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 THE FEDERAL AVIATION REGULATIONS, AND CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL. **THIS DOCUMENT MUST BE CARRIED IN THE AIRCRAFT AT ALL TIMES.**

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P.O. BOX 72, KERRVILLE, TEXAS 78029-0072

SERIAL NUMBER: 24-3240

REGISTRATION NUMBER: HB-DIC

Häfliger
C/M 643

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Häfliger
C/M 643

CONGRATULATIONS

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

- NOTICE -

This manual is provided as an operating guide for the Mooney Model M20J. It is important that you – regardless of your previous experience – carefully read the handbook from cover to cover and review it frequently.

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

REVISING THE MANUAL

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

This handbook will be kept current by Mooney Aircraft Corporation when the yellow information card in front of this handbook has been completed and mailed to Mooney Aircraft Corporation, P.O. Box 72, Kerrville, TX 78029-0072.

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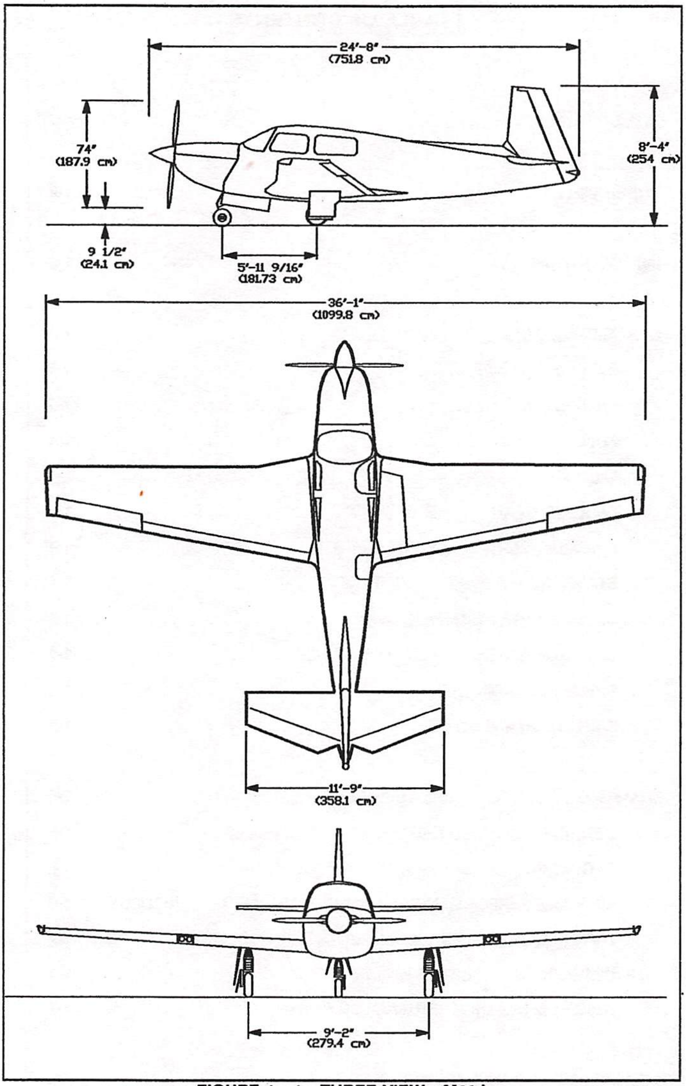

FIGURE 1 - 1 THREE VIEW - M20J

INTRODUCTION

This Pilot's Operating Handbook conforms to GAMA Specification No. 1 and includes both manufacturers material and FAA APPROVED material required to be furnished to the pilot by the applicable Federal Aviation Regulations. SECTION IX contains supplemental data supplied by Mooney Aircraft Corporation.

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

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

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

THIS SECTION DOES NOT REQUIRE FAA APPROVAL.

DESCRIPTIVE DATA

ENGINE

Number of engines	1
Engine Manufacturer	TEXTRON-Lycoming
Model	IO-360-A3B6D
Recommended TBO	2000 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 Octane or 100LL (min. grade)

Accessories

Magnetos	*Bendix D4LN 2021 or D4LN3021
Spark Plugs	18 MM X .750-20 Thd. Connection
Alternator	Prestolite 28V, 70A (14V, 70A - optional)
Starter	Prestolite 24 Volts (12 volts - optional)
	*Lycoming LW-682555-11 or Bendix D4LN-3000 (ALT)

Ratings:

Maximum Continuous Sea Level-BHP/RPM	200/2700

PROPELLER

or MT-Propeller (see Supplements)

Häfliger
C/M 843

Number	1
Manufacturer	McCauley*
Model Number	B2D34C214/90DHB-16E* MTV-12-B/180-17
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.(76.2 cm):

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.(75 cm)
Low: 14.1 degrees +/- .1 degree
High: 29.3 degrees to 31.1 degrees
Spinner: Hartzell No. A2295

FUEL

Minimum Fuel Grade (Color)	100 Octane (Green)/100 LL (Blue)
Total Capacity	66.5 U.S. Gal. (251.7 Liters)(55.4 Imp. Gal.)
Usable	64.0 U.S. Gal. (242.3 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 (Champion CH48103)	Full Flow

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

LANDING GEAR

TYPE: Electrically operated, fully retractable tricycle gear with rubber shock discs. The main wheels have hydraulically operated disc brakes. The nose wheel is fully steerable 14° left or right of center.

Wheel Base	71 9/16 in. (181.8 cm)
Wheel Track	110 in. (279.4 cm)
Tire Size:	
Nose	5.00 x 5 (6 ply)Type III
Main	6.00 x 6 (6 ply)Type III

Tire Pressure:	
Nose	49 PSI
Main	30 PSI
Min. Turning Radius (Mult. by 2 for Wing Tip Clearance Distance) (No brakes applied)	41 ft. (12.5 m)

MAXIMUM CERTIFICATED WEIGHTS

Gross Weight	2900 Lbs. (1315 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.

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. (73.6 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	15.3 Cu. Ft. (.433 cubic meters)
Cargo Area (with rear seats folded down)	33.0 Cu. Ft. (.934 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	16.59 Lbs./Sq. Ft. (83.62 Kg/Sq. m)
Power Loading @ Maximum Gross Weight	14.5 Lbs./HP (6.57 Kg/HP)

IDENTIFICATION PLATE

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

SYMBOLS, ABBREVIATIONS & TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY & SYMBOLS

GS — GROUND SPEED - Speed of an airplane relative to the ground.

KCAS — KNOTS CALIBRATED AIRSPEED - The indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.

KIAS — KNOTS INDICATED AIRSPEED - The speed of an aircraft as shown on its airspeed indicator. IAS values published in this handbook assume zero instrument error.

KTAS — KNOTS TRUE AIRSPEED - The airspeed of an airplane relative to undisturbed air which is the KCAS corrected for altutude and temperature.

V_a — MANEUVERING SPEED - The maximum speed at which application of full available aerodynamic control will not overstress the airplane.

V_{fe} — MAXIMUM FLAP EXTENDED SPEED - The highest speed permissible with wing flaps in a prescribed extended position.

V_{le} — MAXIMUM LANDING GEAR EXTENDED SPEED - The maximum speed at which an aircraft can be safely flown with the landing gear extended.

GENERAL AIRSPEED TERMINOLOGY & SYMBOLS (con't.)

V_{lo}	MAXIMUM LANDING GEAR OPERATING SPEED -The maximum speed at which the landing gear can be safely extended or retracted.
V_{ne}	NEVER EXCEED SPEED - The speed limit that may not be exceeded at any time.
V_{no}	MAXIMUM STRUCTURAL CRUISING SPEED - The speed that should not be exceeded except in smooth air and then only with caution.
V_s	STALLING SPEED - The minimum steady flight speed at which the airplane is controllable.
V_{so}	STALLING SPEED - The minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_x	BEST ANGLE-OF-CLIMB SPEED - The airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_y	BEST RATE-OF-CLIMB SPEED - The airspeed which delivers the greatest gain in altitude in the shortest possible time with gear and flaps up.

ENGINE POWER TERMINOLOGY

BHP	BRAKE HORSEPOWER - The power developed by the engine.
CHT	CYLINDER HEAD TEMPERATURE - Operating temperature of engine cylinder(s) being monitored by a sensor unit. Expressed in°F.
EGT	EXHAUST GAS TEMPERATURE - Temperature of the exhaust gas fuel/air mixture during engine operation.
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.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

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

ENGINE CONTROLS & INSTRUMENTS TERMINOLOGY

Propeller Control	The control used to select engine speed.
Throttle Control	The control used to select engine power by controlling MP.
Mixture Control	Provides a mechanical linkage to the fuel injector mixture control to control the size of the fuel feed aperture, and therefore the air/fuel mixture. It is the primary method to shut engine down.
CHT Gauge	Cylinder head temperature indicator used to determine that engine operating temperature is within manufacturers specifications.
EGT Gauge	Exhaust gas temperature indicator used to identify correct lean fuel flow mixtures for various power settings.
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 pressure altitude are equal. For a given pressure altitude, the higher the temperature, the higher the density altitude.
Indicated Altitude	The altitude actually read from an altimeter when, and only when, the barometric subscale has been set to Station Pressure.
ISA	INTERNATIONAL STANDARD ATMOSPHERE assumes that (1) The air is a dry perfect gas; (2) The temperature at sea level is 15 °Celsius (59° 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° C (-69.7 ° F) is -0.00198° C (-0.003564° F) per foot.
OAT	OUTSIDE AIR TEMPERATURE - The free air static temperature, obtained either from inflight temperature indications or ground meteorological sources. It is expressed in degrees Celsius.
Pressure Altitude	The altitude indicated when Kollsman Window is set to 29.92 In. Hg. or 1013.2 MB. 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.

WEIGHT AND BALANCE TERMINOLOGY (con't.)

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 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 MAC	Center of Gravity expressed in percent of mean aerodynamic percent 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 inch	25.4 millimeters
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

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

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

WEIGHT

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

PRESSURE

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

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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.

NOISE LIMITS

The certificated noise level for the M20J at 2900 lbs. (1315 Kg.) maximum weight is 80.64 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

AIRSPEED LIMITATIONS

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

SPEED		KCAS/KIAS	REMARKS
V_{NE}	Never Exceed Speed	195/196	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	174/174	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed at: lb./Kg. 2250/1021 2470/1120 2740/1243 2900/1315	 103/104 108/109 114/115 117/118	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed	109/112	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 landing 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

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)	58-112	Lower limit is maximum weight Vso in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc (Normal Operating Range)	62-174	Lower limit is maximum weight Vs with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc (Caution Range)	174-196	Operations must be conducted with caution and only in smooth air.
Radial Red Line	196	Maximum speed for all operations.

FIGURE 2-2 AIRSPEED INDICATOR MARKINGS

POWER PLANT LIMITATIONS

Number of Engines 1

Engine Manufacturer . . . . TEXTRON-Lycoming

Engine Model Number IO-360-A3B6D

Engine Operating Limits for Takeoff and Continuous Operations:
- Maximum Continous Power . . . . . . .200 BHP
- Maximum Continous RPM . . . . 2700 RPM
- Transient Continous RPM Limit . 2970 RPM for 3 seconds or less
- Max. Cylinder Head Temperature . . . . . 475 °F (246 °C)
- Maximum Oil Temperature . . . . . 245 °F (118 °C)

Oil Pressure
- Normal Operating 60-90-PSI
- Minimum (IDLE ONLY) . . . . 25 PSI
- Maximum (cold oil) . . . . 100 PSI

Oil Specification MIL-L-22851

Fuel Pressure
- Minimum . . . . 14 PSI
- Maximum . . . . 30 PSI

Fuel Grade (Color) . . . . 100 Octane (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. . . . . 74.0 In. (187.9 cm)*

Propeller Blade Angles @ 30 In. sta.:
- Low . . . . 13.9 ° +/- .2 °*
- High . . . . .33.0° +/- .5°*

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°
. . . . High:29.3° to 31.3°
. . . . MT-Propeller (see supplements)
MTV-12-B/180-17

Häfliger C/M 643

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

NOTE

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

POWER PLANT INSTRUMENT MARKINGS

INSTRUMENT	REDLINE MINIMUM LIMIT	GREEN ARC (NORMAL OPERATING)	YELLOW ARC (CAUTION RANGE)	REDLINE (MAXI-MUM LIMIT)
X Tachometer		1950 - 2700	1500 - 1950	2700 RPM N/A See Sup. LIT-Prop
Cylinder Head Temperature		300 - 475° F (149 - 246° C)		475° F (246° C)
Oil Temperature		150 - 245° F (65 - 118°. C)		245° F (118° C)
Oil Pressure	25 PSI	60 - 90 PSI	(IDLE ONLY) 25 - 60 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

NOTE

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

FIGURE 2-3 POWERPLANT INSTRUMENT MARKINGS

FUEL LIMITATIONS

NOTE

A reduced fuel quantity indicator is installed in each tank filler neck. 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 the tanks only.

Standard Tanks: (2) . . . . 33.25 U.S. Gal. each (126 Liters)(27.7 Imp. Gal.)

Total Fuel: . . . . 66.5 U.S. Gal (251.7 Liters)(55.4 Imp. Gal.)

Usable Fuel: . . . . 64.0 U.S. Gal (242.3 Liters)(53.3 Imp. Gal.)

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

Fuel Grade (and Color):
100 Octane . . . . . 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.

WEIGHT LIMITS

Maximum Weight (takeoff and landing) . . . . . 2900 lbs. (1315 Kg.)

Maximum Weight in Baggage Compartment . . . . 120 lb.
(54.4 Kg.) @ Fuse. Sta. 95.5

Maximum Weight in Hatrack . . . . 10 lb.
(4.54 Kg.) @ Fuse. Sta. 119.0

Maximum Weight in Cargo Area
(Rear seats folded down) . . . . 340 lbs.
(154.2 Kg) @ Fuse. Sta. 70.7

CENTER OF GRAVITY LIMITS (GEAR DOWN)

Most Forward . . . Fuse. Sta. 41.0 IN.(104 cm) @ 2250 lbs. (1020 Kg).
13.3% MAC

Intermediate Forward . . Fuse. Sta. 41.8 IN.(106 cm) @ 2470 lbs. (1120 Kg)
14.7% MAC

Forward Gross . . . Fuse. Sta. 45.0 IN.(114 cm) @ 2900 lbs (1315 Kg)
20.1% MAC

Aft Gross . . . . Fuse. Sta. 50.1 IN.(127 cm) @ 2900 lbs. (1315 Kg.)
28.7% MAC

MAC (at Wing Sta. 93.83)(238 cm) . . . . 59.18 IN. (150 cm)

Datum (station zero) is 5 inches (12.7 cm) aft of the center line of the nose gear attaching bolts, and 33 inches (84 cm) forward of the wing leading edge at wing station 59.25 (150 cm).

MANEUVER LIMITS

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

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

Takeoff maneuvers, prolonged sideslips or steep descents when the selected fuel tank contains less than 8 gallons (48.0 lbs., 30.3 liters, 6.7 IMP. Gal.) of fuel have not been demonstrated and may cause loss of power.

|NOTE|

Up to 400 foot altitude loss may occur during stalls at maximum weight.

Use slow throttle movement. Rapid throttle movement may result in momentary propeller RPM overspeed.

FLIGHT LOAD FACTOR LIMITS

Maximum Positive Load Factor

Flaps Up	+3.8 g.
Flaps Down (33 °)	+2.0 g.

Maximum Negative Load Factor

Flaps Up	-1.5 g.
Flaps Down	0.0 g.

FLIGHT CREW

Pilot	1
Maximum Passenger seating configuration	3

OPERATING 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 91.32 and (3) equipped with avionics in accordance with FAR 91 or FAR 135.

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.

TAKEOFFS WITH OPTIONAL ELECTRIC COWL FLAPS INOPERATIVE ARE PROHIBITED.

Autopilot Limitations - See SECTION IX.

KINDS OF OPERATION EQUIPMENT LIST

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

|NOTE|

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

SEE NEXT PAGE FOR LISTINGS.

KINDS OF OPERATION EQUIPMENT LIST

SYSTEM or COMPONENT	VFR DAY *	VFR NIGHT	IFR DAY	IFR NIGHT
AIRSPEED INDICATOR	1	1	1	1
ALTIMETER, SENSITIVE	1	1	1	1
MAGNETIC DIRECTION INDICATOR	1	1	1	1
MANIFOLD PRESSURE GAUGE	1	1	1	1
TACHOMETER	1	1	1	1
FUEL QUANTITY INDICATOR	2	2	2	2
FUEL PRESSURE INDICATOR	1	1	1	1
OIL PRESSURE INDICATOR	1	1	1	1
OIL TEMPERATURE INDICATOR	1	1	1	1
CYLINDER HEAD TEMPERATURE INDICATOR	1	1	1	1
ALTERNATOR LOAD METER (AMMETER)	1	1	1	1
ALTERNATOR	1	1	1	1
BATTERY	1	1	1	1
LANDING GEAR POSITION INDICATOR	1	1	1	1
SEAT BELT/SHOULDER HARNESS FOR EACH OCCUPANT **	1	1	1	1
OXYGEN MASK FOR EACH OCCUPANT ***	1	1	1	1
FUEL BOOST PUMP	1	1	1	1
PILOT'S OPERATING HANDBOOK & AIRPLANE FLIGHT MANUAL	1	1	1	1
POSITION LIGHTS		3		3
STROBE LIGHTS (anti-collision)		3		3
GYRO HORIZON		1		1
DIRECTIONAL GYRO		1		1
TURN COORDINATOR or TURN & BANK INDICATOR		1		1
LANDING LIGHT ****		1		1
INSTRUMENT LIGHTS (INTERNAL or GLARESHIELD)		1		1
CLOCK (WITH SWEEP SECOND HAND or DIGITAL)			1	1
COMMUNICATION SYSTEM			1	1
NAVIGATION SYSTEM (APPROPRIATE TO FACILITIES BEING USED)			1	1
VACUUM SYSTEM/INDICATOR			1	1

* Equipment must be installed and operable for all operations.

** If inoperative for unoccupied seat(s), seat(s) must be placarded: "DO NOT OCCUPY"

*** Only required when the operating rules require use of oxygen.

**** When required by the appropriate regulations

KINDS OF OPERATION EQUIPMENT LIST (con't.)

SYSTEM or COMPONENT (con't.)	VFR DAY *	VFR NIGHT	IFR DAY	IFR NIGHT
PITOT, HEATED ****			1	1
OAT GAUGE ****			1	1
VSI ****			1	1
ALTERNATE STATIC SOURCE ****			1	1

* Equipment must be installed and operable for all operations.

**** When required by the appropriate regulations

DECALS AND PLACARDS

CABIN INTERIOR

The following placards 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	MIXTURE
	TRIM	SEAT LATCH	BOOST PUMP
	COWL FLAPS	BELT/HARNESS	
	CONDUCT TRIM CHECK PRIOR TO FLIGHT, SEE PILOT'S OPERATING HANDBOOK.		
LDG	BELT/HARNESS	MIXTURE	GEAR
	FUEL	WING FLAPS	PROP
	BOOST PUMP		

ON CONSOLE-BELOW CONTROLS

J90DEC-1

PULL FOR
ALTERNATE
STATIC SOURCE

-457

ON LOWER LEFT INSTRUMENT PANEL

DO NOT OPEN
ABOVE 132 KIAS

-143

ON PILOT'S
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)

COWL FLAPS
CLOSED

ON CONSOLE ABOVE & BELOW
COWL FLAP SWITCH
(UNDER MIXTURE CONTROL)

COWL FLAPS
OPEN

PARK BRAKE
PULL ON

ON LOWER CONSOLE BELOW CONTROLS

MIKE PHONE

-213

LOWER LEFT INSTRUMENT
PANEL

← PUSH TO RELEASE

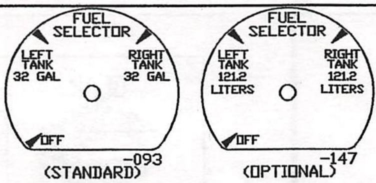
-077

BETWEEN SEATS ON
EMERGENCY GEAR EXTENSION RELEASE

NAV 2 NAV 2 IND INTERCOM FUEL FLOW ISOLATE

(LEGENDS MAY VARY WITH INSTALLED EQUIPMENT)

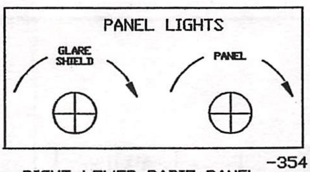
ELT PLACARD – TOP RIGHT INSTRUMENT PANEL



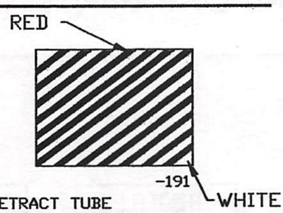
FLOOR BOARD AFT OF CONSOLE

FLOOR BOARD FWD OF PILOT SEAT

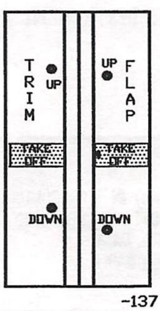
ON MAGNETIC COMPASS



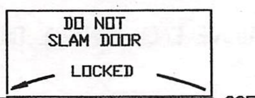
RIGHT LOWER RADIO PANEL



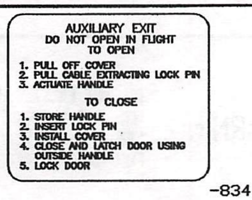
ON RETRACT TUBE
(DISPLAYED THRU WINDOW ON FLOORBOARD WHEN LDG. GR. IS RETRACTED.)



