Interfaced Transponder(s):

☐ Single Transponder serially interfaced to the GDL 88

☐ Dual Transponders serially interfaced to the GDL 88

☒ Single Transponder interfaced to the GDL 88 via self-interrogation

Interfaced GPS/SBAS Position Source(s):

GPS #1:

☐ GNS 400W/500W Series Unit

☒ GTN 6XX/7XX

☐ GNS 480

☐ None

GPS #2:

☐ GNS 400W/500W Series Unit

☐ GTN 6XX/7XX

☐ GNS 480

☒ None

PABI Control

☐ External Switch

☒ Transponder control (ALT vs. ON)

☐ Controlled via display

Anonymous Mode

- ☐ Not Available
- ☐ External Switch
- ☐ Controlled via display

Definitions

The following terminology is used within this document:

ADS-B:	Automatic Dependent Surveillance-Broadcast
ADS-R:	Automatic Dependent Surveillance-Rebroadcast
CSA:	Conflict Situational Awareness
FIS-B:	Flight Information Service-Broadcast
GDL:	Garmin Datalink
GPS:	Global Positioning System
GTN:	Garmin Touchscreen Navigator
LRU:	Line Replaceable Unit
PABI:	Pressure Altitude Broadcast Inhibit
SBAS:	Satellite-Based Augmentation System
TAS:	Traffic Awareness System
TCAD:	Traffic Collision Avoidance Device
TCAS:	Traffic Collision Avoidance System
TIS-B:	Traffic Information Service-Broadcast
UAT:	Universal Access Transceiver
VFR:	Visual Flight Rules

Section 2. LIMITATIONS

2.1 Minimum Equipment

The **GDL 84** 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
Transponder	1 or more	1
Barometric altitude source	1 or more	1

Table 1 – Required Equipment

The **GDL 88** 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
GPS SBAS Position Source (Interfaced or internal)	1 or more	1
Transponder	1 or more	1
Barometric altitude source	1 or more	1

Table 2 – Required Equipment

2.2 ADS-B Out

The GDL 84/88 only complies with 14 CFR 91.227 for ADS-B Out when all required functions are operational as indicated by external annunciators not illuminated or interfaced display ADS-B messages not being present.

2.3 Anonymous Mode

Anonymous Mode must only be operated while operating under VFR while squawking a VFR code. If requested by Air Traffic Control, Anonymous Mode must be turned off.

2.4 Applicable System Software

This AFMS/SAFM is applicable to the software versions shown in Table 3.

The Main software version is displayed on the External LRU page available on some interfaced display devices.

Software Version *(or later FAA Approved versions for this STC)*
3.32

Table 3 - Software Versions

2.5 Pressure Altitude Broadcast Inhibit (PABI)

While operating within airspace requiring an ADS-B Out compliant transmitter, per 14 CFR 91.227, Pressure Altitude Broadcast Inhibit shall only be enabled when requested by Air Traffic Control.

2.6 Traffic Alerting

Traffic alerting is an aid to visual acquisition and may not be used as the sole basis for aircraft maneuvering.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

None.

3.2 Abnormal Procedures

3.2.1 Abnormal Indications

The loss of an interfaced input to the GDL 84/88 may cause the GDL 84/88 to stop transmitting ADS-B Out data or providing ADS-B In function.

Depending on the nature of the fault or failure, the GDL 84/88 may no longer be transmitting all of the required data in the ADS-B Out messages and Traffic Alerts may not be provided by the system.

- For GDL 84 and No Display GDL 88 installations:

  If the GDL 84/88 detects any internal faults or failures, the GDL 84/88 will annunciate this event via the external annunciation (if installed).

  ADS-B annunciator illuminated:

  Transponder.. ....**VERIFY ON**
  ADS-B Circuit Breaker...**VERIFY CLOSED**

  For configurations with two annunciator lamps:

  Using two lights, three messages/states are capable of being conveyed to the flight crew: NO POSN, FAULT, and TX FAIL.

  If the GDL 84/88 detects any failures that affect compliance of 91.227, the following annunciations are provided:

  - NO POSN illuminated - the GDL 88 has detected that it does not have a valid position from the internal or any of the external GPS/SBAS sources. (See Section 3.2.3 for further information.)
  - Both NO POSN and FAULT illuminated- the GDL 84/88 is annunciating TX FAIL.