ON LOWER ENGINE CONTROL CONSOLE



ABOVE INSIDE CABIN DOOR

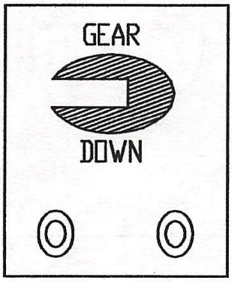


ABOVE INSIDE BAGGAGE DOOR HANDLE

FLAPS UP
-381

FLAPS DN
-379

RIGHT CONSOLE ABOVE AND BELOW FLAP SWITCH



-369

(DISPLAYED THRU WINDOW IN FLOORBOARD WHEN LDG. GR. IS EXTENDED)

THROTTLE
PUSH INCREASE
-383

PROP
PUSH INCREASE
-385

MIXTURE
PUSH RICH
-387

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

-155

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

–153

ON TOP BAGGAGE DOOR JAMB

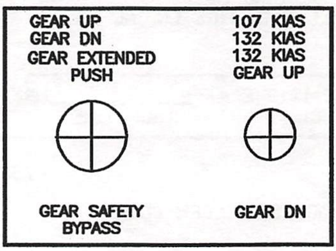
WARNING

DO NOT EXCEED 170 LBS.
(77.1 Kg) ON THIS SEAT BACK.

SEE AIRCRAFT LOADING SCHEDULE DATA
FOR BAGGAGE COMPARTMENT ALLOWABLE

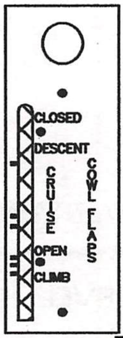
–376

ON FORWARD END OF REAR SEAT
BOTTOM STRUCTURE



–393

UPPER CENTER INSTRUMENT PANEL



–657

ON LOWER CONSOLE
BELOW FLAP SWITCH

GLARE SHIELD
–380

PANEL
–384

UNDER RIGHT RADIO PANEL
(FUSES)

FUSELAGE INTERIOR (inside tailcone)

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

MAINTAIN

LEVEL HERE

-071

ON HYDRAULIC BRAKE RESERVOIR

ENGINE OIL
OIL INSTALLED IN THIS ENGINE IS:

NEXT OIL CHANGE IS DUE AT ____________HRS.
(USE GREASE PENCIL) TACH TIME

-750

ON OIL ACCESS/FILLER DOOR

EXTERIOR

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

TIRE PRESSURE 30 PSI
(207 KPA) -761

ON MAIN GEAR DOORS

TIRE PRESSURE 49 PSI
(338 KPA) -759

ON NOSE GEAR DOOR

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

STANDARD

FUEL–100 (GREEN) or
100LL (BLUE) MIN. OCT.
121.2 LITERS USEABLE

OPTIONAL

FUEL–100 (GREEN) or
100LL (BLUE) MIN. OCT.
26.6 IMP GAL USEABLE

OPTIONAL

ON FUEL TANK CAPS

TOWING LIMITS -700

WARNING
DO NOT EXCEED
TOWING LIMITS -701

ON NOSE GEAR LEG

DO NOT PUSH -009

ON LEADING EDGE OF HORIZONTAL STABILIZER AND TRAILING EDGE OF BOTH SIDES OF RUDDER

NO STEP -007

ON INBOARD END OF FLAPS, WING LEADING EDGES AND WING AHEAD OF FLAPS

HOIST POINT -011 ON UNDERSIDE OF WINGS (2 PLCS)	
FUEL DRAIN UNDER EACH WING NEAR SUMP DRAINS	PITOT DRAIN UNDER LEFT HAND WING LEADING EDGE NEAR FUSELAGE
GASCOLATOR DRAIN UNDER FUSELAGE AFT OF NOSE WHEEL WELL	STATIC DRAIN UNDER TAILCONE AFT OF WING TRAILING EDGE

J90DEC-8

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INTRODUCTION

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

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

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

NOTE

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

AIRSPEEDS FOR EMERGENCY OPERATIONS

CONDITION . . . . . RECOMMENDED SPEED

ENGINE FAILURE AFTER TAKEOFF

Wing Flaps UP	85 KIAS
Wing Flaps DOWN	75 KIAS

MAXIMUM GLIDE SPEED

2900 lb/1315 Kg	93 KIAS
2740 lb/1243 kg	90 KIAS
2500 lb/1134 kg	87 KIAS
2300 lb/1043 kg	84 KIAS

MANEUVERING SPEED

2900 lb/1315 Kg	120 KIAS
2740 lb/1243 kg	115 KIAS
2470 lb/1120 kg	109 KIAS
2250 lb/1021 kg	104 KIAS

PRECAUTIONARY LANDING WITH ENGINE POWER,

Flaps DOWN	75 KIAS

EMERGENCY DESCENT (GEAR UP)

Smooth Air	196 KIAS
Turbulent Air	
2900 lb/1315 Kg	120 KIAS
2740 lb/1243 kg	115 KIAS
2470 lb/1120 kg	109 KIAS
2250 lb/1021 kg	104 KIAS

EMERGENCY DESCENT (GEAR DOWN)

Smooth Air	132 KIAS
Turbulent Air	
2900 lb/1315 Kg	120 KIAS
2740 lb/1243 kg	115 KIAS
2470 lb/1120 kg	109 KIAS
2250 lb/1021 kg	104 KIAS

ANNUNCIATOR PANEL WARNING LIGHTS

WARNING LIGHT	FAULT & REMEDY
GEAR UNSAFE	RED light indicates landing gear is not in fully extended or retracted position. Refer to "FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY" or "FAILURE OF LANDING GEAR TO RETRACT".
LEFT or RIGHT FUEL	RED light indicates 2 1/2 to 3 gallons (9.5 to 11.4 liters) of usable fuel remain in the respective tank. Switch to fuller tank.
PROP DE-ICE (if installed)	BLUE light indicates power applied to De-Ice boots.
PITOT HEAT	BLUE light indicates power applied to heater. (On some foreign A/C - AMBER light indicates power is NOT applied to Pitot Heat).
SPEED BRAKE (if installed)	Speedbrakes are extended.
HI/LO VAC (Flashing)	Suction is below 4.25 In. Hg. (RED)
HI/LO VAC (Steady)	Suction is above 5.5 In. Hg. (RED)

NOTE

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

ALT VOLTS (Flashing)	RED light indicates alternator output is low. Refer to "ALTERNATOR OUTPUT LOW".
ALT VOLTS (Steady)	RED light indicates overvoltage and field C/B tripped or field switch is OFF. Refer to "ALTERNATOR OVERVOLTAGE".
START POWER	RED light indicates switch or relay is engaged and starter is energized. Flight should be terminated as soon as practicable. Engine & electrical system damage may result. This is normal indication during engine start.
STBY VAC (if installed)	AMBER light indicates stand-by vacuum system is ON.
REMOTE RNAV (if installed)	AMBER light indicates DME not slaved to RNAV.
BOOST PUMP	Fuel Boost Pump is ON.

ENGINE

POWER LOSS - DURING TAKEOFF ROLL

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

POWER LOSS - AFTER TAKEOFF AND IN FLIGHT (RESTART PROCEDURES)

Airspeed . . . . 85 KIAS
Fuel Selector . . . . SELECT OTHER TANK
Fuel Pressure . . . . Verify in GREEN ARC
Fuel Boost Pump . . . . ON (IF REQUIRED)
Throttle . . . . FULL FORWARD
Propeller . . . . FULL FORWARD
Mixture . . . . FULL FORWARD
Magneto Starter/Switch . . . . VERIFY on "BOTH"

If engine does not restart after initial attempts:

Mixture . . . . IDLE CUTOFF (Initially)
then advance slowly toward RICH until engine starts.

If engine does not restart, extablish best glide speed and proceed to

FORCED LANDING EMERGENCY.

After engine restarts:

Throttle . . . . ADJUST as required
Propeller . . . . ADJUST as required
Mixture . . . . .RE-LEAN as power is restored

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

ENGINE ROUGHNESS

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

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

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

Throttle . . . . .REDUCE
Check if a lesser throttle setting causes roughness to decrease.
If severe engine roughness cannot be eliminated LAND AS SOON AS PRACTICABLE.

(OPTIONAL) ELECTRIC COWL FLAPS FAILURE - FULL CLOSED POSITION

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

Power	AS REQUIRED
Mixture	RICH
Airspeed	120 KIAS
Cylinder Head Oil Temperature	MONITOR - - NORMAL OPERATING RANGE

HIGH CYLINDER HEAD TEMPERATURE

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

HIGH OIL TEMPERATURE

NOTE

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

Cowl Flaps	OPEN
Airspeed	INCREASE
Power	REDUCE

PREPARE FOR POSSIBLE ENGINE FAILURE IF TEMPERATURE CONTINUES HIGH.

LOW OIL PRESSURE

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

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 engine power loss from an overrich condition. Enrich the mixture when opening the throttle or increasing engine speed to prevent engine power loss 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
Fuel Boost Pump	ON
Mixture	INCREASE until engine starts and adjust for smooth engine operation.

LAND AS SOON AS PRACTICABLE.

FIRES

ENGINE FIRE-DURING START ON GROUND

Magneto/Starter Switch	CONTINUE cranking

If engine starts:

Power	1500 RPM for several minutes or until fire is extinguished.
Engine	**SHUTDOWN - Inspect for damage**

If engine does NOT start:

Magneto/Starter Switch	CONTINUE cranking
Mixture	IDLE CUTOFF
Throttle	FULL FORWARD
Fuel Selector Valve	OFF
Magneto/Starter Switch	OFF
Master Switch	OFF
Fire	EXTINGUISH with Fire Extinguisher

ENGINE FIRE-IN FLIGHT

Fuel Selector Valve	OFF
Throttle	CLOSED
Mixture	IDLE CUTOFF
Magneto/Starter Switch	OFF
Cabin Ventilation & Heating Controls	CLOSED
Cowl Flaps	CLOSED
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. Proceed with FORCED LANDING EMERGENCY. Do not attempt an engine restart.

ELECTRICAL FIRE- IN FLIGHT (Smoke in Cabin)

Master Switch	OFF

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

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

Alternator Field Switch	OFF
All Electrical Switches	OFF
Cabin Ventilation	OPEN
Heating Controls	AS DESIRED
Circuit Breakers	CHECK to identify faulty circuit if possible.

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

Master Switch	ON
Alternator Field Switch	ON

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

LAND AS SOON AS POSSIBLE.

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 196 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 196 knots. Additionally, a descent at 132 knots will provide a smoother ride and a safer airspeed in the event air turbulence is encountered, resulting in less pilot workload.

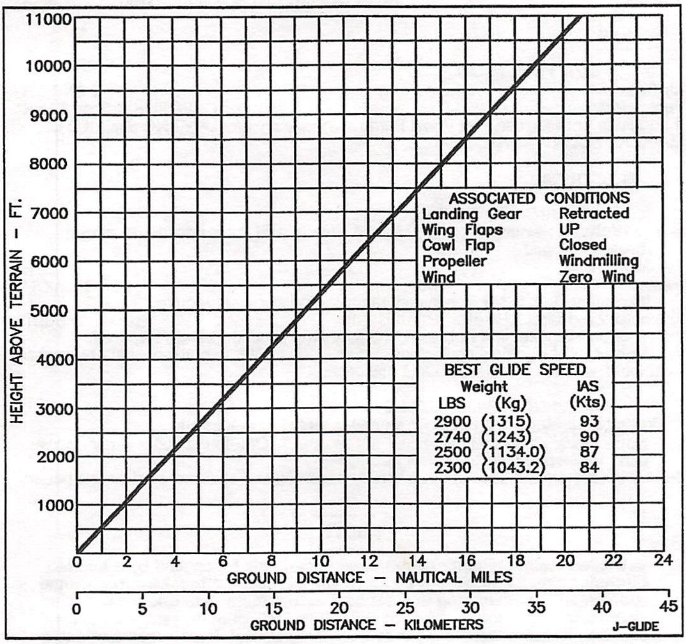
Therefore: The following procedure should be used for an emergency descent:

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° F (149° C) minimum.

GLIDE

**MAXIMUM GLIDE DISTANCE
MODEL M20J**



FORCED LANDING EMERGENCY

POWER OFF - GEAR RETRACTED OR EXTENDED

Emergency Locator Transmitter	ARMED
Seat Belts/Shoulder Harnesses	SECURE
Cabin Door	UNLATCHED
Fuel Selector	OFF
Mixture	IDLE CUTOFF
Magneto/Starter	OFF
Wing Flaps	Full DOWN (33 Degrees)
Landing Gear	DOWN or UP Depending on Terrain
Approach Speed	AS SLOW AS POSSIBLE
Master Switch	OFF, prior to landing
Landing	LEVEL, TAIL LOW ATTITUDE

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

Mixture	ENRICH
Fuel Selector	OPPOSITE (fullest) TANK

If condition persists, use Fuel Boost Pump as necessary and LANDING SHOULD BE MADE AS SOON AS PRACTICABLE.

ELECTRICAL

ALTERNATOR OVERVOLTAGE
(Voltage warning light illuminated steady and Alternator Field circuit breaker tripped.)

Avionics Master	OFF
Master	OFF, then ON

If Warning Light is still illuminated, the following steps are required:

Alternator Field Circuit Breaker	RESET

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

1. Non-esential electrical equipment . . . OFF to conserve battery power.
2.. Land, when practical, to correct malfunction.

ALTERNATOR OUTPUT LOW
(Voltage warning light flashing; ammeter showing discharge)

1. Non-esential electrical equipment . . . OFF to conserve battery power.
2. Land, when practical, to correct malfunction.

Battery endurance will depend upon battery condition and electrical load on the battery.

NOTE

A tripped main alternator circuit breaker can only be caused by a shorted alternator circuit and cannot be corrected by resetting breaker. This should be verified by attempting to reset breaker not more than one time. If this fails, turn alternator field switch OFF. Turn OFF all non-esential electrical equipment and terminate flight as soon as practical. Repair malfunctioning alternator prior to next flight.

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 (7 to 20 times and RETURN until gear is down and locked, GEAR DOWN light illuminated; STOP when resistance is felt.
Visual Gear Down Indicator . . . . CHECK ALIGNMENT by viewing from directly above the indicator.

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

Continuing to pull on T-Handle after GEAR DOWN light ON will bind actuator; electrical retraction MAY NOT be possible until binding is eliminated. Return lever to normal position and secure latch. Reset landing gear actuator C/B.

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

Do not operate landing gear electrically with manual extension system engaged.

FORCED LANDING EMERGENCY

GEAR RETRACTED OR EXTENDED

Emergency Locator Transmitter . . . . ARMED
Seat Belts and Shoulder Harnesses . . . . .SECURE
Cabin Door . . . . UNLATCHED

When sure of making landing area:

Fuel Selector . . . . OFF
Throttle . . . . AS REQUIRED
Mixture . . . . .IDLE CUTOFF
Magneto/Starter . . . . OFF
Wing Flaps . . . . FULL DOWN (33°)
Landing Gear . . . . . UP or DOWN - DEPENDING ON TERRAIN
Master Switch . . . . OFF
Approach Speed . . . . As SLOW As Possible
Landing . . . . LEVEL, TAIL LOW ATTITUDE

FAILURE OF LANDING GEAR TO RETRACT

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

IF GEAR FAILS TO RETRACT, GEAR HORN – **SOUNDING**, GEAR ANNUNCIATOR LIGHTS and GEAR SAFETY BY-PASS LIGHT – **ILLUMINATED:**

GR SAFETY BY PASS SWITCH . . . . DEPRESS
and HOLD until landing gear fully retracted
GEAR DOWN and GEAR UNSFE Lights . . . . EXTINGUISHED
GEAR RELAYS Circuit Breaker . . . . PULL
(Warning horn and Gear By-Pass light will go OFF

IF GEAR FAILS TO RETRACT, GEAR HORN – **DOES NOT SOUND**, GEAR ANNUNCIATOR LIGHTS and GEAR BY-PASS LIGHT – **NOT ILLUMINATED**:

EMERGENCY GEAR EXTENSION LEVER . Verify LATCHED in proper position.
GEAR RELAYS Circuit Breaker . . . . RESET

CONTINUE FLIGHT if desired.

When ready to extend landing gear:

AIRSPEED . . . . Below 132 KIAS
GEAR RELAYS CIRCUIT BREAKER . . . . RESET
GEAR SWITCH . . . . DOWN Position

If gear will not extend electrically, refer to FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY.

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 normal static air sources are blocked. Selecting Alternate Static Air changes the source of static air for altimeter, airspeed indicator and rate-of-climb from outside aircraft to cabin interior.
When alternate static air source is in use, adjust indicated airspeed and altimeter readings according to the appropriate alternate static source airspeed and altimeter calibration tables in SECTION V.
The static air source valve is located on lower left portion of pilot's flight panel above pilot's left knee.

|NOTE|

When using the alternate static source the pilots window and airvents MUST BE KEPT CLOSED

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

UNLATCHED DOORS IN FLIGHT

CABIN DOOR

If cabin door is not properly closed it may come unlatched in flight. This may occur during or just after take-off. The door will trail in a position approximately 3 inches (7.6 cm) open, but flight characteristics of the airplane will not be affected. Return to the field in a normal manner. If practicable, secure door in some manner to prevent it from swinging open during landing.
If it is deemed impractical to return and land, the door can be closed in flight, after reaching a safe altitude, by the following procedures:

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

BAGGAGE DOOR

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

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

ICING

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

DO NOT OPERATE IN KNOWN ICING CONDITIONS.

The Model M20J is **NOT APPROVED** for flight into known icing conditions and operation in that environment is prohibited. However, if those conditions are inadvertently encountered or if flight into heavy snow is unavoidable, the following procedures are recommended until further icing conditions can be avoided:

INADVERTENT ICING ENCOUNTER

Pitot Heat	. ON
Propeller De-Ice	ON (if installed)
Alternate Static Source	ON (if required)
Cabin Heat & Defroster	. ON

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

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

|NOTE|

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

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

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

|NOTE|

If ice blocks induction air filter, alternate air system will open automatically.

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

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

Stall warning system may be inoperative.

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

With ice accumulations of any amount, use no more than 15° flaps for approach and landing. Fly approach speeds at least 10 knots higher than normal, expect a higher stall speed resulting in higher touchdown speed with longer landing roll. Use normal flare and touchdown technique.

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

EMERGENCY EXIT OF AIRCAFT

CABIN DOOR

PULL latch handle AFT.
OPEN door and exit aircraft.

BAGGAGE COMPARTMENT DOOR (AUXILIARY EXIT)

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

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

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

SPINS

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

Up to 2000 feet altitude may be lost in a one turn spin and recovery; 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 anti-spin procedures should shorten the recovery.

INTENTIONAL SPINS ARE PROHIBITED.
In the event of an inadvertent spin, the following recovery procedure should be used:

Throttle . . . . RETARD to IDLE
Ailerons . . . . NEUTRAL
Rudder . . . . . . Apply FULL RUDDER opposite 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
HOLD ANTI-SPIN CONTROLS UNTIL ROTATION STOPS.
Wing Flaps (If extended) . . . . . . RETRACT as soon as possible
Rudder . . . . NEUTRALIZE when spin stops
Control Wheel . . . . SMOOTHLY MOVE AFT
. . . . to bring the nose up to level flight attitude.

OTHER EMERGENCIES

Refer to SECTION IX for EMERGENCY PROCEDURES of Optional Equipment.

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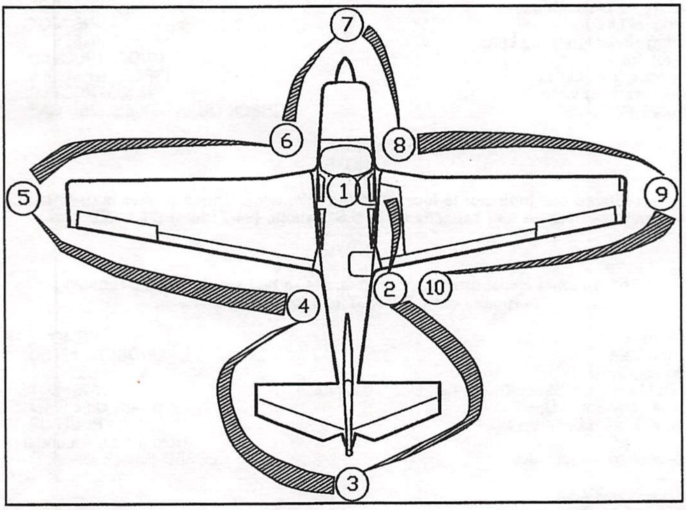
INTRODUCTION

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

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

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

PREFLIGHT INSPECTION



1. Cockpit -

Gear Switch	DOWN
Magneto/Starter Switch	OFF
Master Switch	ON
Rocker Switches	OFF
Circuit Breakers	IN
Battery Voltage	CHECK(22-24 VOLTS)
Internal/External Lights	CHECK Operation
Fuel Gauges - Quantity	CHECK
Pitot Heat Switch	ON-Check Pitot Heat Annunciator ILLUMINATED
Pitot Heat Switch	OFF
Master Switch	OFF

2. Right Fuselage/Tail Cone-

Instrument Static Port	UNOBSTRUCTED
General Skin Condition	INSPECT
Access Panels	SECURED
Tail Tiedown	REMOVE

3. Empennage -

Elevator and Rudder attach points and control linkage attachments	INSPECT
General Skin Condition	INSPECT-Remove ice, snow, or frost.

4. Left Fuselage/Tail Cone-

Fresh Air Vent (on Dorsal Fin)	CLEAR
Instrument Static Port	UNOBSTRUCTED
General Skin Condition	INSPECT
Tailcone/Empennage Access Door	SECURED
Static System Drain Valve	PUSH UP (Hold 3-5 Seconds)

5. Left Wing -

General Skin Condition	INSPECT-Remove ice, snow, or frost.
Flap and attach points	INSPECT
Aileron and attach points	INSPECT
Control Linkages	INSPECT
Wing Tips, Lights and Lens	INSPECT
Pitot Tube	UNOBSTRUCTED
Landing/Taxi Lights	INSPECT lens/bulbs
Stall Warning Vane	UNOBSTRUCTED
Fuel Tank	CHECK QUANTITY-SECURE CAP

NOTE

A reduced fuel indicator is located in the filler neck. This indicator is used to indicate useable 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.

Tiedown	REMOVE
Tank Vent	UNOBSTRUCTED
Wheel Chock	REMOVE
Left Main Gear, Shock Discs, Tire, Doors & Linkage	INSPECT
Fuel Tank Sump Drain	DRAIN Until Clear
Pitot System Drain Valve	PUSH UP (Hold for 3-5 seconds)
Gascolator Drain Valve	CLOSED (Check for drips)

6. Left Cowl Area -

Windshield	CLEAN
Cabin Air Inlet	Unobstructed
Left Side Engine Cowl Fasteners	SECURED
Left Cowl Flap	INSPECT

7. Propeller/Spinner & Front Cowl -

Blades	INSPECT for nicks, cracks, oil leaks, rotational movement. INSPECT de-ice boots(if installed).
Spinner	INSPECT for security, cracks
Cooling Air and Induction Intake	UNOBSTRUCTED
Nose Gear, Shock Discs, Tire, Doors & Linkage	INSPECT
Wheel chock	REMOVE

8. Right Cowl Area -

Right Side Engine Cowl Fasteners	SECURED
Engine Oil Level	CHECK (FULL for extended flight.(Max. 8 qts.) (Minimum qty. 6 qts.)
Exhaust Pipe	SECURED
Right Cowl Flap	INSPECT
Windshield	CLEAN
Cabin Air Inlet	UNOBSTRUCTED

9. Right Wing -

Fuel Tank Sump Drain	DRAIN until clear
Right Main Gear, Shock Discs, Tire, Doors & Linkage	INSPECT
Wheel Chock	REMOVE
Tank Vent	UNOBSTRUCTED
Tiedown	REMOVE
Landing/Taxi lights	INSPECT lens/bulbs
Fuel Tank	CHECK QUANTITY-SECURE CAP

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.

Wing Tip, Lights & Lens	INSPECT
Aileron and attach points	INSPECT
Flap and attach points	INSPECT
Control Linkages	INSPECT
General Skin Condition	INSPECT-REMOVE ice, snow or frost

10. Baggage Door . . . . Verify SECURED
Verify inside latch mechanism is properly secured.
(Check outside handle operation)

11. Return to Cockpit

Fuel Selector	R: PULL gascolator ring (5 seconds)
Fuel Selector	L: PULL gascolator ring (5 seconds)
Master Switch	VERIFY OFF

BEFORE STARTING CHECK

Preflight Inspection	COMPLETED
Seats, Seat Belts/Shoulder Harness	ADJUST & SECURE
Magneto/Starter Switch	OFF
Master Switch	OFF
Alternator Field Switch	OFF
Radio Master Switch	OFF
Fuel Boost Pump	OFF
Alternate Static Source	Push OFF
Rocker Switches	OFF
Directional Gyro (slave/free switch)	SLAVED (If installed)
Circuit Breakers	CHECK
Emergency Locator Transmitter	ARM
Throttle	CLOSED
Propeller	HIGH RPM
Mixture	IDLE CUTOFF
Cowl Flaps (Check operation of Optional electric cowl flaps)	VERIFY OPEN
Parking Brake	SET
Wing Flap Switch	CENTERED(Flaps UP)
Cabin Vent	AS DESIRED
Cabin Heat	PUSH OFF
Defrost	PUSH OFF
Fuel Selector	FULLEST TANK
Radios	SET FREQUENCIES (Non-digital radios)
Landing Gear Switch	DOWN
RED Emergency Gear Handle	DOWN & LATCHED
Internal Lights	OFF
Passengers	Emergency/General information briefing

Refer to SECTION IX for Optional Equipment Checks.

Obtain local information prior to engine start.

ENGINE START

~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.

NOTE

When starting engine using an approved external power source no special starting procedure is necessary. Use normal starting procedures below. (Auxiliary Power Cable Adapter is available from Mooney Aircraft Corporation). Battery SHOULD NOT BE COMPLETELY DEPLETED when engine is to be started using an external power source.

Before Starting Checklist	COMPLETED
Throttle	1/4 OPEN
Cowl Flaps	OPEN
Propeller	FULL FORWARD
Mixture	FULL FORWARD
Master Switch	ON
Alternator Field Switch	ON
Annunciator Lights	PRESS TO TEST
Fuel Boost Pump	ON to Establish Pressure, then OFF
Mixture	IDLE-CUTOFF
Propeller Area	CLEAR
Magneto/Starter Switch	TURN and PUSH to START release to both when engine starts.

NOTE

"START POWER" warning light should illuminate when magneto/starter switch is in "START" position and MUST extinguish when starter switch is released.

NOTE

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

Mixture	Move slowly and smoothly to RICH
Throttle	Set at 1000 to 1200 RPM
* Engine Oil Pressure	CHECK GREEN ARC - if MINIMUM OIL PRESSURE is not indicated within 30 seconds, **STOP ENGINE** and determine problem.
* Ammeter	CHECK (Turn Ldg. Lt. ON; observe negative movemet of needle)
* Internal/External Lights	As Desired
* Engine Instruments	CHECKED
* Fuel Flow Indicator	TEST/RESET (if desired)

~CAUTION~

Do not operate engine at run-up speed unless the oil temperature is at least 75° F. (needle moves off White dot). Operation of the engine above 1200 RPM before reaching minimum oil temperature may cause engine damage due to insufficient oil flow for lubrication.

FLOODED ENGINE START

Fuel Boost Pump	OFF
Throttle	FULL FORWARD
Mixture	IDLE CUTOFF
Magneto/Starter Switch	TURN and PUSH to start release to both when engine starts.
Mixture	FULL FORWARD
Throttle	Retard to 1200 RPM

* REFER to remaining ENGINE START procedures above.

WARM ENGINE START

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.
Mixture	Move slowly and smoothly to RICH
Throttle	1000 to 1200 RPM

* REFER to remaining ENGINE START procedures above.

BEFORE TAXI

Engine Start Checklist	COMPLETED
Radio Master Switch	ON
Elevator Trim Switch	ON
Annunciator Panel	PRESS TO TEST
Internal/External Lights	As desired
Directional Gyro	SET or SLAVE SWITCH - ON
Instruments	Normal Indications
Radios	CHECK (Set Frequencies)
Altimeter	SET
Fuel Selector	Switch tanks verify engine runs on other tank
Cowl Flaps	CHECK OPERATION (FULL OPEN or AS REQUIRED)
Equipment Checks	Refer to SECTION IX

NOTE

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

TAXI

Before Taxi Checklist	COMPLETED
Parking Brake	Release
Brakes	Check during Taxi
Directional Gyro	Proper indication during turns
Turn Coordinator	Proper indication during turns
Artificial Horizon	Erect during turns
Throttle	Minimum power
Cowl Flaps	OPEN or As Desired
Propeller	FULL FWD

~ CAUTION ~

To prevent battery depletion in prolonged taxi or holding position before takeoff, increase RPM until "LOW VOLTAGE" light extinguishes.

BEFORE TAKEOFF

Taxi Checklist	COMPLETED
Parking Brake	SET
Fuel Selector	FULLEST TANK
Propeller	HIGH RPM
Mixture	Full Forward
Cowl Flaps	FULL OPEN or AS REQUIRED
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 to high RPM (3 times)
Ammeter	CHECK positive charge indication
Annunciator Panel	CHECK ALT VOLTS & HI/LO VAC lights-OFF
Throttle	Retard to IDLE RPM
Trim	Takeoff setting
Wing Flaps	Check operation-SET TAKEOFF POSITION (15 degrees)
Flight 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)
Internal/External Light	As Desired
Rotating Beacon/Strobe Lights	ON
Pilots Window	CLOSED
Emergency Gear Extension (Red) Handle	DOWN and LATCHED
Annunciator Lights	CHECK PROPER INDICATION
Parking Brake	Release

TAKEOFF

Before Takeoff Checklist	COMPLETED

|NOTE|

Move the engine 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 propeller area instead of being pulled into it.

TAKEOFF (NORMAL)

Electric Fuel Boost Pump . . . . ON at start of takeoff roll
Power . . . . FULL THROTTLE (2700 RPM)
Mixture . . . . FULL RICH (Lean for smooth operation at HIGH ALTITUDE)
Engine Instruments/Annunciator Panel . . . . CHECK for proper indications
Liftoff/Climb Speed . . . . As specified in SECTION V (Normal Takeoff Distance)
Landing Gear . . . . . RETRACT in Climb after clearing obstacles.
Wing Flaps . . . . UP
Electric Fuel Boost Pump . . . . OFF - CHECK Pressure

CLIMB

|NOTE|

If applicable, use noise abatement procedures as required.

|NOTE|

See SECTION V for rate of climb graph.

CLIMB (CRUISE)

Throttle . . . . 26" Hg Manifold Pressure
Propeller . . . . 2600 RPM
Mixture . . . . . . .RICH (Lean for Smooth Operation at high elevation)
Cowl Flaps . . . . FULL OPEN or As Required
Airspeed . . . . 90 to 100 KIAS
Maintain these power settings and attitude to at least 3000 feet AGL or cruise altitude.

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

CLIMB (BEST RATE)(Vy)

Power . . . . FULL THROTTLE and 2700 RPM
Mixture . . . . FULL RICH (Lean at higher altitudes for smooth operation)
Cowl Flaps . . . . FULL OPEN
Airspeed . . . . .86 KIAS at sea level decreasing to 80 KIAS at 10,000 ft.

CLIMB (BEST ANGLE)(Vx)

Power . . . . FULL THROTTLE and 2700 RPM
Mixture . . . . FULL RICH (Lean at higher altitude for smooth operation)
Cowl Flaps . . . . FULL OPEN
Airspeed . . . . 66 KIAS at sea level increasing approximately 1.0 KIAS for each 5000 feet altitude

CRUISE

Upon reaching cruise altitude, accelerate to cruise airspeed; retrim aircraft as necessary for level flight. Set manifold pressure and RPM for desired power setting per Cruise Power Chart in SECTION V and close cowl flaps.

NOTE

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

NOTE

When cruising in conditions where the OAT is well above standard, it may be necessary to OPEN cowl flaps to trail position (pull aft approx. 3 in.) to keep engine temperatures within green arc.

Optional electric cowl flaps may be opened slightly in order to keep engine temperatures within green arc.

When optional electric cowl flaps are OPEN during cruise, the following effects on cruise speed will result:

Electric Cowl Flaps 1/4 open (1st Index)
Approximate loss in TAS . . . . 2 KTAS
Electric Cowl Flaps 1/2 open (2nd Index)
Approximate loss in TAS . . . . 4 KTAS

---*---

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

A. Leaning **with** exhaust gas temperature gauge (EGT) installed.
   1. Lean the mixture until exhaust gas temperature peaks on the EGT indicator.

   ECONOMY CRUISE - Enrich mixture (push mixture control forward) until 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 peak EGT to be rechecked and mixture re-set.

B. Leaning **without** exhaust gas temperature gauge (EGT) installed:
   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.

FUEL TANK SELECTION

Boost Pump Switch . . . . ON
Fuel Selector . . . . OPPOSITE TANK
Boost Pump Switch . . . . OFF
(Observe fuel pressure gauge for proper pressure reading)

DESCENT

Mixture . . . . LEAN to 14° C (25°F) rich of peak EGT as required for smooth engine 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 - 115 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

| 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 112 KIAS

~ CAUTION ~

To minimize control wheel forces when entering landing configuration, timely nose-up trimming is recomended to counteract nose-down pitching moment caused by reduction of power and/or flap extension.

Trim . . . . As desired
Parking Brake . . . . VERIFY OFF

NOTE

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

GO AROUND (BALKED LANDING)

~ CAUTION ~

To minimize control wheel forces during go-around, timely nose-down trimming is recomended to counteract nose-up pitching moment as power is increased and/or flap retraction.

Power	FULL THROTTLE/2700 RPM
Mixture	FULL RICH
Airspeed	65 KIAS
Wing Flaps	TAKEOFF position after climb established
Trim	NOSE DOWN (to reduce control force)
Airspeed	Accelerate to 76 KIAS
Landing Gear	RETRACT
Wing Flaps	RETRACT
Cowl Flaps	OPEN
Airspeed	Accelerate to 86 KIAS

LANDING

LANDING (NORMAL)

Approach for landing checklist	COMPLETED
Approach Airspeed	As specified in SECTION V (Normal Landing Distances)
Touchdown	Main wheels first (aligned with runway)
Landing Roll	Lower nose wheel gently
Brakes	As required
Fuel Boost Pump	OFF after landing

NOTE

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

NOTE

- ONE SUGGESTED METHOD -

Crosswind landings may be accomplished by using above procedures except maintain approach speed approximately 10 KIAS above normal. Use 15° flaps for crosswinds below 10 Kts and flaps UP for crosswinds over 10 Kts. Allow aircraft to crab until short final, then set up sideslip (low wing into the wind). Accomplish touchdown in slight wing low sideslip and aircraft aligned with runway. During landing roll, position flight controls to counteract crosswind.

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

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

TAXI AFTER LANDING

Throttle	1000 to 1200 RPM
Wing Flaps	RETRACT
Cowl Flaps	FULL OPEN
Trim	RESET to 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
Alternator Field Switch	OFF
Master Switch	OFF
Oxygen System (if equipped)	OFF

SECURING AIRCRAFT

Magneto/Starter	OFF/Key removed
Master Switch	VERIFY OFF
Radio Master	VERIFY OFF
Electrical Switches	VERIFY OFF
Parking Brake	RELEASE and install wheel chocks

For extended parking	Control wheel - SECURED with seat belts; cabin vents CLOSED,

TIE DOWN aircraft at wing and tail points.

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INTRODUCTION

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

VARIABLES

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

To obtain effect of altitude and OAT on aircraft performance:

1. Set altimeter to 29.92 in.Hg. and read "Pressure Altitude".
2. Using the OAT grid for the applicable chart, read corresponding effect of OAT on performance.

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

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

OPERATIONAL PROCEDURES FOR MAXIMUM FUEL EFFICIENCY

For maximuim fuel efficiency in the M20J, proper mixture leaning during cruise flight must be accomplished. The IO-360-A3B6D engine in the M20J has been designed to attain maximum fuel efficiency, at desired cruise power, at 14°C rich of peak EGT. EGT is usually a more accurate indication of engine operation and fuel burn than indicated fuel flow. Therefore it is recommended that the mixture be set using EGT as the primary reference instead of setting to a particular fuel flow.

The following procedure is recommended for setting cruise power and leaning to best economy at 75% power or less:

1. After leveling off, set the manifold pressure and RPM for the desired cruise power in accordance with the Cruise Power Schedule as shown in this SECTION. At this point, the mixture control is at full rich from the climb.

2. Next, slowly move the mixture control toward lean while observing the EGT indicator. If leaning the mixture causes the original manifold pressure setting to change, use the throttle to maintain that desired cruise manifold pessure and continue leaning until best economy setting is obtained.

PERFORMANCE CONSIDERATIONS

RANGE ASSUMPTIONS

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

USE OF COWL FLAPS

When in level cruise flight with outside air temperatures well above standard or when cruising at very high altitudes, it may be necessary to open cowl flaps to keep engine temperatures within normal operating range. The **standard cowl flaps** are manually actuated and can be opened to a trail position by pulling the Cowl Flap Control aft, approximately 3 inches. The effect on cruise speed or range for manual cowl flaps is negligible due to the aerodynamic position that is maintained.

The **optional electric cowl flaps** are multi-position, numerous open settings are available to keep cylinder head and oil temperatures within normal operating range under the most adverse conditions.

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

Cowl flap's position indicator - 1/4 open, (Indicator positioned at first index);

(Approximate loss in TAS) . . . . 2 Kts.

Cowl flap's position indicator - 1/2 open, (Indicator positioned at second index);

(Approximate loss in TAS) . . . . 4 Kts.

An appropriate adjustment to the range data shown for the cowl flap's closed condition can be made based on the flight time planned with the cowl flap's partially open.
For example:
Using the above speed decrement for the cowl flap's 1/2 open position for a 5 hour flight will result in the following decrease in range:

5 hr. x 4 Kts. = 20 N.M. reduction in range

MAIN LANDING GEAR LOWER DOORS REMOVAL

If numerous takeoffs and landings are to be conducted on soft fields or in tall grass, or if ice and snow are likely to be present on runway and taxiway surfaces for extended periods, it may be advantageous to remove the lower doors (gear extended position) installed on each main landing gear. These doors can be damaged during operations in soft field conditions, or a heavy accumulation of packed snow or ice inside the doors could prevent proper landing gear operation.

If these small gear doors are removed, a decrease in cruise speed and range can be expected and should be considered in preflight planning. To be conservative, the following figures should be used:

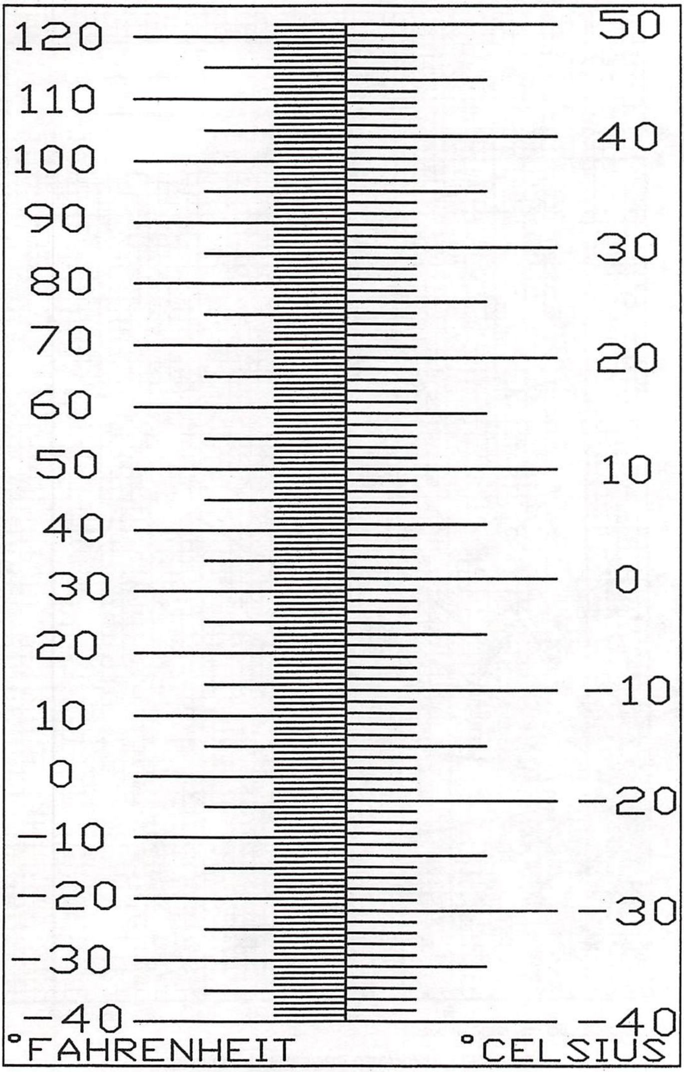
A. Decrease true airspeed at cruise by approximately 5 Kts.

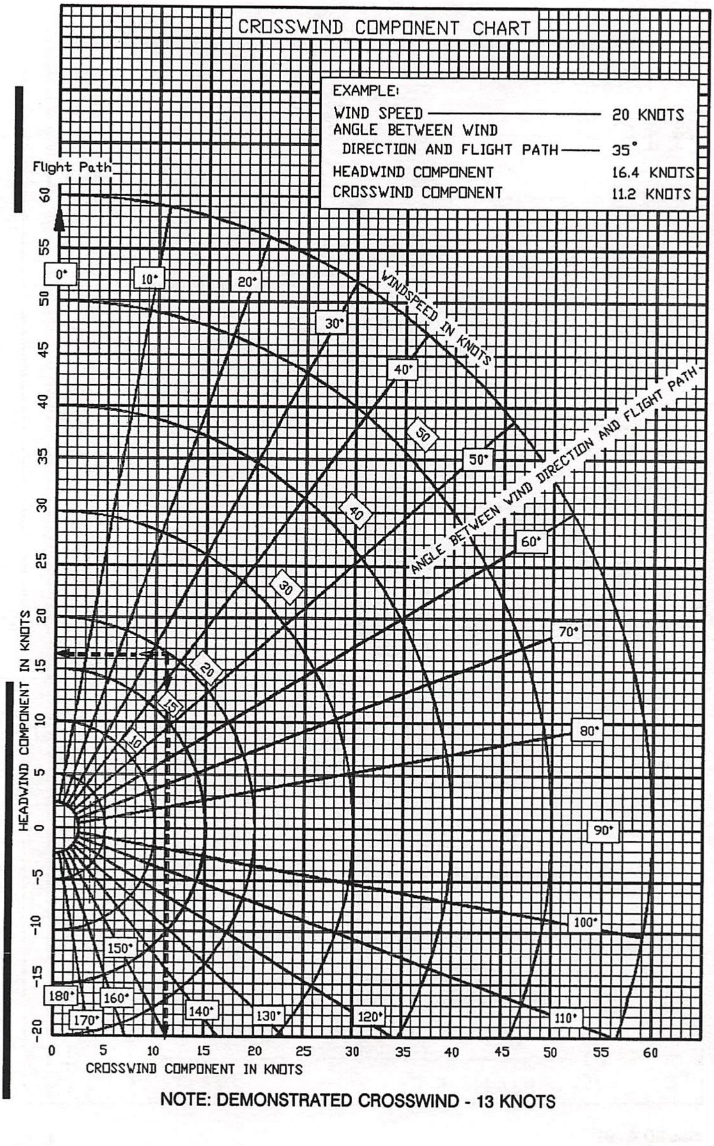
B. Decrease range by as much as 50 N.M.(92 Km) for 64.0 gallon (243 liters) fuel capacity.

OPERATIONAL CONSIDERATIONS

NOTE
Engine cooling has been satisfactorily demonstrated for an outside air temperature of 23°C (40°F) above standard. This is not an operating limitation. (See Powerplant Limitations in SECTION II.)