The following annunciation indicates that the requirements of 91.227 may not be met:

- FAULT - the GDL 84/88 has detected a loss of an input or internal fault resulting in the GDL 84/88 not transmitting full ADS-B information or degradation in performance. Contact service to resolve the fault.

For configurations with one ADS-B annunciator lamp:

If the GDL 84/88 detects any failures that affect compliance with the requirements of 91.227, the ADS-B annunciator will be steadily illuminated.

When the GDL 84/88 detects a FAULT that does not affect compliance with requirements of 91.227 this will be annunciated to flight crew at the beginning of subsequent power cycles by flashing the ADS-B annunciator on/off for approximately 20 seconds after power up. Contact service to resolve the fault.

- For GDL 88 Installations with an interfaced display:

Reference Display Device documentation for applicable annunciations.

3.2.2 LOSS OF AIRCRAFT ELECTRICAL POWER GENERATION

Loss of electrical power generation.....**REMOVE POWER FROM GDL 84/88**

If the GDL 84/88 is load shed due to a loss of electrical power generation, ADS-B Out, ADS-B In, and the display of interfaced traffic system data 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.

3.2.3 LOSS OF GPS/SBAS POSITION DATA

When the GPS/SBAS receiver is inoperative or GPS position information is not available or invalid, the GDL 84/88 will no longer be transmitting ADS-B Out data and ADS-B traffic alerting functions will be unavailable.

3.2.4 VISUAL/AURAL TRAFFIC ALERT

Traffic Alert Annunciation and Aural

Traffic...**VISUALLY ACQUIRE**

Section 4. NORMAL PROCEDURES

The procedures described below are specific only to the GDL 88. Cockpit Reference Guides and Pilot Guides for interfaced displays will provide additional operating information specific to the displays or other traffic systems.

4.1 Unit Power On

GDL 84/88 Annunciations.. **CONSIDERED**

<u>NOTE</u>

If installed, the GDL 84/88 single lamp ADS-B Annunciator will flash on/off for approximately 20 seconds after power up if a fault was present during a previous power cycle. This indicates the unit requires service but does not indicate that the unit will not comply with 91.227.

The GDL 84/88 only complies with 14 CFR 91.227 for ADS-B Out when all required functions are operational as indicated by external annunciators not illuminated.

4.2 Before Takeoff

GDL 84/88 Annunciations.. **CONSIDERED**

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

The Garmin GDL 84/88 Pilot's Guide, part number and revision listed below, contain additional information regarding GDL 84/88 system description, control, and function. Cockpit Reference Guides and Pilot Guides for interfaced displays provide additional operating information.

- GDL 84/88 ADS-B Transceiver Pilot's Guide
  P/N 190-01122-03 Rev E or later

7.2 Mode 3/A Code, IDENT, and Emergency Status

Mode 3/A Code, IDENT, and Emergency Status data that is included in the ADS-B OUT message is obtained automatically by the GDL 84/88. No pilot action except normal use of the transponder is required.

7.3 Flight ID

Flight Identification will default to the aircraft registration. If interfaced with a Garmin transponder or GTN an alternate Flight ID can be entered via those interfaces and will automatically be updated at the GDL 84/88.

7.4 Pressure Altitude Broadcast Inhibit

For aircraft with an interfaced Garmin GTX 33/330/32/327 or SL 70 transponder the broadcast of pressure altitude is controlled by the transponder mode. Turning the transponder to ALT will also broadcast pressure altitude in the ADS-B output. Turning the transponder to ON will inhibit pressure altitude from being broadcast.

For aircraft without a Garmin GTX 33/330/32/327 or SL 70 transponder pressure altitude broadcast is controlled via a separate switch or interfaced GNS or GTN display.

7.5 Traffic Sources and Alerting

The GDL 84/88 is capable of receiving ADS-B, ADS-R, and TIS-B traffic reports in order to track traffic around the aircraft and provide alerts to the flight crew to aid in visual acquisition and avoidance.

Traffic alerting is provided via a visual annunciation and audio callouts for these alerts. The audio callout will include any available information regarding the intruder, to include direction, range, and relative altitude (high, low, same altitude).

Due to the nature of TIS-B, its service volumes, and incomplete equipage/adoption of ADS-B Out equipment, not all traffic will be tracked by the GDL 84/88. This is much like an active traffic system and does not track non-transponder equipped aircraft. The flight crew must use "see and avoid" procedures to visually acquire and avoid other aircraft.