TEMPERATURE CONVERSION





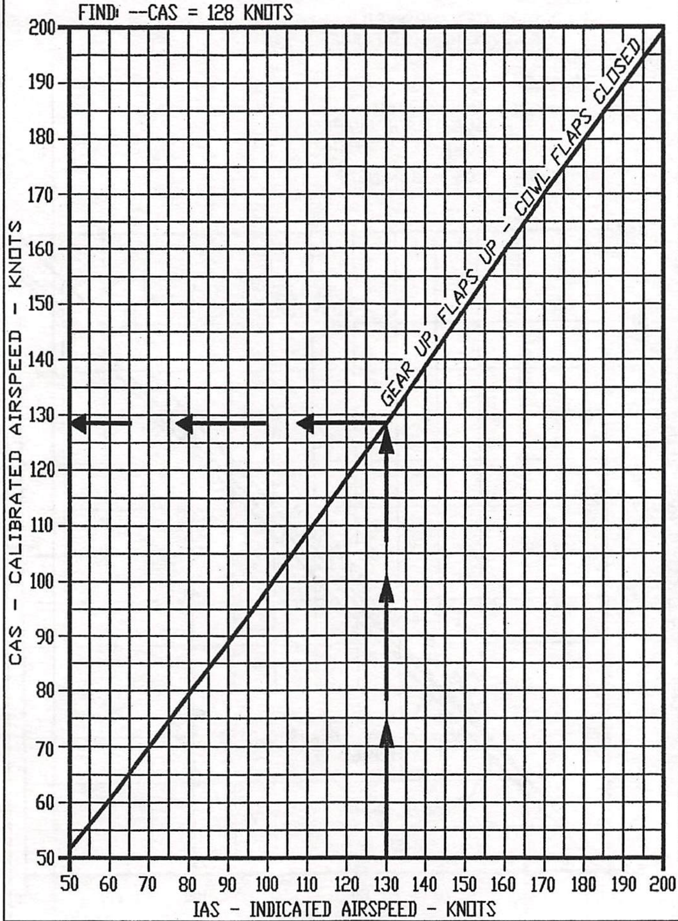
NOTE: DEMONSTRATED CROSSWIND - 13 KNOTS

AIRSPEED CALIBRATION
PRIMARY STATIC SYSTEM
(GEAR UP)

EXAMPLE:
GIVEN: --IAS 130 KNOTS
FLAPS 0, GEAR UP

FIND: --CAS = 128 KNOTS

INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR



AIRSPEED CALIBRATION

PRIMARY STATIC SYSTEM

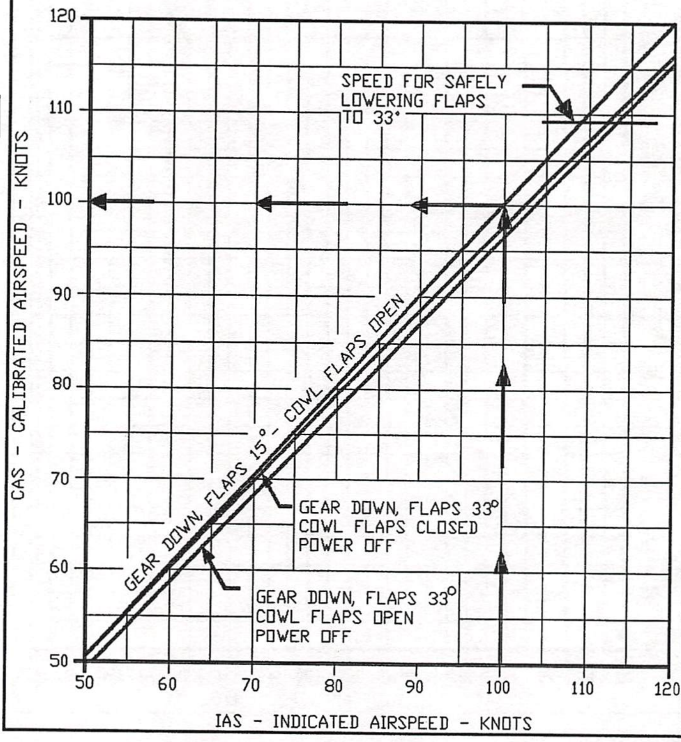
(GEAR DOWN)

TEXT: INDICATED AIRSPEED ASSUMES
ZERO INSTRUMENT ERROR

EXAMPLE:

GIVEN: IAS 100 KNOTS
GEAR DOWN, FLAPS 15°
COWL FLAPS OPEN

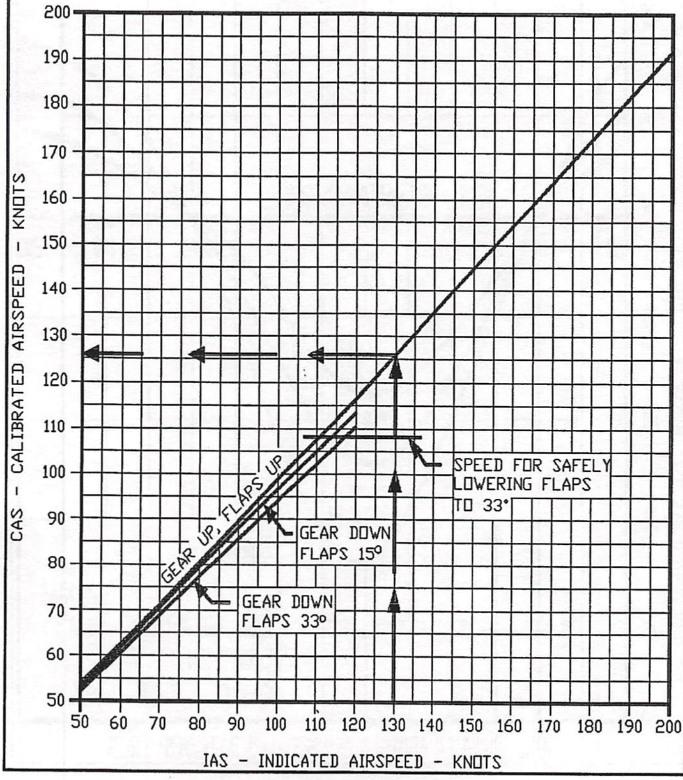
FIND: CAS = 100 KNOTS

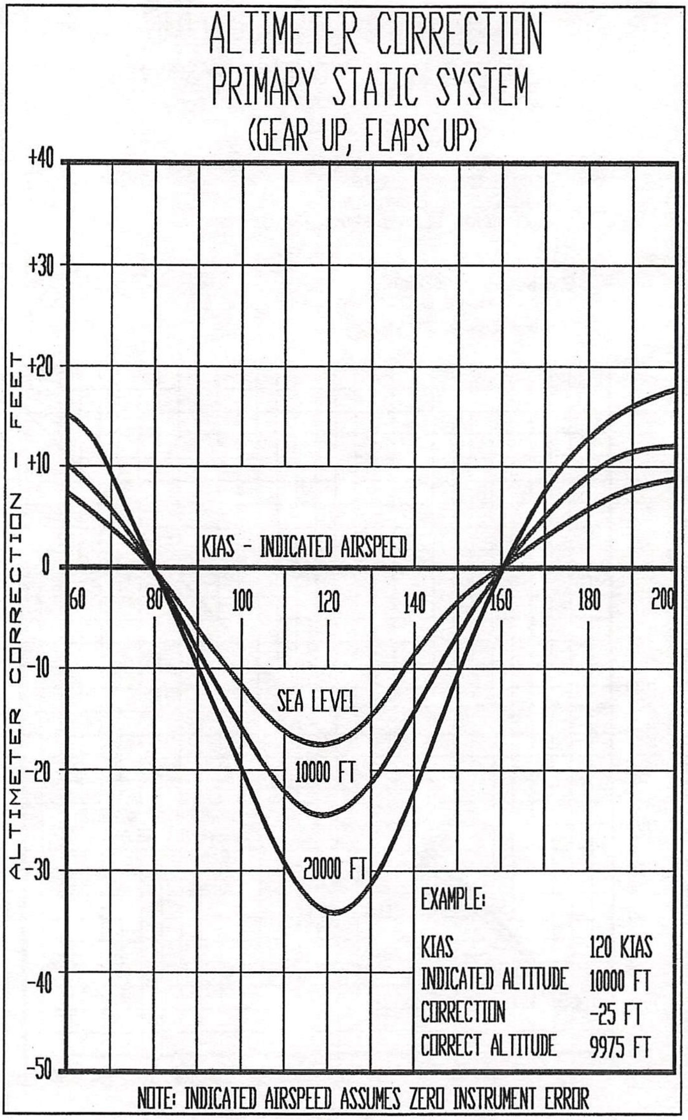


AIRSPEED CALIBRATION
ALTERNATE STATIC SYSTEM

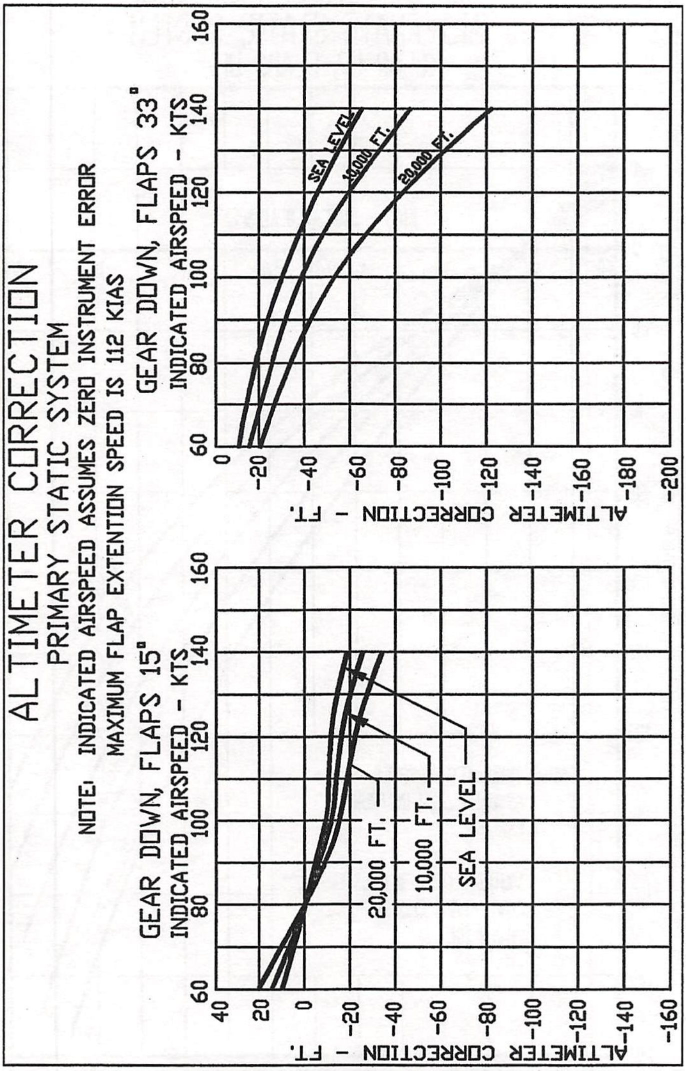
TEXT: INDICATED AIRSPEED ASSUMES
ZERO INSTRUMENT ERROR
VENT CLOSED, DEFROSTER ON
COWL FLAPS CLOSED, POWER ON

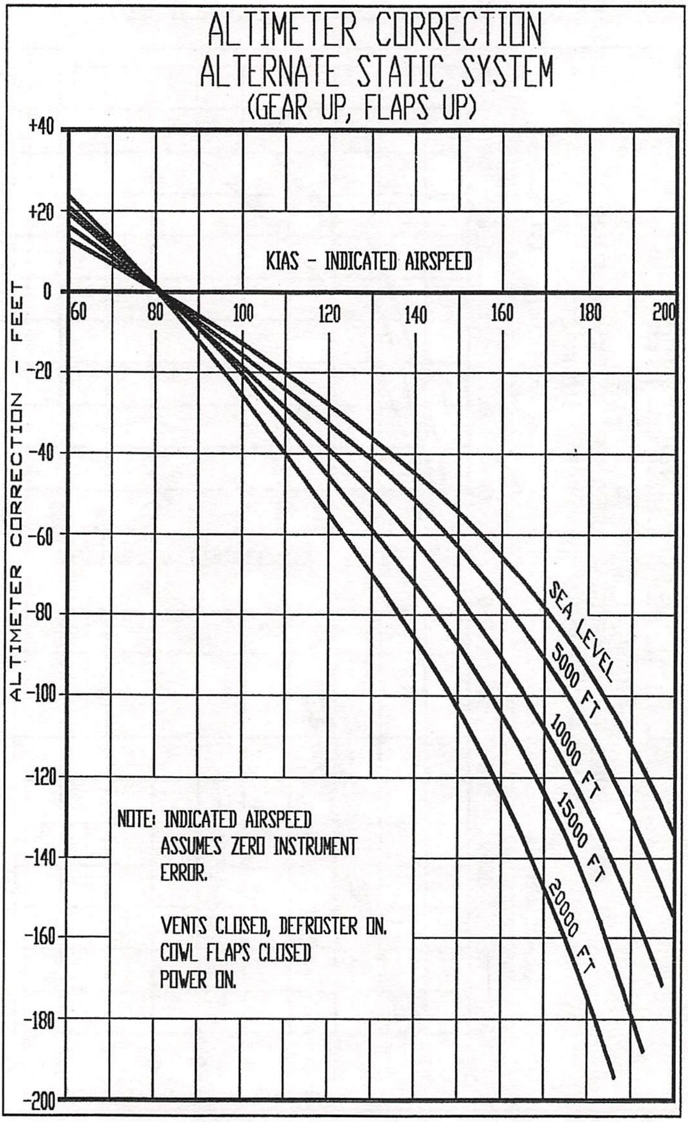
EXAMPLE:
GIVEN: --IAS 130 KNOTS
FLAPS 0°, GEAR UP
FIND: --CAS = 126 KNOTS



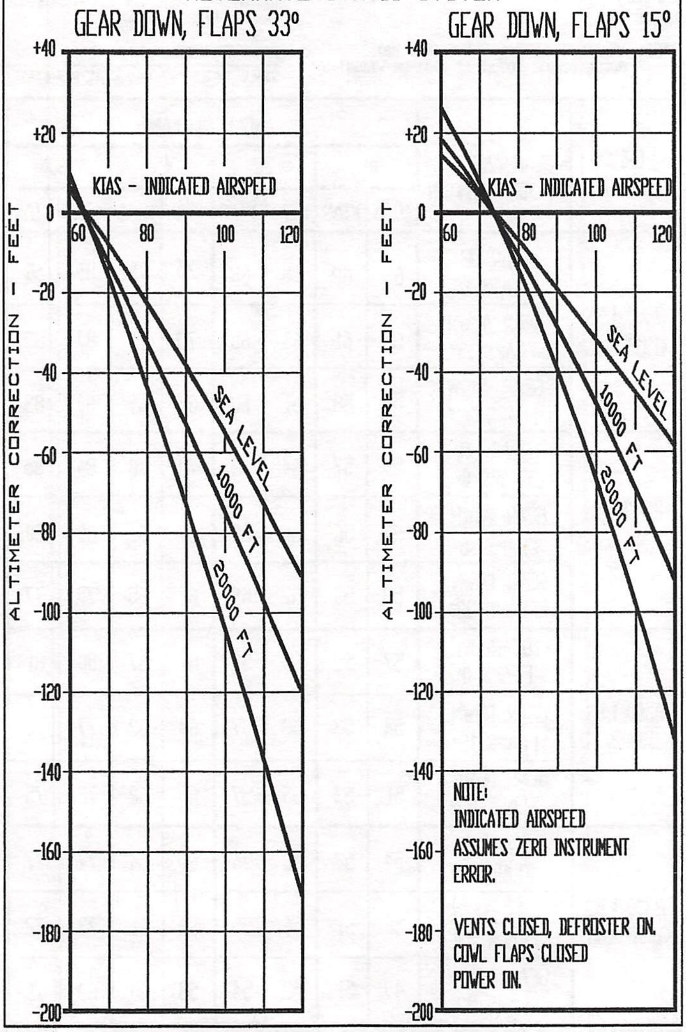

ALTIMETER CORRECTION
PRIMARY STATIC SYSTEM
(GEAR UP, FLAPS UP)
ALTIMETER CORRECTION - FEET
+40
+30
+20
+10
0
-10
-20
-30
-40
-50
KIAS - INDICATED AIRSPEED
60
80
100
120
140
160
180
200
SEA LEVEL
10000 FT
20000 FT
EXAMPLE:
KIAS 120 KIAS
INDICATED ALTITUDE 10000 FT
CORRECTION -25 FT
CORRECT ALTITUDE 9975 FT
NOTE: INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR

ALTIMETER CORRECTION-PRIMARY STATIC SYSTEM




ALTIMETER CORRECTION
ALTERNATE STATIC SYSTEM
(GEAR UP, FLAPS UP)
+40
+20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
ALTIMETER CORRECTION - FEET
KIAS - INDICATED AIRSPEED
60
80
100
120
140
160
180
200
SEA LEVEL
5000 FT
10000 FT
15000 FT
20000 FT
NOTE: INDICATED AIRSPEED
ASSUMES ZERO INSTRUMENT
ERROR.
VENTS CLOSED, DEFROSTER ON.
COWL FLAPS CLOSED
POWER ON.

ALTIMETER CORRECTION
ALTERNATE STATIC SYSTEM



STALL SPEED vs. ANGLE OF BANK

ASSOCIATED CONDITIONS:
FORWARD C.G.
POWER IDLE

NOTE: UP TO 400 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 (63 KIAS)

GROSS WEIGHT	GEAR AND FLAP POSITION	ANGLE OF BANK 0°		30°		45°		60°	
		KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS
2900 LBS (1315 KGS)	GEAR UP FLAPS 0°	63	62	68	68	75	75	89	91
	GEAR DOWN FLAPS 15°	62	61	66	65	73	72	87	88
	GEAR DOWN FLAPS 33°	56	58	61	63	67	69	80	83
2740 LBS (1243 KGS)	GEAR UP, FLAPS 0°	59	57	64	63	70	70	84	85
	GEAR DOWN, FLAPS 15°	57	56	61	60	67	66	80	80
	GEAR DOWN FLAPS 33°	53	55	57	59	63	65	75	77
2500 LBS (1134 KGS)	GEAR UP, FLAPS 0°	57	55	61	59	67	67	80	81
	GEAR DOWN, FLAPS 15°	54	53	58	57	64	63	77	76
	GEAR DOWN FLAPS 33°	51	53	55	57	60	62	72	75
2300 LBS (1032 KGS)	GEAR UP, FLAPS 0°	54	52	58	56	65	64	77	77
	GEAR DOWN, FLAPS 15°	52	51	56	55	62	61	73	72
	GEAR DOWN FLAPS 33°	49	51	52	54	58	60	69	71

NORMAL TAKEOFF DISTANCE

TAKEOFF WEIGHT - LBS (KGS)	LIFTOFF SPEED - KIAS	SPEED AT 50 FT - KIAS
2900 (1315)	59	76
2600 (1180)	58	76
2300 (1043)	55	71

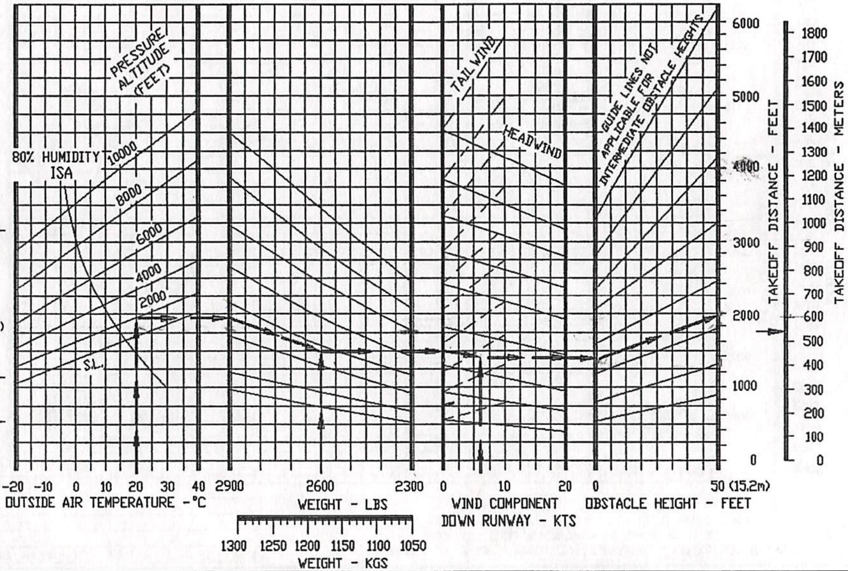
NOTE
1) MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KNOTS
2) SET FULL POWER PRIOR TO BRAKE RELEASE.
3) TO OBTAIN THE SPEED AT 50 FT. INCREASE PITCH ATTITUDE APPROX. 5° AFTER LIFTOFF.

ASSOCIATED CONDITIONS

POWER	FULL THROTTLE, 2700 PRM, 80% HUMIDITY
LANDING GEAR UNTIL OBSTACLE CLEARED	EXTENDED
WING FLAPS	15°
COWL FLAPS	FULL OPEN
RUNWAY SURFACE	PAVED, LEVEL & DRY

EXAMPLE: ⟶

OAT	20°C
PREASURE ALTITUDE	2000 FT.
WEIGHT	2600 LBS. (1180 KGS)
HEADWIND COMPONENT	6 KTS
GROUND ROLL	1200 FT. (366 m)
TOTAL TAKEOFF DISTANCE (50 FT. OBSTACLE)	2000 FT. (610 m)



NORMAL TAKEOFF DISTANCE - GRASS SURFACE

TAKEOFF WEIGHT - LBS (KGS)	LIFTOFF SPEED - KIAS	SPEED AT 50 FT - KIAS
2900 (1315)	59	76
2600 (1180)	58	76
2300 (1043)	55	71

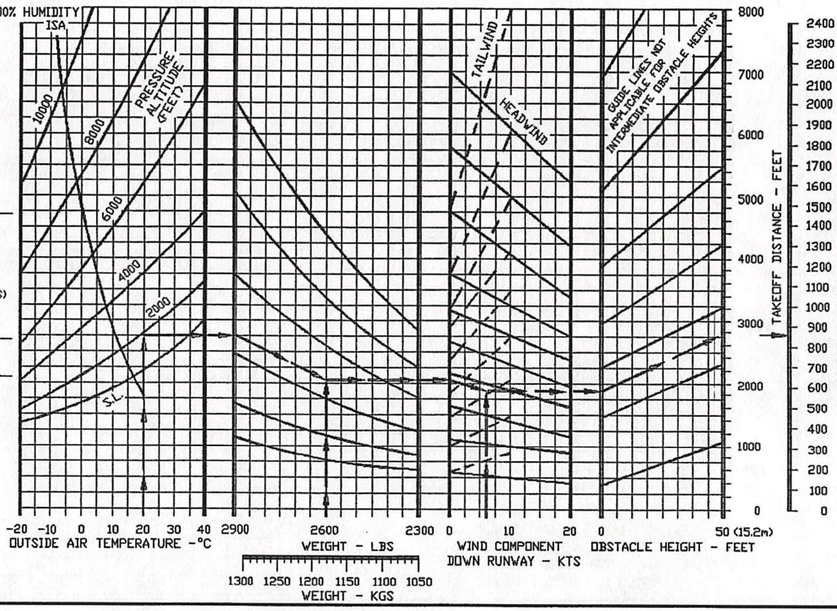
NOTE
1) MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KNOTS
2) SET FULL POWER PRIOR TO BRAKE RELEASE.
3) TO OBTAIN THE SPEED AT 50 FT. INCREASE PITCH ATTITUDE APPROX. 5° AFTER LIFTOFF.

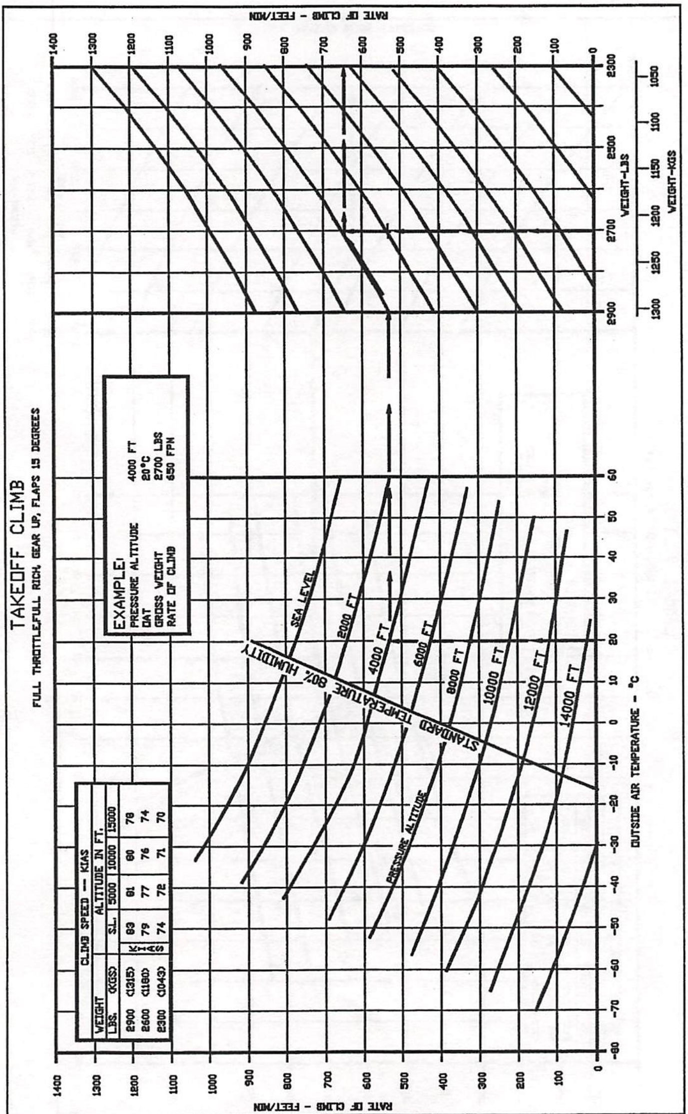
ASSOCIATED CONDITIONS

POWER	FULL THROTTLE, 2700 PRM, 80% HUMIDITY
LANDING GEAR	EXTENDED UNTIL OBSTACLE CLEARED
WING FLAPS	15°
COWL FLAPS	FULL OPEN
RUNWAY SURFACE	SHORT LEVEL DRY GRASS

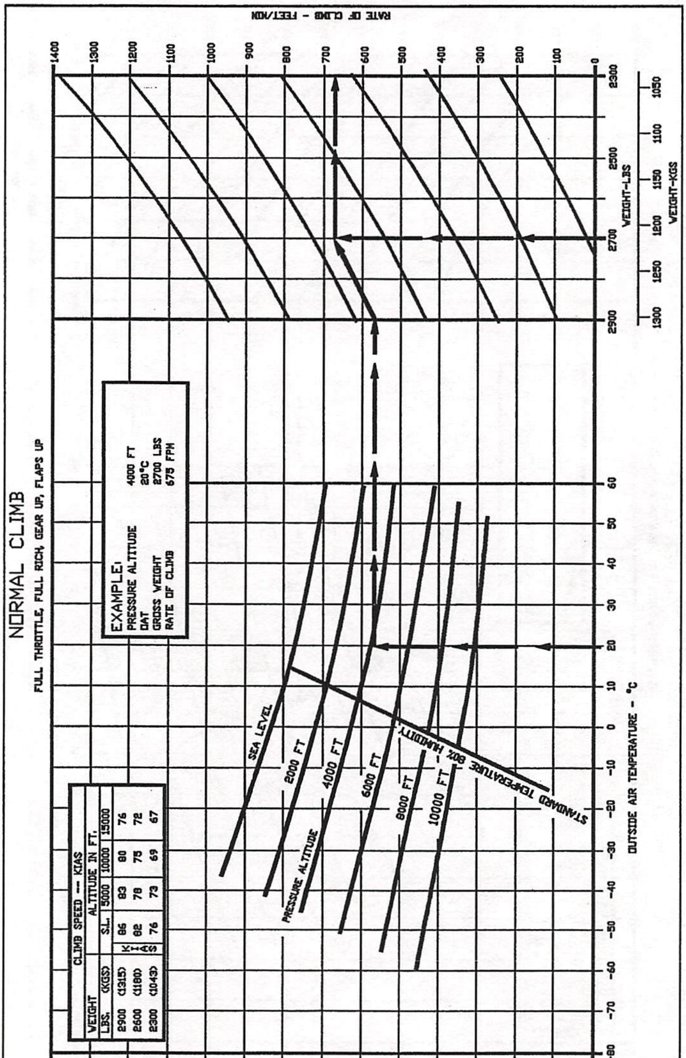
EXAMPLE:

OAT	20°C
PREASURE ALTITUDE	2000 FT.
WEIGHT	2600 LBS (1180 KGS)
HEADWIND COMPONENT	6 KTS
GROUND ROLL	1875 FT. (571 m)
TOTAL TAKEOFF DISTANCE (50 FT. OBSTACLE)	2775 FT. (846 m)





CLIMB SPEED — KIAS						
WEIGHT			ALTITUDE IN FT.			
LBS.	(KGS)		S.L.	5000	10000	15000
2900	(1315)	K	83	81	80	78
2600	(1180)	I A	79	77	76	74
2300	(1043)	S	74	72	71	70

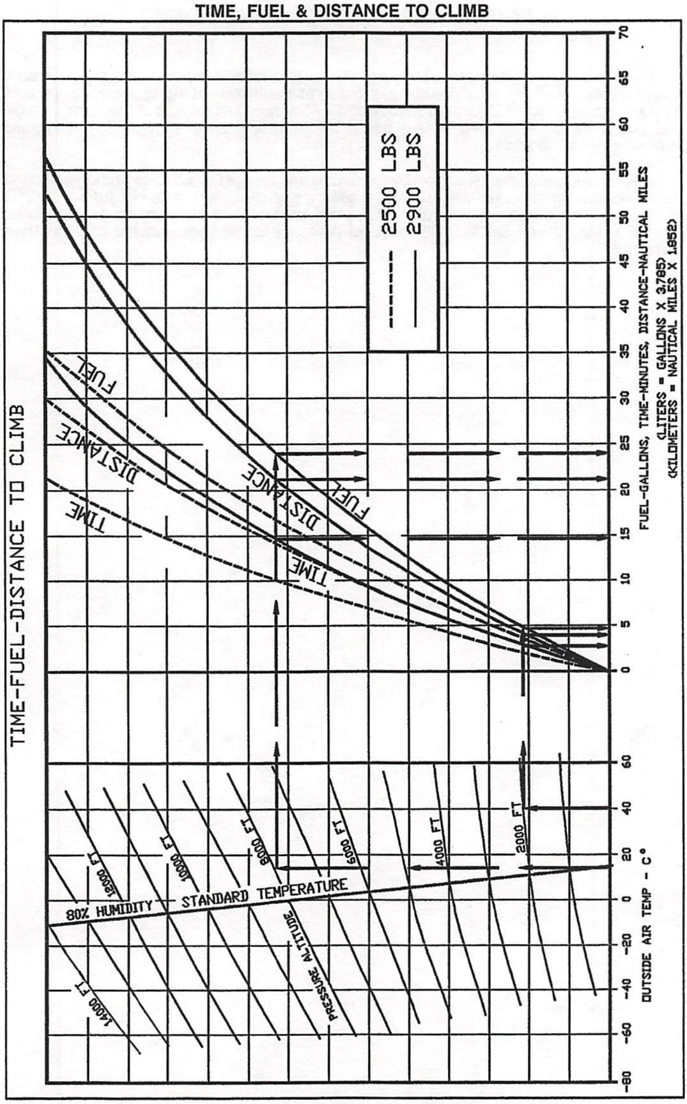


CLIMB SPEED -- KIAS						
WEIGHT			ALTITUDE IN FT.			
LBS.	(KGS)		S.L.	5000	10000	15000
2900	(1315)	K	86	83	80	76
2600	(1180)	I A	82	78	75	72
2300	(1043)	S	76	73	69	67

EXAMPLE:

PRESSURE ALTITUDE	4000 FT
OAT	20°C
GROSS WEIGHT	2700 LBS
RATE OF CLIMB	675 FPM

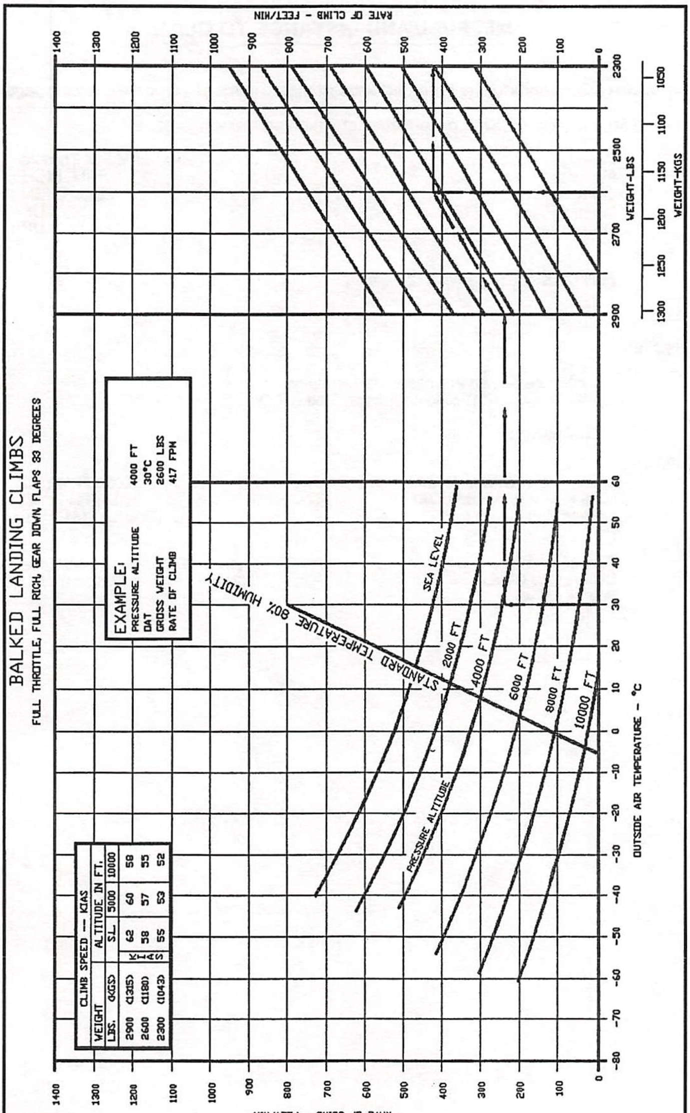
TIME, FUEL & DISTANCE TO CLIMB



CRUISE & RANGE DATA CONDITIONS

1. All Cruise & Range Data tables allow for: warmup, taxi, takeoff, climb at max. power at best rate of climb speed (V_y) to cruise altitude, cruise to destination at the specified power and mixture setting, descent to pattern altitude and a 45 minute fuel reserve at the same altitude and power setting. The data is also based on 64 U.S. gals. of usuable 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 in. 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.



WEIGHT LBS.	(KGS)	ALTITUDE IN FT. SL	5000	10000
2900	(1315)	62	60	58
2600	(1180)	58	57	55
2300	(1043)	55	53	52

TIME, FUEL AND DISTANCE TO CLIMB

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

Climb Speed: V_y from Climb performance graph on preceeding page.

Power:	2700 RPM,Full Throttle
Mixture:	FULL RICH
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 (4.1Kg) of fuel for Start, Taxi & T.O.

EXAMPLE:

GIVEN:

Initial Pressure Altitude/OAT	.2000 Ft./40° C
Final Pressure Altitude/OAT	.8000 Ft./15° C
Takeoff Weight	2900 lbs./1315 Kg.

FIND:

Time to Climb	(14.9 – 2.5) = 12.4 Minutes
Distance to Climb	(21.5 – 4.0) = 17.5 Naut. Mi.
Fuel to Climb	(24.0 – 4.8) = 19.2 lbs.

Mooney M20J

CRUISE POWER SCHEDULE

EXAMPLE:
CRUISE ALT. 6000 FT.
OAT 10°C(50°F)
POWER 65%
RPM 2600
M.P. 22.0
(7° C CORRECTION)

1. BEST POWER IS 55°C(100°F) RICH OF PEAK EGT.
2. ECONOMY CRUISE IS 14°C(25°F) RICH OF PEAK EGT.

NOTE: ADD .4" M.P. FOR EACH 10°C(50°F) OAT ABOVE STANDARD DAY TEMPERATURE. SUBTRACT .4" M.P. FOR EACH 10°C (50°F) BELOW STD. 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
	Std. 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°												

CRUISE POWER SCHEDULE (2 of 2)

Mooney M20J

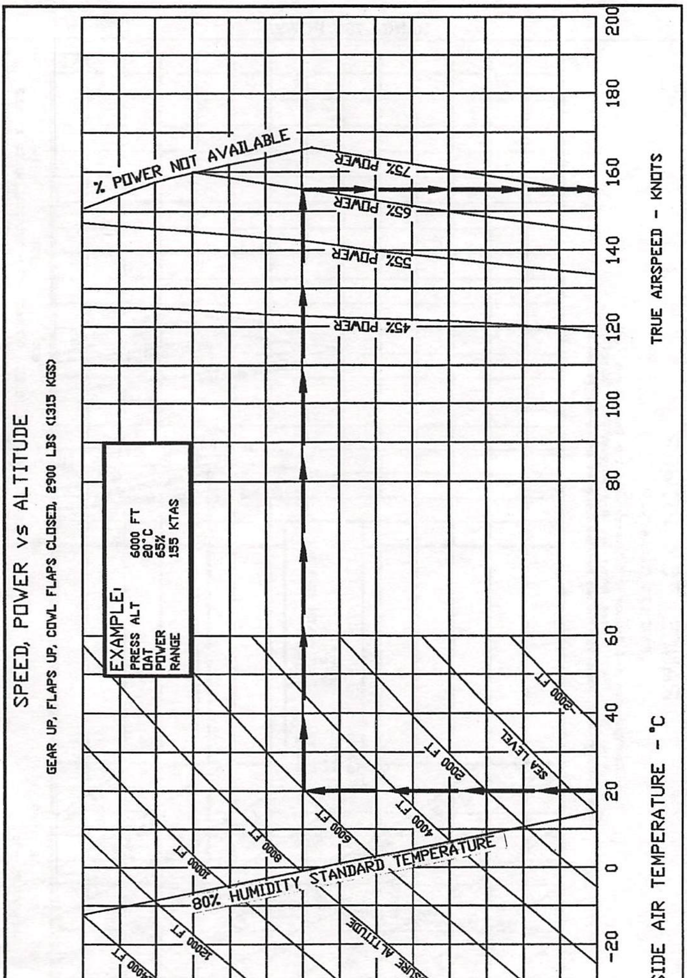
CRUISE POWER SCHEDULE

1. BEST POWER IS 55°C(100°F) RICH OF PEAK EGT.

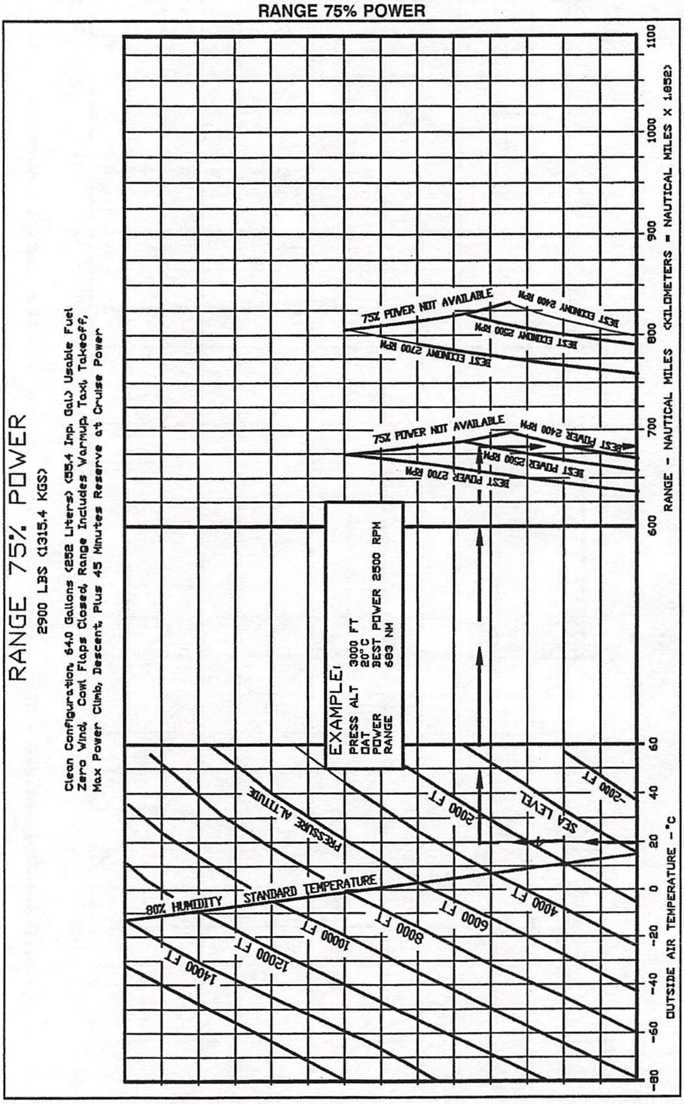
2.ECONOMY CRUISE IS 14°C(25°F) RICH OF PEAK EGT.

Pressure Altitude Feet			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	6.9	7.0	7.2	7.3	7.5
		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
Std. Day	Std. 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°		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

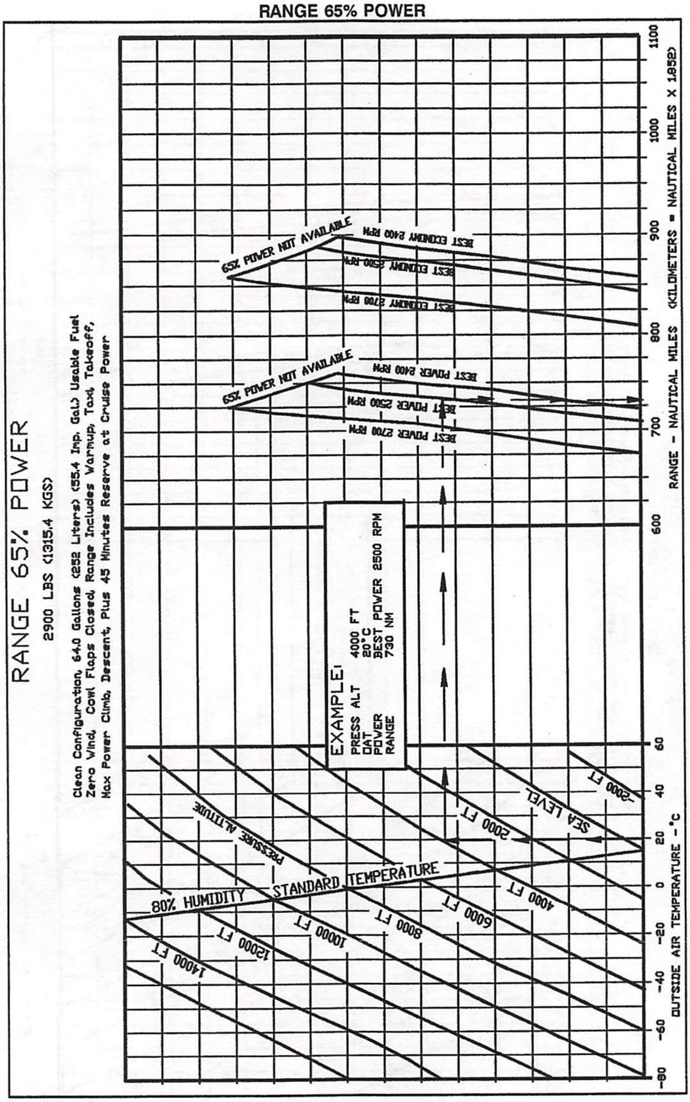
NOTE: Add .4" M.P. for each 10° C OAT above Std. Day Temperature. Subtract .4" M.P. for each 10°C OAT below STD. If OAT above STD. precludes obtaining desired M.P., use next higher RPM/MP with appropriate temperature correction to M.P.