7.6 Interfaced Active Traffic System (Optional, GDL 88 Only)

When an active traffic system is interfaced with a GDL 88, the GDL 88 receives traffic from the active traffic system and attempts to correlate – or match – this traffic with ADS-B traffic the GDL 88 has received and is already tracking. When a correlation is made, the active traffic system or ADS-B target with the most accurate information is displayed to the flight crew. Any active traffic system or ADS-B traffic that is not correlated will also be displayed for the flight crew. The correlation of traffic by the GDL 88 ensures that only the most accurate, and no duplicate, traffic targets are displayed for the flight crew's situational awareness.

In addition, the GDL 88 will use its air-ground logic or inputs to automatically switch the active traffic from Standby to Operate when transitioning from ground to air, and from Operate to Standby when transitioning from air to ground.

If the GDL 88 fails then external traffic device data is no longer sent to the display, however aural traffic alerts from these traffic systems may continue to be received.

When interfaced to an active traffic system, traffic alerts are provided as follows:

- Alerts will be provided by the TCAS system for targets tracked solely via TCAS <u>AND</u> targets that are tracked via TCAS and ADS-B which are correlated.
- Alerts will be provided by the GDL 84/88 for targets that are tracked solely by ADS-B.

The optional interfaced display's Pilot's Guides and supplements provide additional information regarding the functionality and control of the traffic device.

7.7 Power

Power to the GDL 84/88 is provided through a circuit breaker labeled "ADS-B" or "UAT"

7.8 External Switches

External switches may be installed in conjunction with the GDL 84/88. Table 4 lists the switches and function they perform:

Switch Label	Function
UAT ALT RPTG ON/OFF	Enables and disables Pressure Altitude Broadcast Inhibit functionality.
UAT ANONYMOUS ENABLED / DISABLED	Enables and disables Anonymous Mode functionality.
TRAFFIC MUTE	Acknowledges and mutes a currently playing aural Traffic Alert.
BRT/DIM	Enables GDL 88 annunciators to be dimmed appropriately for lighting conditions.

Table 4 – External Switches

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the

GARMIN GI 275 MULTIFUNCTION INSTRUMENT
as installed in

Mooney M20J
Make and Model Airplane

Registration Number: N5772R Serial Number: 24-1502

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: 1-13-2020

LOG OF REVISIONS			
Rev	Page	Description	FAA Approval
1	All	Initial issue.	See Cover Page

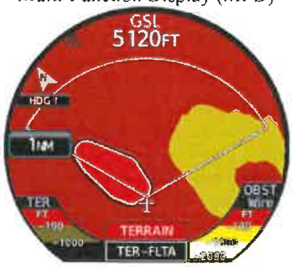
TABLE OF CONTENTS

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.

<table>
<tr><td>Multi-Function Display (MFD)

</td><td>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)</td></tr>
<tr><td>Standby ADI

</td><td>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. If appropriately configured 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.</td></tr>
<tr><td>Engine Indication System (EIS)

</td><td>Units configured for EIS can display the following engine parameters:
Engine RPM
Manifold Pressure
Oil Pressure
Oil Temperature
EGT, Primary EGT
CHT
TIT
CDT
IAT
Alternator / Battery
Fuel Flow, Pressure, Quantity
Carb Temp</td></tr>
</table>

Table 1- GI 275 System Function

-00	Basic Instrument
-10/-30	Includes internal ADAHRS
-20/-40	Capable of Integrating with an Autopilot

Table 2- GI 275 Hardware Variants

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)	

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/-30 variant, 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

Except for installations that are limited to VFR, GI 275 systems require 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. GI 275 system redundancy is satisfied by using a GI 275 MFD or HSI that is configured as a standby instrument, or by using a dedicated GI 275 ADI. When configured as a standby instrument the GI 275 MFD and HSI include an ADI Page which is displayed automatically when faults are detected or when selected by the pilot. 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 will indicate that the battery is no longer charging.

1.4 Definitions

ADAHRS: Air Data and Attitude Heading Reference System

ADC: Air Data Computer

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

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	2.01

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

If the GI 275 is used as the 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 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 integral ADC provides full time air data, the only required external input is from an approved and installed GPS.

NOTE

GI 275 attitude will remain valid if either GPS or Air Data is lost.

Flight in IMC is not authorized unless the 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 uninterrupted attitude information is required from the GI 275 ADI.

2.7 Electronic Standby and/or Primary Instrument Power

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 25000 ft, only 30 minutes of backup battery operation is required. Refer to the battery status and information found in the battery menu (Menu → Systems → Battery).