SPEED, POWER VS ALTITUDE
GEAR UP, FLAPS UP, COWL FLAPS CLOSED, 2900 LBS (1315 KGS)
EXAMPLE:
PRESS ALT 6000 FT
OAT 20°C
POWER 65%
RANGE 155 KTAS
% POWER NOT AVAILABLE
75% POWER
65% POWER
55% POWER
45% POWER
80% HUMIDITY STANDARD TEMPERATURE
PRESSURE ALTITUDE
14000 FT
12000 FT
10000 FT
8000 FT
6000 FT
4000 FT
2000 FT
SEA LEVEL
-2000 FT
OUTSIDE AIR TEMPERATURE - °C
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
200
TRUE AIRSPEED - KNOTS

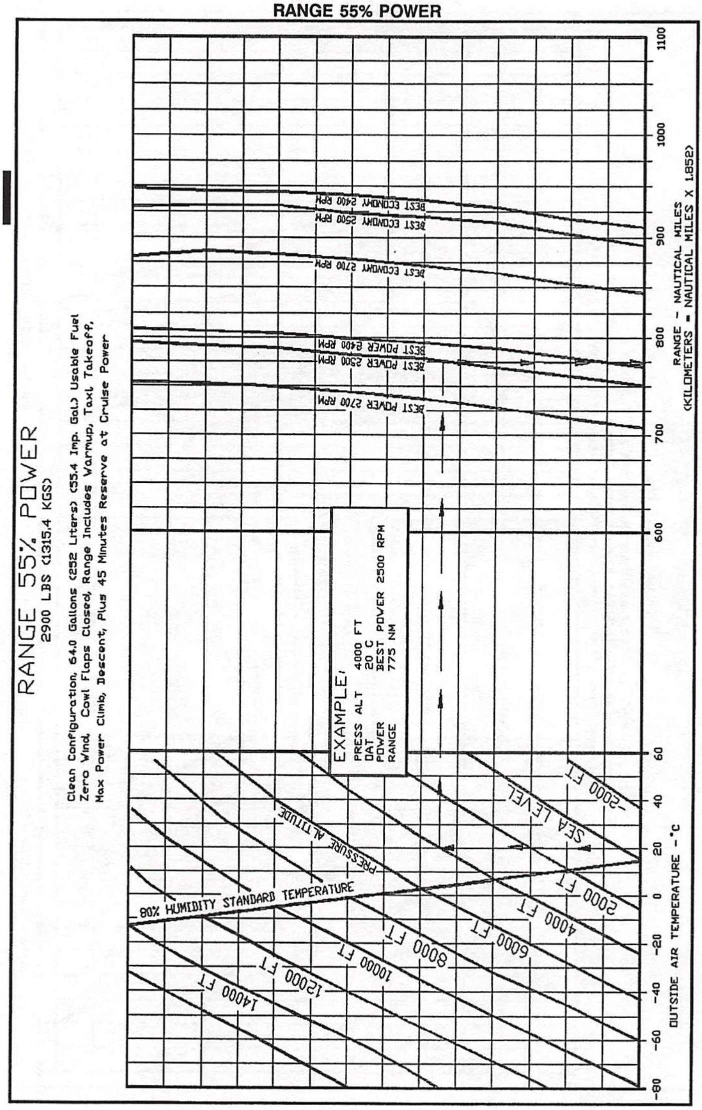
RANGE 75% POWER



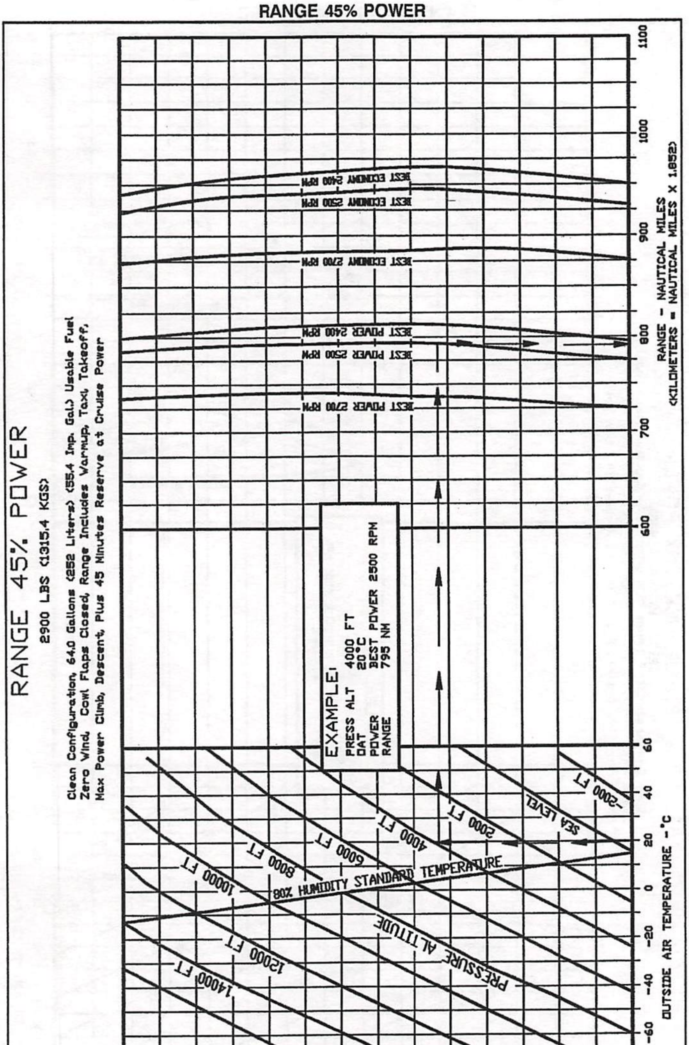
RANGE 65% POWER



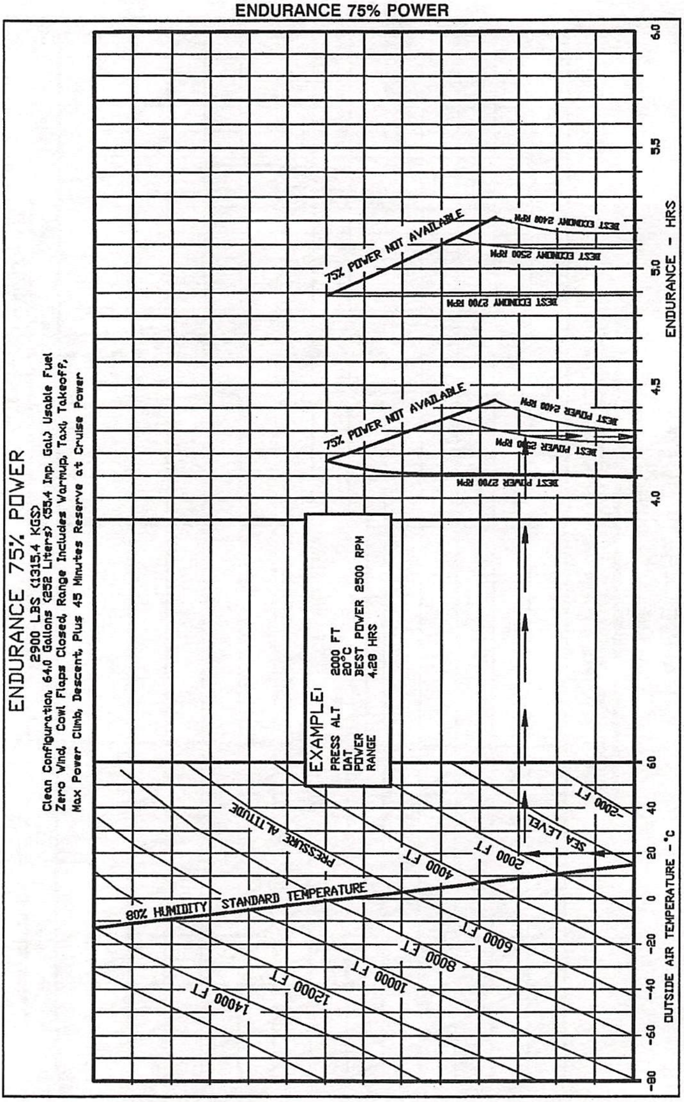
RANGE 55% POWER



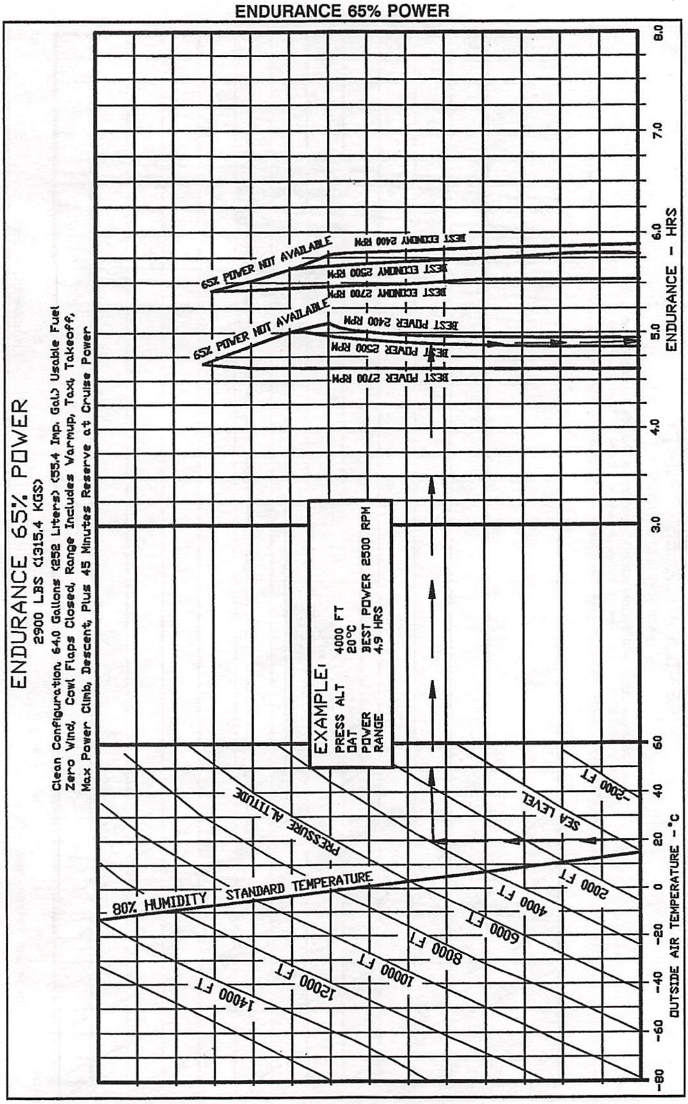
RANGE 45% POWER



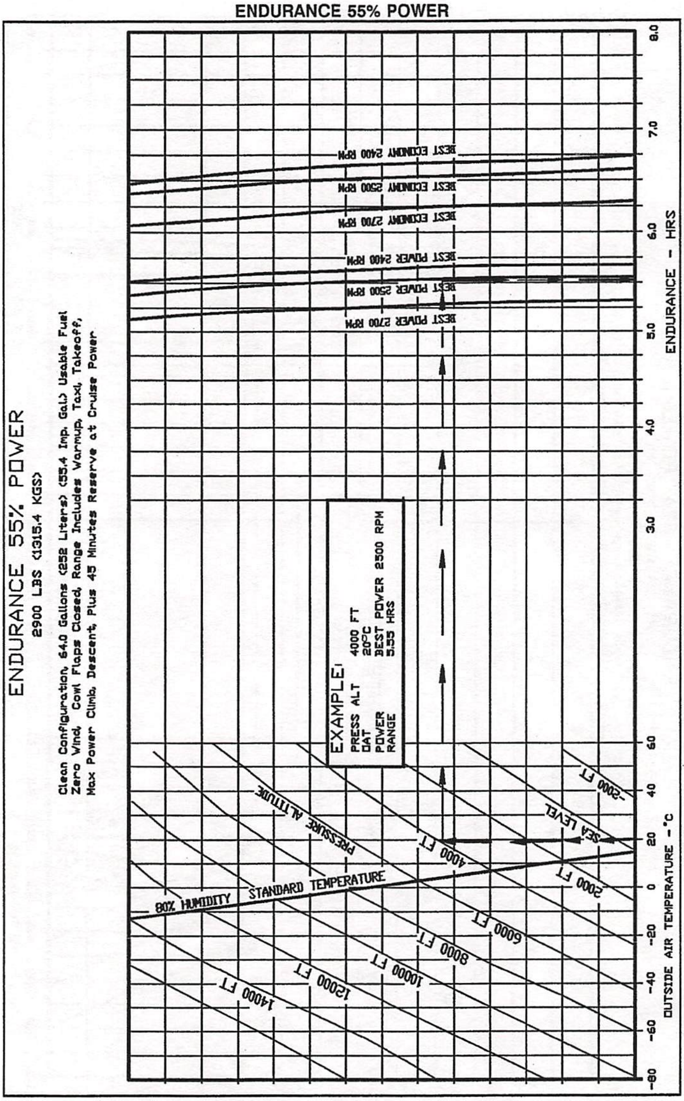
ENDURANCE 75% POWER



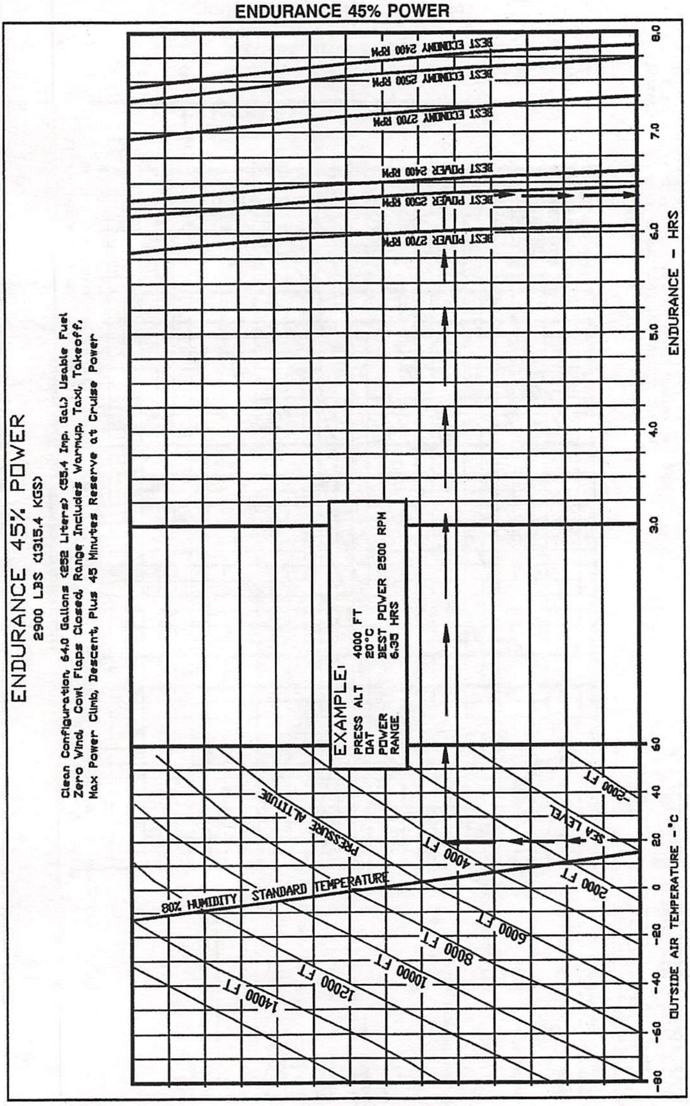
ENDURANCE 65% POWER



ENDURANCE 55% POWER



ENDURANCE 45% POWER



NORMAL LANDING DISTANCE

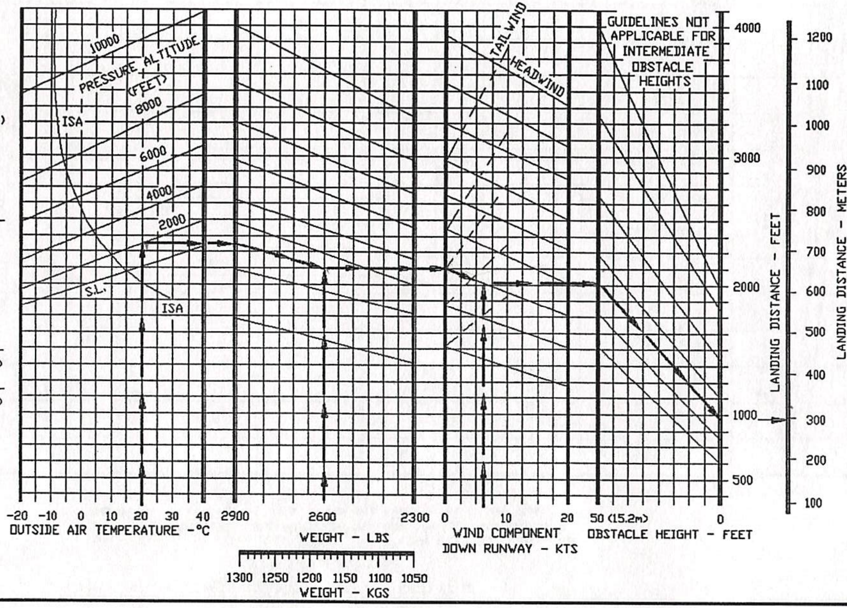
LANDING WEIGHT - LBS (KGS)	APPROACH SPEED KIAS
2900 (1315)	78
2600 (1180)	74
2300 (1043)	70

NOTE 1) MAXIMUM DEMONSTRATED CROSSWIND VELOCITY IS 11 KNOTS
2) AFT CONTROL WHEEL PRESSURE IS RECOMMENDED TO IMPROVE BRAKING EFFECTIVENESS DURING LANDING ROLL.

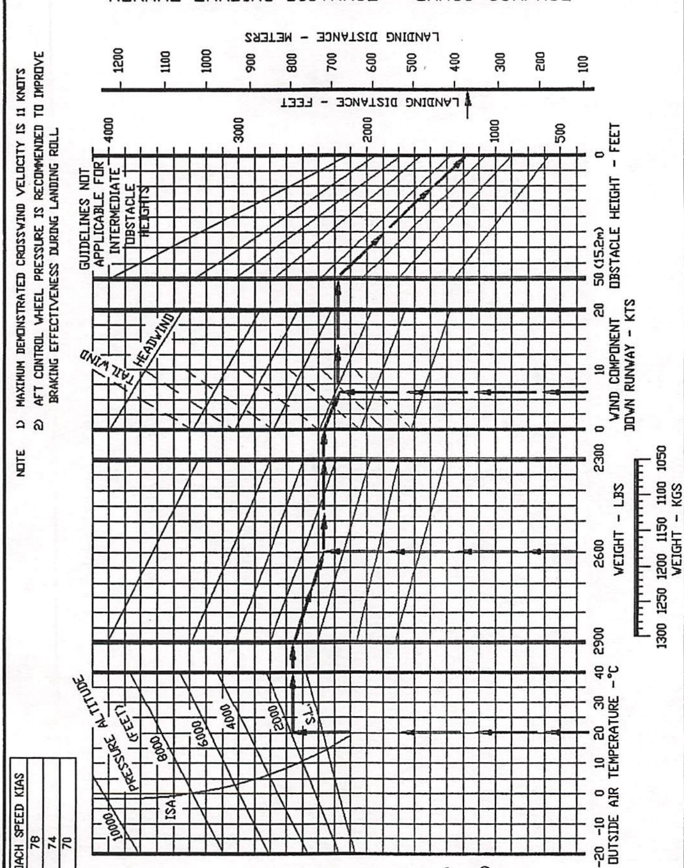
ASSOCIATED CONDITIONS

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

EXAMPLE: → OAT	20°C
PRESSURE ALTITUDE	2000 FT.
WEIGHT	2600 LBS (1180 KGS)
HEADWIND COMPONENT	6 KTS
GROUND ROLL	975 FT. (297 m)
TOTAL LANDING DISTANCE (50 FT. OBSTACLE)	2005 FT. (611 m)



NORMAL LANDING DISTANCE - GRASS SURFACE



LANDING WEIGHT - LBS (KGS)	APPROACH SPEED KIAS
2900 (1315)	78
2600 (1180)	74
2300 (1043)	70

ASSOCIATED CONDITIONS

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

EXAMPLE:

OAT	20°C
PRESSURE ALTITUDE	2000 FT.
WEIGHT	2600 LBS (1180 KGS)
HEADWIND COMPONENT	6 KTS
GROUND ROLL	1225 FT. (373 m)
TOTAL LANDING DISTANCE (50 FT. OBSTACLE)	2225 FT. (678 m)

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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. 24-3240

AIRCRAFT REGISTRATION NO. HB-DIC

1. Edition: 12-10-91

Mooney Aircraft Corporation Approval Signature & Date

Häfliger
C/M 643

INTRODUCTION

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

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

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

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

The maximum certificated gross weight for the Model M20J under all operating conditions is 2900 pounds (1315 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.)(.72 Kg/l) from total weight as weighed. (Use 5.82 lb/gal(.69 Kg/l) 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 OTHER TANK.
e. Replace 1.25 gal. (4.7 liters, 1.0 Imp.Gal.) fuel @ 6.0 lb./gal.(.72 Kg/l) into each tank (unusable fuel). (Use 5.82 lb/gal.(.69 Kg/l) 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.

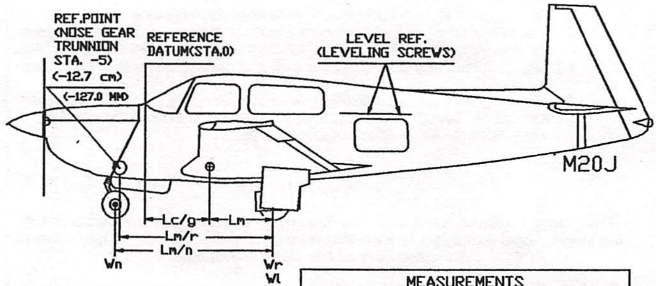
|NOTE|

Depending on the aircraft C.G. location the distance from the centerline of the main wheel axles to the trunnion reference point may be longer than to the centerline of the nose wheel axle.

12. Record weights and measurements, and compute basic weight and CG as follows on next page:

NOTE:
Wing jack points are located at Fus. Sta. 56.658 in. Nose jack point is the propeller yoke. Use yoke jack to lift aircraft. Refer to SECTION VIII, JACKING, for procedures.

M20J - WEIGHT and BALANCE CHART



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

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

a. CG Forward of Main Wheels:

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

b. CG Aft of Datum (Station 0):

_____ In/cm/mm Distance from Center Nose Gear Trunion to Center of Main Wheel Axles (Horizontal) ($L_{M/R}$) — 5 IN./12.7 cm/127 mm Distance from Nose Gear TDrunion to Datum (CONSTANT) — _____ In/cm/mm Result of Computation Above (L_M) = _____ In/cm/mm CG (FUS. STA) Distance Aft of DAtum (Empty Weight CG) ($L_{C/G}$)

If fuel has not been drained, the usable fuel must be analytically subtracted to determine the Basic Empty Wt. and CG. Use loading calculation procedure shown on page 6-6.

WEIGHT	LBS. (Kg)	C.G. IN/cm/mm	MOMENT Lb-In(Kg-cm)(Kg-mm)/1000
As Weighed (W_T)			
Usable fuel	—	48.43 in/123 cm/1230 mm	—
Basic Empty Wt.			

OWNERS WEIGHT AND BALANCE RECORD

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

AIRPLANE MODEL - M20J | SERIAL NO. 24-3240 | FAA REG. NO. HB-DIC

DATE	DESCRIPTION OF MODIFICATION	WEIGHT CHANGE ADDED (+) WT. (LBS) (Kg)	WEIGHT CHANGE ADDED (+) ARM (INCHES) (cm)/(mm)	WEIGHT CHANGE REMOVED (-) WT. (LBS) (Kg)	WEIGHT CHANGE REMOVED (-) ARM (INCHES) (cm)/(mm)	RUNNING EMPTY WEIGHT WT. (LBS) (Kg)	RUNNING EMPTY WEIGHT MOMENT /1000	RUNNING EMPTY WEIGHT ARM (IN) (cm)/(mm)	USEFUL LOAD LBS
12/10/91	BASIC EMPTY WEIGHT AS DELIVERED (Wt) (Includes full oil - 8 Qts.(7.6 liters)	—	—	—	—	1914	89.67	46.8	986
01/02/92	WX-900 Stormscope	4.36	89.5	—	—	1918	90.06	46.9	982
02/22/94	Prop-Change : Difference	—	—	11.07	-35.5	1907	90.07	47.22	993
11/12/97	GPS-Install (AVIONITEC AG)	7.35	20.96	—	—	1914	90.22	47.13	985.5
25/10/06	Exchange XPDR / Alt Digitizer					1915,5	90.26	47.12	984.5
08/04/09	Exchange ELT to Artex ME 406					1912,29	89.872	47.00	987.7
12/01/11	Neuwägung					1912,4	90,456	47,3	987,6
01/03/13	Neuwägung / Neubeckierung					1907,0	89,248	46,8	993,0
04/2014	Avionics upgrade					1904.55	89.322	46.9	995.5

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

M20J WT & BAL. RECORD

Datas take over from original-AFM
27. Mai 2003

AVIONITEC AG
FOCA.140
EASA.145.
Häfliger
C/M 643
FOCA
Harald Brack
AVIONITEC AG
CH.145.0181

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, procede as follows:

Step 1. Refer to the latest entry on page 6-5 for the current empty weight and moment.

NOTE

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

Step 2: Note the pilot's weight and the position his seat will occupy in flight. Find this weight on the left scale of the Loading Computation Graph (page 6-7) 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 2900 Pounds(1315 Kg) 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.

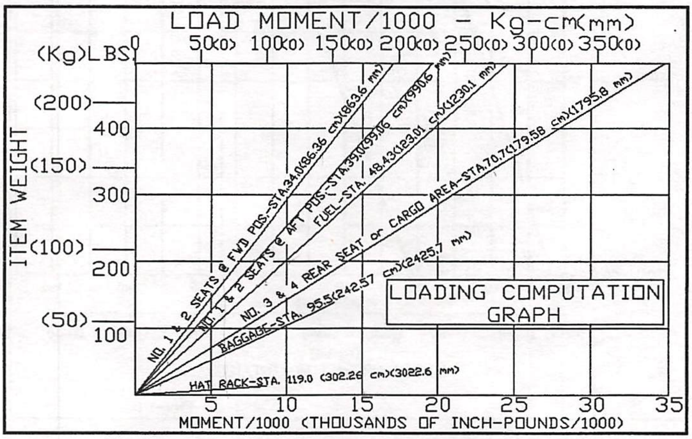
PROBLEM FORM

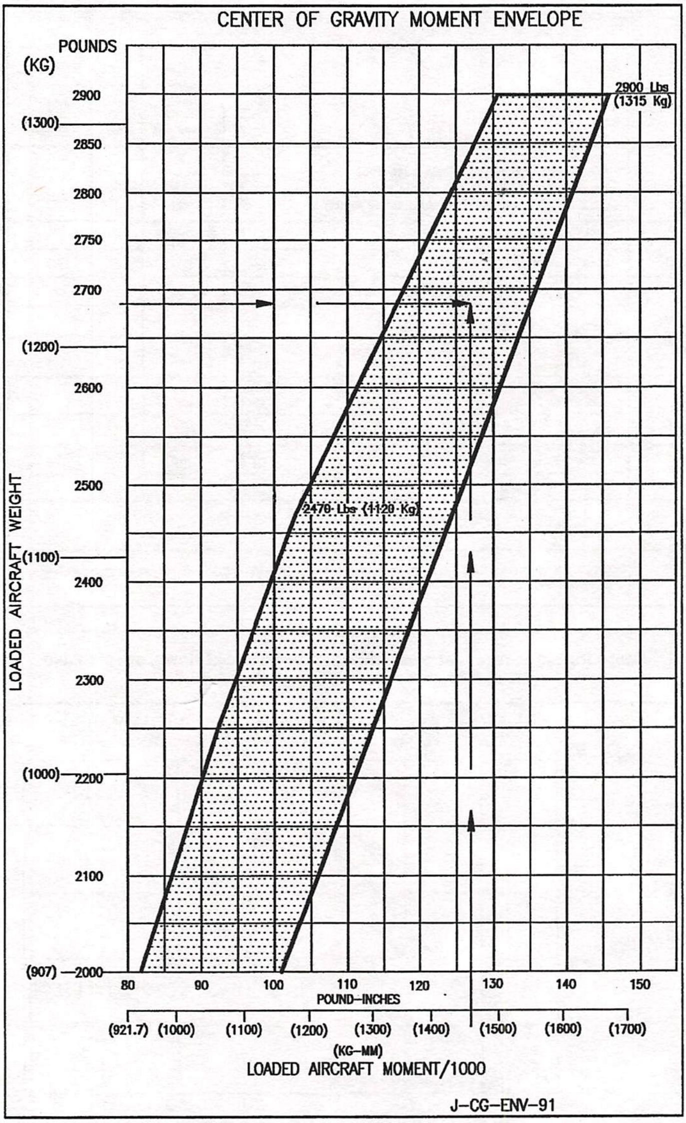
STEP	ITEM	Sample Problem WEIGHT Lbs. (Kg.)	Sample Problem MOMENT Lb.in/1000 (Kg.cm/1000)	Your Problem WEIGHT Lbs. (Kg.)	Your Problem MOMENT Lb.in/1000 (Kg.cm/1000)
1	A/C Basic Empty Wt.(W_T) (From page 6-5) (Includes Full Oil) 8 Qts.(7.6 Li)@Sta.11.5 (29.2 cm)(Oil sump assumed FULL for all flights)	1750 (793.79)	77.02 (887.38)		
2	Pilot Seat (#1) *	170 (77.11)	6.0/2nd pos (6.85)		
	Co-Pilot Seat (#2) *	170 (77.11)	5.78/Fwd (6.66)		
3	Left Rear Seat (#3) or Cargo Area	170 (77.11)	12.02 (13.85)		
	Right Rear Seat (#4) or Cargo Area				
4	Fuel (Max. Usable 64 Gal.(242.3 Li), 384 Lbs.(174.2 Kg) @ Sta. 48.43 (123.0 cm)	312.0 (141.5)	15.11 (17.41)		
5	Baggage (Max. 120 Lbs.)(54.43 Kg) @ Sta. 95.5 (242.57 cm)	110 (49.9)	10.51 (12.10)		
	Hat Rack (Max. 10 Lbs.)(4.54 Kg) @ Sta. 119.0 (302.26 cm)	3.0 (1.36)	.36 (.41)		
6	Loaded Aircraft Weight	2685 (1218)			
	Total Moment/1000		127 (1463.7)		
7	Refer to Center of Gravity Moment Envelope to determine whether your A/C loading is acceptable.				
*	Obtain the moment/1000 value for each seat position(FWD, MID or AFT) from loading computation graph below.				

J-LD-PRB

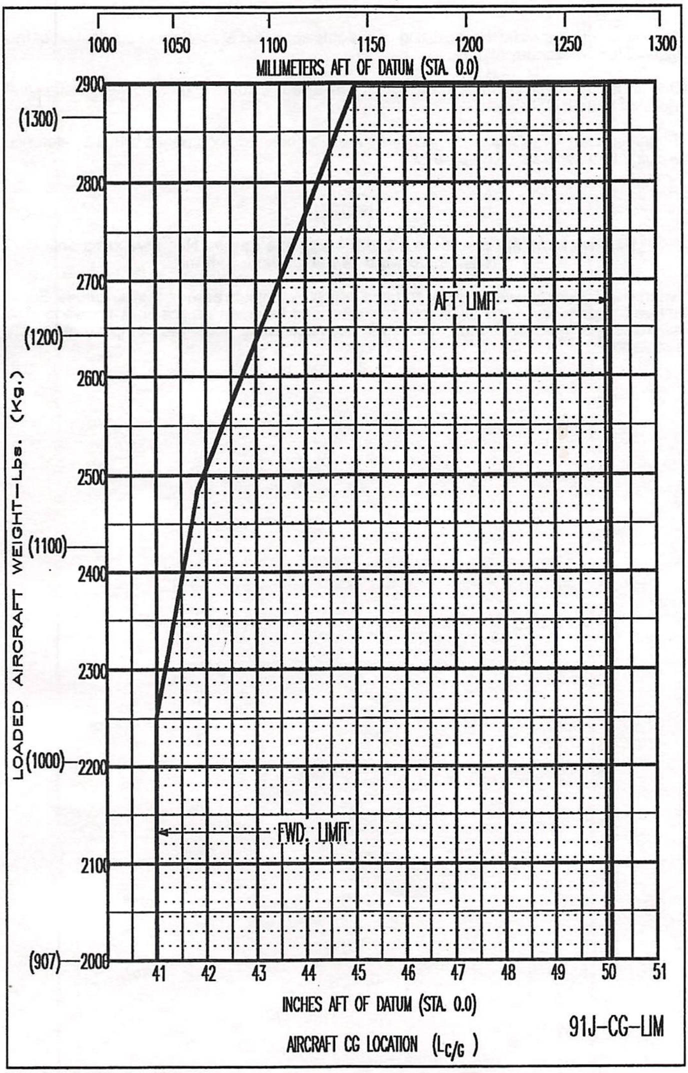
CAUTION

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
POUNDS
(KG)
2900
(1300)
2850
2800
2750
2700
(1200)
2600
2500
(1100)
2400
2300
(1000)
2200
2100
(907)
2000
LOADED AIRCRAFT WEIGHT
2900 Lbs
(1315 Kg)
2470 Lbs (1120 Kg)
80
90
100
110
120
130
140
150
POUND-INCHES
(921.7)
(1000)
(1100)
(1200)
(1300)
(1400)
(1500)
(1600)
(1700)
(KG-MM)
LOADED AIRCRAFT MOMENT/1000
J-CG-ENV-91

M20J - CENTER OF GRAVITY LIMITS ENEVELOPE



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 Aircraft Corporation.

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

J-EQ-A1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) (POUNDS)	ARM (cm) (INCHES)	MO. 12 DAY 10 YEAR 91 MARK IF INSTLD		
	A. POWERPLANT & ACCESSORIES						
1A	Engine, Lycoming IO360-A3B6D (Includes Starter, Prestolite 60 Amp Alternator, and Oil Filter) (70 Amp Alternator OPT.)	600363	(149.7) 330.00 *	(-40.0) -15.76 *	X		
2A	Oil Radiator (Stewart Warner)	620052	(1.1) 2.4	(_9.7) -3.8	X		
3A	Valve, Oil Quick Drain (Net Change)	600363	(.005) 0.00	(-35.6) -14.00			
4A	Propeller - Constant Speed (McCauley-B2D34C214/90DHB -16E or -16EP)	680031	(22.5) 49.50	(-90.2) -35.50			
5A	Governor, Propeller (McCauley C290D5/T17)	660115	(1.25) 2.75	(-3.6) -1.40	X		
6A	Spinner Installation	680031	(2.18) 4.80	(-88.9) -35.00	X		
7A	Brakett ~~Induction~~ Air Fileter	BA-6205 ~~600355~~ STC-SA71GL	(.45) 1.00	(-64.8) -25.50	X		
8A	Fuel Selector Valve	610152	(.41) 0.9	(66.7) 26.25	X		
9A	Propeller - Constant Speed (HARTZELL) HC-C2YK-1BF/F7666A-3Q	680031	(24.6) 54.25	(-90.2) -35.50			

Häfliger
C/M 643

EQUIPMENT LIST

MO 02
DAY 22
YEAR 94

J–EQ–A2

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MARK IF INSTLD		
	A. Powerplant and Accessories (con't.)						
10 A	Prop. C/S : MTV-12-B / 180-17	LBA STC No. 0288/555 R2	(21,0) 46.31	(–90.55) 35.64	X		

EQUIPMENT LIST

J-EQ-B1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT POUNDS	ARM (Cm)	ARM INCHES	MARK IF INSTLD		
						MO.	12		
						DAY	10		
						YEAR	91		
	B. ELECTRICAL SYSTEM								
1B	BATTERY (24 VOLT)	800351	(13.40)	29.55	(281.43)	110.8	X		
2B	BATTERY (12 VOLT)	800351	(12.5)	27.5	(281.43)	110.8			
3B	REGULATOR, VOLTAGE (28 VOLT)	800351	(.27)	.6	(10.16)	4.0	X		
4B	REGULATOR, VOLTAGE (14 VOLT)	800351	(.27)	.6	(10.16)	4.0			
5B	HEATED PITOT	820252	(.52)	1.15	(106.30)	41.85	X		
6B	ELECTRIC FUEL PUMP	610256	(1.09)	2.4	(38.10)	15.0	X		
7B	STALL WARNING INDICATOR	800351	(.45)	1.0	(127.00)	50.0	X		
8B	GEAR WARNING INDICATOR	800351	(.45)	1.0	(49.53)	50.0	X		
9B	WING TIP STROBE LIGHT INSTL.	800351	(2.27)	5.0	(134.62)	53.0	X		
10B	TAIL STROBE LIGHT INSTL.	800351	(.68)	1.5	(548.18)	215.82	X		
11B	LANDING/TAXI LIGHTS (2 SETS)	210417	(2.7)	(5.88)	(105.7)	41.6	X		
12B	ACTUATOR, FLAP	750097	(2.31)	5.1	(261.92)	103.12	X		

EQUIPMENT LIST

J-EQ-B2

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT POUNDS	ARM (Cm)	ARM INCHES	MARK IF INSTLD MO. 12 DAY 10 YEAR 91	MO. DAY YEAR	MO. DAY YEAR
	B. ELECTRICAL SYSTEM (con't.)								
13B	HOUR METER INSTL.	950241	(.14)	.3	(46.99)	18.5			
14B	CIGARETTE LIGHTER W/ 3 ASHTRAYS	800351	(.79)	1.74	(49.53)	19.5	X		
15B	ACTUATOR, LANDING GEAR	560260	(5.08)	11.2	(99.06)	39.0	X		
16B									
17B	E.L.T. (D & M ELT-8)	810152	(1.63)	3.59	(307.34)	121.0			
~~18B~~	~~E.L.T. (ARTEX) 110-4~~	~~810152~~	~~(2.33)~~	~~5.13~~	~~(307.34)~~	~~121.0~~	~~X~~		
19B	Hour Meter Winters P/N1510		(.14)	.3	(46.99)	18.5	x		
20B	ELT Artex ME 406			2.1		121.0	7.4.03		

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EQUIPMENT LIST

J-EQ-C1

							MO.	12		
							DAY	10		
							YEAR	91		
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	POUNDS	ARM (Cm)	INCHES	MARK IF INSTLD			
	C. WHEELS, TIRES & BRAKES									
1C	MAIN WHEEL & BRAKE ASSY (2)	520029	(6.22*)	13.72*	(163.57)	64.4	X			
	WHEEL ASSY (2)	520029	(4.99)	11.0	(162.51)	63.98	X			
	BRAKE ASSY (2)	520029	(1.23)	2.72	(167.59)	65.98	X			
2C	TWO MAIN TIRES (6-PLY RATING) 6.00x6 TYPE III WITH REGULAR TUBES	520029	(7.71)	17.0	(162.51)	63.98	X			
3C	NOSE WHEEL ASSY	540000	(1.18)	2.6	(-13.46)	-5.3	X			
4C	NOSE WHEEL TIRE ASSY, (6-PLY RATING), 5.00x5 TYPE III, WITH REGULAR TUBE	540000	(3.17)	7.0	(-13.46)	-5.3	X			
5C	BRAKE MASTER CYLINDER (2)	850112	(1.45)	3.2	(21.08)	8.3	X			
6C	HYDRAULIC RESERVOIR	850112	(.14)	.3	(276.23)	108.75	X			
7C	VALVE, PARKING BRAKE	850112	(.27)	.6	(-3.68)	-1.45	X			

J-EQ-C2

EQUIPMENT LIST

					MO.	12		
					DAY	10		
					YEAR	91		
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES		MARK IF INSTLD		
	C. WHEELS, TIRES & BRAKES (con't.)							

EQUIPMENT LIST

J-EQ-D1

		MO.	12		
		DAY	10		
		YEAR	91		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT POUNDS	ARM (Cm)	ARM INCHES	MARK IF INSTLD		
	D. INSTRUMENTS								
1D	ATTITUDE GYRO	820071	(1.33)	2.93	(44.35)	17.46			
2D	DIRECTIONAL GYRO	820071	(1.33)	2.93	(42.67)	16.8			
3D	GAUGE, OAT, WINDOW MOUNTED	950058	(.057)	.125	(71.75)	28.25			
4D	GAUGE, OAT, PANEL MOUNTED	820071	(.25)	.55	(46.99)	18.5	X		
5D	INDICATOR - VERTICAL SPEED	820071	(.43)	.95	(46.99)	18.5	X		
6D	TURN COORDINATOR	820071	(.83)	1.84	(41.91)	16.5	X		
7D	MANIFOLD PRESSURE	820071	(.45)	1.0	(46.94)	18.48	X		
8D	ALTIMETER	820071	(.49)	1.07	(47.49)	18.7			
9D	AIRSPEED INDICATOR	820071	(.30)	.66	(47.75)	18.8	X		
10D	MAGNETIC COMPASS	820230	(.23)	.50	(55.63)	21.9	X		
11D	TACHOMETER, ELECTRIC	820071	(.36)	.80	(48.13)	18.95	X		
12D	TACHOMETER, MECHANICAL	820071	.45	1.0	45.72	18.0			

EQUIPMENT LIST

J-EQ-D2

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MARK IF INSTLD		
				MO.	12		
				DAY	10		
				YEAR	91		
	D. INSTRUMENTS (con't.)						
13D	E. G. T.	820071	(.23) .5	(46.94) 18.48	X		
14D	FUEL FLOW	600363	(.63) 1.39	(46.94) 18.48	X		
15D	CLUSTER GAUGE	820071	(.53) 1.16	(49.02) 19.3	X		
16D	ANNUNCIATOR PANEL	820071	(.32) .7	(44.45) 17.5	X		
17D	CLOCK - ELECTRIC	820071	(.11) .25	(49.78) 19.6	X		
18D	ALTERNATE STATIC AIR SOURCE	820252	(.14) .31	(46.99) 18.5	X		
19D							
20D							

EQUIPMENT LIST

MO. 12
DAY 10
YEAR 91

J-EQ-E1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MARK IF INSTLD		
	E. MISCELLANEOUS SYSTEMS						
1E	VACUUM SYSTEM INSTL.	860052	(2.58) 5.68*	(25.88) 10.19	X		
	VACUUM PUMP	860052	(1.5) 3.4	(-12.7) -5.0	X		

EQUIPMENT LIST

J-EQ-F1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MO. 12 DAY 10 YEAR 91 MARK IF INSTLD
	F. CABIN ACCOMMODATIONS				
1F	SUN VISORS	130291	(.32) .71	(83.82) 33.0	X
2F	SAFETY HARNESS (INERTIAL REEL) FRONT (SET OF 2)	140214	(2.27) 5.0	(194.26) 76.48	X
3F	SAFETY BELT ASSY, REAR OCCUPANT (2)	140262	(1.36) 3.0	(180.34) 71.0	X
4F					
5F					
6F					
7F					
8F					

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C/M 643

EQUIPMENT LIST

J-EQ-G1

					MO.	12	1	
					DAY	10	2	
					YEAR	91	92	
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MARK IF INSTLD			
	G. AVIONICS, AUTOPILOT'S & MISC.							
1G	~~KING KX-165~~	~~810150~~	~~5.7~~	~~+14.38~~	X			
2G	~~KING KX-165~~	~~810150~~	~~5.7~~	~~+14.38~~	X			
3G	~~KING KI-202~~	~~810150~~	~~1.3~~	~~[illegible]5.0~~	X			
4G	KING KMA-24	810150	1.7	+19.0	X			
5G	KING KR-87 w/ KI-227	810150	5.9	+49.54	X			
6G	KING KN-62A	810150	2.6	+15.0	X			
7G	~~KING KT-76A~~	~~810150~~	~~2.4~~	~~+14.6~~	X			
8G	~~TERRA ENCODER~~	~~810150~~	~~.5~~	~~+12.0~~	X			
9G	KING KCS-55A w/KI-525A	810150	11.34	+66.46	X			
10G	KING KAP-150	810150	23.2	+75.0	X			
11G	NAT AA80 "INTERVOX"	810150	.7	+17.0	X			
12G	WX-900 STORMSCOPE	FAA 337	4.36	+89.5		X		