2.8 Standby and/or Primary Flight Instruments

☐ This installation does not have separate standby instruments or does not require standby instruments (aircraft limited to VFR).

☐ This installation uses pneumatic or the aircrafts original primary flight display instruments.

☑ 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.

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.

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 two AHRS/ADC sensors sources, 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 Type Ratings

The standby GI 275 ADI is authorized for operations in aircraft that require a type rating.

2.20 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.

2.21 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.

2.22 Glove Usage

The touchscreen can be operated with gloves made for capacitive touchscreens.

2.23 VFR GPS

The VFR GPS (VGPS) is an emergency position and temporary navigational aid available for use when the certified navigator data is unavailable or invalid or in VMC flight if no other GPS source is interfaced.

2.24 Service Required

It is prohibited to initiate flight when a "Service Required" advisory is present on the ADI or EIS display.

2.25 Powerplant Gauge Markings

When engine gauges are replaced by the GI 275 EIS in accordance with this STC, gauge markings shall be equivalent or most effectively displayed according to the cumulative Type Design data available for the aircraft.

2.26 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.

2.27 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.

2.28 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

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*

* one GI 275 EIS and GEA 24/110 are required per engine

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 between 15 degrees and 35 degrees of the pilot's primary field of view, an external annunciator is required.

2.29 Minimum Flight Crew

Installation of a GI 275 does not affect a Minimum Flight Crew determination.

2.30 Placards

2.30.1 GI 275 Reversion Backup Switch

Adjacent to the GI 275 Reversion Backup Switch:

2.30.2 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"

2.30.3 Aircraft Category

There is no placarding that is specific or unique to aircraft category.

Section 3. EMERGENCY PROCEDURES

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" to force reversion.
2. Seek VFR conditions or land as soon as practicable.

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)

NOTE

If airborne AHRS alignment without an operative GPS navigator is necessary, minimize maneuvering and turbulence during and after the restart process. Without an operative GPS navigator, 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.

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.

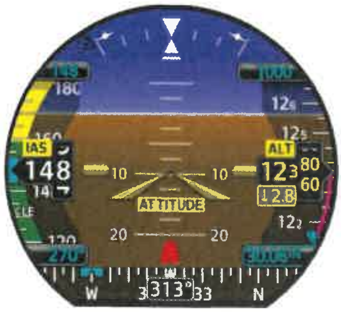
1. Use standby Airspeed Indicator and Altimeter
2. Seek VFR conditions or land as soon as practical

If multiple ADC sources are installed:

3. Select the operative ADC (i.e., ADC 1, 2, or 3) using the ADI Sensors menu (MENU → SENSORS)

3.1.4 ATTITUDE, ALT, or IAS monitor CAUTION

If an ATTITUDE, ALT, or IAS miscompare CAUTION is displayed in amber 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

NOTE

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, on backup battery operation is inhibited if the battery's temperature drops below -20° C or exceeds 80° C.

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

<table>
<tr><th>Aural Alert</th><th>Annunciation All Pages</th><th>Annunciation Terrain Page</th><th>Action</th></tr>
<tr><td>“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”</td><td>TER</td><td>PULL UP
-OR-
TERRAIN
-OR-
OBSTACLE
-OR-
WIRE</td><td>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.</td></tr>
<tr><td>“CAUTION, Terrain”
-OR-
“CAUTION, Obstacle”
-OR-
“CAUTION, Wire”</td><td rowspan="4">TER</td><td>TERRAIN
-OR-
OBSTACLE
-OR-
WIRE</td><td>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.</td></tr>
<tr><td>“Too low, Terrain”</td><td>TERRAIN</td><td>Establish climb to the minimum altitude for present position/procedure</td></tr>
<tr><td>“Sink Rate”</td><td>TERRAIN</td><td>Decrease rate of descent</td></tr>
<tr><td>“Don’t sink”</td><td>TERRAIN</td><td>Establish a positive rate of climb</td></tr>
</table>

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.

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
- Amber "LOI" text on the ADI
- Amber "DR" text on the moving map
- Amber "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 alternate GPS source is not available:

2. Select alternate navigation source (VOR or LOC, if available) or refer directly to external navigation data.

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:

- ±10° bank
- ±5° 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 ±10° bank and ±5° 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 ADC 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 AHRS 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.

3.3.3 Advisories – White		
Annunciation	*Pilot Action*	*Cause*
ATTITUDE, ALT, or IAS (text on ADI) ATTITUDE	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).

4.1.1 ADI System Check

1. Verify that no amber 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.
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

4.2.1 Autopilot Disconnect Test

In some installations, 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.

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 NAV autopilot mode is enabled. 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 amber when there is no GPSS command available.


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 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.

☐ 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.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTION

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 amber 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/-30 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. Amber 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.

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. All units across all systems must be verified the units match for each function and LRU.

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 recommended 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/-30 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 -10s/-30s 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.

Barometric altitude is required for Vertical Navigation (VNAV) calculations on interfaced GTNs. 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 HIS map page on HIS 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. (R01724944)

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.

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. (R01724954)

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:
    - o 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 °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.

Notes

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 cruse 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 Flight and Engine Hour Meter

The Flight/Engine Hour Meter can be accessed from the Engine Menu. The flight hour meter will increment in tenth of an hour resolution when the aircraft is in the air and the engine hour meter will increment in tenth of an hour resolution when any engine is running.

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 2.27.

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

Section X

SECTION X
SAFETY INFORMATION

MOONEY M20J

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.

SECTION X
SAFETY INFORMATION

MOONEY M20J

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 folowing 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
0 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

SECTION X
SAFETY INFORMATION

MOONEY M20J

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.
Cowl flaps in proper position.
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 and is required by FAA to operate in accordance with the FAA Approved Airplane Flight Manual and/or placards installed.

MOONEY M20J

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.

MOONEY M20J

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 distated 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 sparcely 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 judgement 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 practicing at altitudes in excess of 6,000 feet 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 the handbook.

STANDARD PROCEDURE FOR SPIN RECOVERY

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

Rudder..............Apply FULL RUDDER opposite the direction of spin

Control Wheel........FORWARD of neutral in a brisk motion. Additional FORWARD elevator control may be required if the rotation does not stop.

Ailerons..................................NEUTRAL

Throttle...........................RETARD to IDLE

Flaps.....If extended, RETRACT as soon as possible

Rudder.................................NEUTRALIZE

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.

MOONEY M20J

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 natu[illegible] 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 hazard[illegible] to light airplanes. This roll effec[illegible] can exceed the maximum counter roll obtainable [illegible] a[illegible] airplane.

The turbulent areas may reamin for [illegible]s l[illegible]ng [illegible] three minutes or more, depending on w[illegible] conditions, and may extend several [illegible] [illegible]hind the airplane. Plan to fly sl[illegible] [illegible] to the upwind side of the other [illegible] [illegible] light path.

Because of the wide variety of condition[illegible] [illegible] can be encountered, there is no set rule to follow to avoid wake turbulence in all situat[illegible]s. However, the Airman's Information Manua[illegible] goes into considerable detail for a number o[illegible] wake turbulence avoidance procedures. [illegible]se 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 re[illegible]ain extended for approximately ten sec[illegible]s longer than normal, allowing the wheels to [illegible] and dissipate the freezing moisture. The la[illegible] gear should then be cycled up, then down, wa[illegible] 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 also be alert to the possibility of the brakes freezing.

Use caution when taking off or landing during gusty wind conditions. Also be aware of the special wind conditions caused by buildings or other obstructions located near the runway in a crosswind pattern.

[illegible]TS 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 shows reaction times and causes foolish errors due to inattention. In addition to the most common causes of fatigue, insufficient rest and loss of sleep, the pressure of business, financial worries and family problems can be important 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 given 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.

The symptoms are slow but progressive, insidious in onset, and are most marked at altitudes starting above ten thousand 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 nonsmokers. Use oxygen on flights above 10,000 feet and at any time when symptoms appear.

HYPERVENTILATION

Hyperventilation or overbreathing, 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 and consciously slow your breathing rate until symptoms clear and then resume normal breathing rate. Normal breathing can be aided by talking aloud.

ALCOHOL

Common sense and scientific evidence dictate th you not fly as a crew member while under influence of alcohol. Even small amounts alcohol in the human system can adversely aff judgment and decision making abilities. FAR 91 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 of alcohol at 15,000 feet produce the same adverse effects as 6 ounces 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 and drugs such as aspirin, antihistamines, col tablets, cough mixtures, laxatives, tranquilizers and appetite suppressors, may seriously impair th judgment and coordination needed while flyin The safest rule is to TAKE NO MEDICINE before while flying, except on the advice of your Aviation Medical Examiner.

SECTION X
SAFETY INFORMATION

MOONEY M20J

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 Federal Avaition Administration 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