SUPERSEDED AVIONITEC CH.145.0180

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EQUIPMENT LIST

J-EQ-G2

					MO.	10	12	04
					DAY	10	11	03
					YEAR	91	97	14
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MARK IF INSTLD			
	G. AVIONICS, AUTOPILOT'S & MISC. (con't)							
13G	~~KING KLN-89B GPS~~		3.3	+14.7			X	
14G	KING KA-92 GPS ANTENNA		.3	+83.6			X	
15G	~~MD-41 CONTROL/ANNUNCIATOR~~		2.5	+17.05			X	
16G	~~WIRING~~ -GPS		3.0	+22.55			X	
17G	Garmin Mode S XPDR GTX 330		4,2	14,6				
18G	Sandia Alt. Digitizer SAE 5-35		0,9	12,0				
19G	Garmin NAV/COM/GPS #1 GTN 650		7,0	15,0				X
20G	Garmin NAV/COM #2 GNC 255A		4,0	15,0				X
21G	King NAV 2 Indicator KI-209		1,2	16,0				X
22G	Garmin GPS Antenna GA 35		0,3	83,6				X
23G								
24G								

SUPERSEDED AVIONITEC CH.145.0181

AVIONITEC AG
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EASA.145.181
25.10.06

Häfliger C/M 643
AVIONITEC AG CH.145.0181

EQUIPMENT LIST

MO. 12
DAY 10
YEAR 91

J-EQ-H1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT POUNDS	ARM (Cm)	ARM INCHES	MARK IF INSTLD		
	H. AUXILIARY EQUIPMENT								
1H	TOW BAR (STOWED)	010001	(1.03)	2.28	(242.57)	95.5	X		
2H	JACK POINTS (STOWED) (3 EA)	010000	(.10)	.21	(302.26)	119.0	X		
3H	WING TIE DOWN RINGS (STOWED) (2)	010002	(.10)	.21	(302.26)	119.0	X		
4H	FUEL SAMPLER CUP (STOWED)	610010	(.04)	.09	(302.26)	119.0	X		
5H	ENGINE OPERATOR'S MANUAL	010026	(.35)	.77	(302.26)	119.0	X		
6H	AIRCRAFT P.O.H./A.F.M.	010026	(.84)	1.86	(302.26)	119.0	X		
7H	CARGO 'D' RINGS	010027	(.04)	.09	(302.26)	119.0	X		
8H	CARGO RESTRAINT BELTS	140233	(.27)	.6	(302.26)	119.0	X		
9H									
10H									
11H									
12H									

EQUIPMENT LIST

J-EQ-I1

MO. 12
DAY 10
YEAR 91

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT POUNDS	ARM (Cm)	ARM INCHES	MARK IF INSTLD
	I. OPTIONAL EQUIPMENT						
1I	OXYGEN SYSTEM INSTL. 115.7 cu. ft. (COMPOSITE)	870029	(14.16)	31.21	(317.50)	125.0	
2I	CURTAINS	950163	(1.32)	2.90	(162.56)	64.0	
3I	HEADREST ASSY.- FRONT	140267	(1.57)	3.47	(114.30)	45.0	X
4I	HEADREST ASSY. - REAR	140313	(1.57)	3.47	(203.20)	80.0	X
5I	AUX. POWER RECEPTACLE - INSTL.	950268	(1.48)	3.27	(332.74)	111.0	X
6I	AUX. POWER CABLE ADAPTER	880042	(3.43)	7.57		***	
7I	BRAKE INSTL., DUAL	850112	1.61	3.55	(38.10)	15.0	
8I	FIRE EXTINGUISHER INSTL.	950251	(1.20)	2.65	(153.67)	60.5	X
9I	FIXED STEP ASSY	840071	(1.24)	2.75	(274.32)	108.0	X
10I	PROPELLER DE-ICE BOOTS	690001	(2.64)	5.93	(-78.36)	-30.85	
11I	SEAT, PILOT, VERTICAL ADJUST. (STD) NET CHG.	140215	+(1.79)	+3.94		**	
12I	SEAT, CO-PILOT, VERTICAL ADJUST.	140215	(+1.79)	+3.94		**	

** - ARM WILL VARY WITH SEAT POSITION BETWEEN STA. 34.0 IN. (86.4 Cm) AND 39.0 IN. (99.1 Cm)
*** 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

MO.	12	
DAY	10	
YEAR	91	

J-EQ-I2

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MARK IF INSTLD		
	I. OPTIONAL EQUIPMENT (con't.)						
13I	RUDDER PEDAL EXTENSION	720115	(.06) .13	(38.10) 15.0	X		
14I	OXYGEN REFILL HOSE ADAPTER	870025	(2.04) 4.5	***			
15I	G-METER	820172	(.34) .76	(280.67) 110.5			
16I	STANDBY VACUUM PUMP INSTL.	860060	(5.44) 12.0	(249.94) 98.4	X		
17I	WING TIP RECOGNITION LIGHTS	210410	(.60) 1.32	(134.62) 53.0	X		
18I	TOW BAR (FOLDING)	010034	(1.03) 2.28	(242.57) 95.5			
19I	BEACON INSTL., FLASHING	800351	(.48) 1.06	(426.72) 168.0			
20I	INBOARD ARM REST INSTL.	140295	(.95) 2.1	(87.63) 34.5	X		
21I	SEAT, PILOT, VERTICAL ADJUST. (SPECIAL EDITION) NET	140235	9+1.79) +3.94	**	X		
22I	SEAT, CO-PILOT, VERTICAL ADJUST. CHG. (SPECIAL EDITION)	140235	(+1.47) +3.94	**	X		

** ARM WILL VARY WITH SEAT POSITION BETWEEN STA. 34.0 IN. (86.4 Cm) AND 39.0 IN. (99.1 Cm).
*** 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.

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EQUIPMENT LIST

J-EQ-I3

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MARK IF INSTLD		
				MO.	12	04	
				DAY	10	03	
				YEAR	91	14	
	I. OPTIONAL EQUIPMENT (con't.)						
23I	DESCENT RATE CONTROL (VAC)	950155	(5.59) 12.32	(177.80) 70.0			
24I	WINDSHIELD DEFROSTER BLOWER INSTL.	640314	(.46) 1.02	(11.43) 4.5	X		
25I	AVIONICS COOLING BLOWER	810414	(.68) 1.5	(5.08) 2.0	X		
26I	DESCENT RATE CONTROL (ELECTRIC)	950271	(5.8) 12.8	(177.8) 70.0			
27I	SKYMAP	810218	(8.71) 19.2	(141.3) 55.63			
	Power Flarm Core		0.4	11,8		x	
	FLarm Display Aboba V4		0,2	19		x	
	ADS-B Antenna CI-105		0,3	141,1		x	
	FLARM Top Antenna GAV868		0,3	100,1		x	
	FLARM Bottom Antenna GAV868		0,3	141,1		x	

EQUIPMENT LIST

J-EQ-I4

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MARK IF INSTLD MO.	MARK IF INSTLD DAY	MARK IF INSTLD YEAR
	I. OPTIONAL EQUIPMENT (con't.)						

EQUIPMENT LIST

J-EQ-I4

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg) POUNDS	ARM (Cm) INCHES	MARK IF INSTLD MO.	MARK IF INSTLD DAY	MARK IF INSTLD YEAR
	I. OPTIONAL EQUIPMENT (con't.)						

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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-canti- lever-laminar-flow type. The airfoil varies from a NACA 63_2-215 at the wing root to a NACA 64_1-412 at the wing tip. 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 provide pitch attitude trim. The tricycle landing gear allows maximum taxi vision and ground maneuvering. Hydraulic disc 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. Electric trim is optional.

Wing Flaps

The wing flaps are electrically operated and interconnected through push-pull tubes and bellcranks. Total flap area is 17.98 square feet (1.67 sq. m). Nominal travel is 0 to 33 degrees and limit switches prevent travel above or below these limits. The flap position is controlled by a pre-select switch located on the lower control console. Also located on the control console is a flap position indicator which shows which pre-select position has been selected: full up, takeoff (15 degrees) or full down position. 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.

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, stabilizer and cowl flap position indicators are on the lower center console.

FLIGHT PANEL & INSTRUMENTS

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

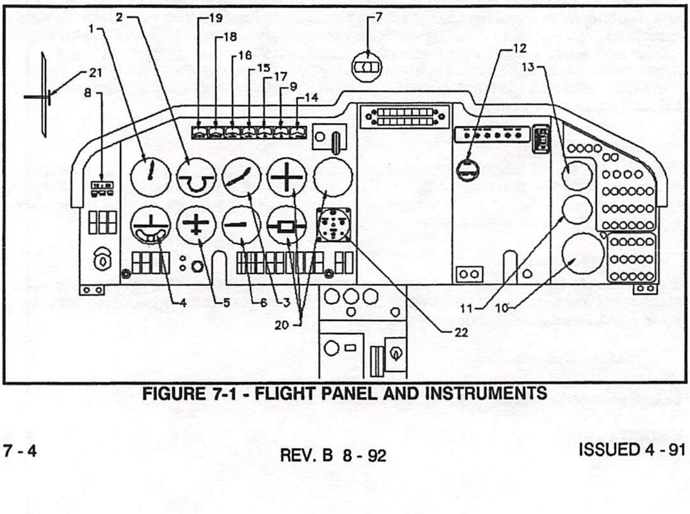

FIGURE 7-1 - FLIGHT PANEL AND INSTRUMENTS

1. **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.

2. **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.

3. **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.

4. **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".

5. **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.

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

7. **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.

8. **CLOCK. (Mechanical Clock -Optional)**
The electric, digital, panel mounted clock, may be used/set by the following procedures:.
Three buttons are located below the digital face of the clock and identified as START/STOP, CLEAR & MODE.
Normal or Elapsed time.
MODE - Push to switch from normal time to elapsed time.
START/STOP - Push to start or stop seconds when in elapsed time mode.
CLEAR - Push to reset elapsed time to Zero.
Set Hours, Minutes or 24 vs 12 hour time
Push and Hold bot START/STOP & CLEAR buttons for 4-5 second to enter clock mode; 12 H or 24 H will flash.

Push both START/STOP & CLEAR buttons three (3) times more to select either 12 or 24 hour mode.
Push CLEAR to select hours (hours flashing/minutes blank) or minutes (hour steady/minutes flashing) for setting.
Push START/STOP to increase either hours or minutes until desired time is set.
In 12 H mode set PM (P) if necessary.
Push MODE to return to normal time.

9. **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 electrical system. The instrument is calibrated in degrees F.

10. **TACHOMETER -MECHANICAL (STANDARD).**
The standard tachometer is a mechanical instrument that is driven from a geared pad on the engine accessory case by means of a cable enclosed within a housing. The instrument is calibrated in revolutions per minute (RPM).
10.**TACHOMETER- ELECTRIC (OPTIONAL)**
An electric meter which counts pulses generated by a hall effect generator dirven by the tachometer pad. The instrument is calibrated in revolutions per minute (RPM).

11. **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.

12. **HOUR METER (LOCATIONS MAY VARY)**

13. **EGT GAUGE.**
A thermocouple probe in No. 3 exhaust pipe transmits temperature variations to the indicator which serves as a visual aid during leaning. Exhaust gas temperature varies with fuel-air ratio, manifold pressure and RPM.

14. **AMMETER. (Push for Volts)**
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 being appied 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 of the battery.

15. **OIL PRESSURE GAUGE.**
The electric oil pressure gauge uses a transducer which varies resistance with pressure as reference.

16. **FUEL PRESSURE GAUGE.**
The fuel pressure gauge is of the electric type and uses a transducer as reference. It is calibrated in pounds per square inch and indicates the pressure to the fuel injector.

17. **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 degrees F.

18 & 19. **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(Liters Optional) of fuel.

20. **AVIONICS/RADIO INSTRUMENTS**
Refer to SECTION IX for the description of the radio configuration installed in this aircraft.

21. **OAT GAUGE (WINDOW MOUNTED-STANDARD) (PANEL MOUNTED - OPTIONAL)**
The OAT gauge provides free stream outside air timperature in ° C.

22. **INTER-COM SYSTEM (if installed)**(Various systems may be installed)

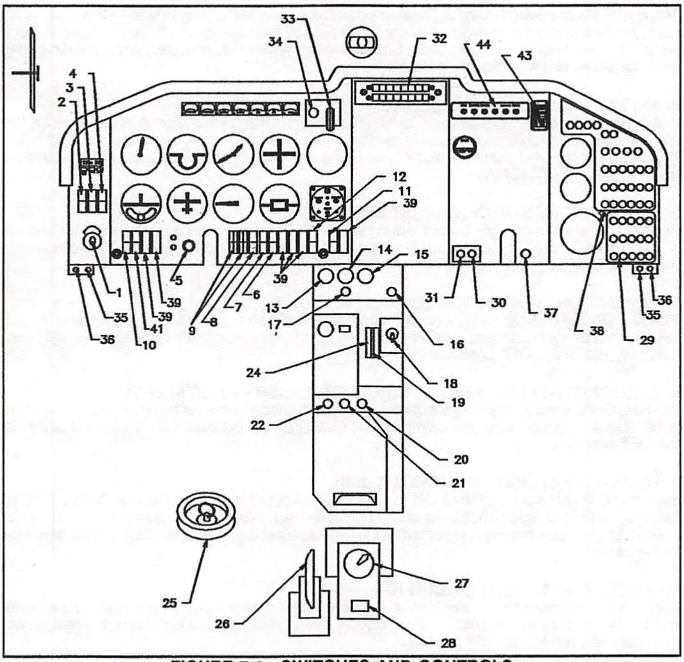

FIGURE 7-2 - SWITCHES AND CONTROLS

SWITCHES AND CONTROLS

1. **MAGNETO/STARTER SWITCH**
The magneto/starter switch combines both ignition and starting functions. Turning ignition key clockwise through R, L, and BOTH to START position and then pushing forward on the key and receptacle engages the starter. Releasing the key when the engine starts allows the switch to return, by spring action, to the BOTH position. 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 or BOTH position, both magnetos are hot and the ignition system is ON.

2. **MASTER SWITCH**
The Master Switch operates the battery relay which controls battery power to the main ship bus bar. This switch cuts the alternator field power from main bus to the alternator. This switch also cuts off all ship power except the electric clock and cabin light rocker switches (or if equipped, door light switches).

3. **ALTERNATOR FIELD SWITCH**
This switch controls the alternator field power from main bus and Master Switch to the alternator.

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

5. **ALTERNATE STATIC SOURCE VALVE**
Pulling alternate static source valve to full aft position changes the source of static air for the altimeter, airspeed indicator and rate-of-climb indicator from outside of the aircraft to cabin interior. Airspeed and altimeter readings are affected slightly when alternate static source is used (Refer to SECTION V).

6. **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 automatically trip to the OFF position.

7. **NAVIGATION LIGHT SWITCH/CIRCUIT BREAKER**
Pushing ON the navigation light combination 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.

8. **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.

9. **TAXI/LANDING LIGHT SWITCHES (L & R)**
Select and PUSH split switches ON to turn desired set of lights on. Push switches OFF to turn desired set of lights off. Lights should be operated only for short time periods while not in flight to preclude overheating of lamp. Overload protection is achieved by circuit breakers in the panel.

10. **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.

11. **OPTIONAL/ELECTRIC TRIM SWITCH/CIRCUIT BREAKER (IF INSTALLED)**
This switch is normally left in the ON position and serves as both a circuit protector and as a master disconnect for the electric trim system in the event of a malfunction.

12. **FUEL BOOST PUMP SWITCH**
Pushing ON or OFF the switch/circuit breaker controls operation of the electric 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.

13. **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.

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 of RPM can be obtained by turning the knob clockwise to increase RPM and counterclockwise to decrease RPM. The knob should not be turned in any closer than 1/8" to the panel nut face.

15. **MIXTURE CONTROL**
The mixture control allows the pilot to adjust the fuel-air ratio (mixture) of the engine. Pushing the control forward richens the mixture. 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 to richen the mixture, and counterclockwise to lean. The knob should not be turned in any closer than 1/8" to the panel nut face.

16. **COWL FLAP CONTROL (MANUALLY OPERATED)**
Pull control aft to open cowl flaps for ground and climb operations unless temperature is cooler than normal. An intermediate position is available during cruise flight (approx. three inches aft) to keep engine temperatures in normal operating range if necessary.

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

17. **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.

18. **WING FLAP SWITCH**
The wing flap switch, in a recess on the right of the console, operates the electrically actuated wide span wing flaps. The flap switch incorporates a pre-select feature for TAKEOFF and FULL DOWN positions. Move switch down to first detent position to obtain TAKEOFF flaps (15°). Move switch to full down position to select FULL DOWN flaps (33°). When flap switch is moved UP to either TAKEOFF position or FULL UP position the flaps will retract to the selected position.

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Placing switch in the UP position retracts the flaps completely.

19. **WING FLAP POSITION INDICATOR**
Wing flap position is mechanically indicated via a cable mounted directly to the flap jackshaft. A pointer in the flap position indicator, on the console, indicates selected flap position. The intermediate mark in the pointer range is the flap TAKEOFF setting (15°).

20. **CABIN VENT CONTROL (FRESH AIR)**
Pulling the cabin vent control opens valve in air box (located on firewall) to allow cooling air from right side cabin air inlet duct on airplane to enter cabin through console distribution duct. Optimum use of the cabin vent control is described in the Cabin Environment Section.

21. **CABIN HEAT CONTROL**
Pulling the cabin heat control routes heated air into cabin. 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.

22. **DEFROST CONTROL**
Pulling the defrost control decreases air flow to the lower cabin and increases air flow to the windshield in the front of the glareshield area. Optimum use of the defrost control is described in the Cabin Environment Section. The optional blower motor switch is activated when the control is pulled aft. This turns on a fan within the ventilation system to move more air over the windshield.

23. **NOT USED.**

24. **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. Electric trim is optional.

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

26. **TRIM CONTROL WHEEL**
Rotating trim control wheel forward lowers the nose; rearward rotation raises the nose of the aircraft.

27. **FUEL SELECTOR VALVE**
The fuel selector valve located on the floorboard is a three-position valve which allows 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.

28. **GEAR DOWN POSITION INDICATOR (FLOORBOARD)**
The illuminated gear-down position indicator at the back of fuel selector pan, aft of center console, has two marks that align when the landing 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.

29. **CIRCUIT BREAKER PANEL (C/B positions may vary)**
Push-to-reset and push-pull circuit breakers automatically break the electrical current flow if a system receives an overload.

30. **RADIO LIGHT SWITCH AND DIMMER**
Turning radio light switch knob clockwise turns the radio and indicator lights ON. Continued turning clockwise increases light intensity. This control also operates the internal instrument lights.

31. **PANEL LIGHT SWITCH AND DIMMER**
Turning panel light switch knob clockwise turns the instrument lights located in the glareshield ON. Continued turning clockwise increases light intensity.

32. **ANNUNCIATOR PANEL**
See description of functions elsewhere in this Section.

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

|NOTE|

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

34. **GEAR SAFETY OVERRIDE SWITCH (GR SAFETY BY PASS)**
The gear safety override switch is a manual means of electrically by-passing the Airspeed Safety Switch. In the event the landing gear switch is inadvertently placed in the gear-up position, the gear Airspeed Safety Switch prevents the gear being retracted before takeoff speed of approximately 60 +/-5 KIAS is reached. To retract landing gear at a lower airspeed, the GR SAFETY BY PASS switch may be pressed until landing gear is completely retracted.

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~ CAUTION ~

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

35. MICROPHONE JACK

36. HEADSET JACK

37. CIGAR LIGHTER

38. POST LIGHT

39. SPARE LEGEND
USED FOR SWITCHES AS NEEDED FOR OPTIONAL AIRCRAFT CONFIGURATION.

40. NOT USED

41. STANDBY-VACUUM (if installed)

42. NOT USED

43. ELT SWITCH

44. OPTIONAL SWITCH PLACARD (TYPICAL)

ANNUNCIATOR AND SWITCH PANELS

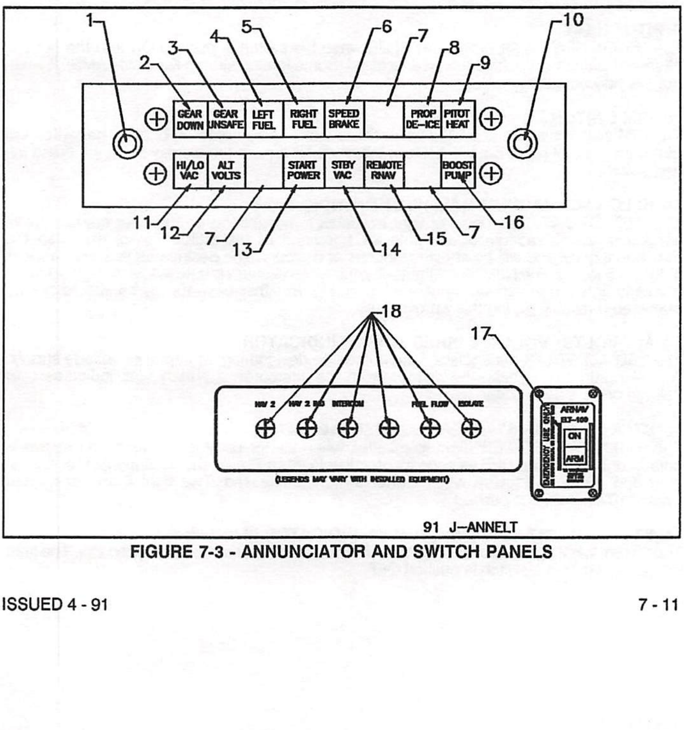

FIGURE 7-3 - ANNUNCIATOR AND SWITCH PANELS

1. **PRESS-TO-TEST SWITCH**
Press RED press-to-test switch (3-5 sec.) with Master Switch ON to illuminate annunciator light bulbs (some annunciator legends may not be active, see descriptions below). Defective bulbs should be replaced prior to flight.

2 & 3. **GEAR DOWN and GEAR UNSAFE - GEAR SAFETY INDICATORS**
The GREEN "GEAR DN" light and a RED "GEAR UNSAFE" light provide visual landing gear position signals. The green light (GEAR DN) shows continuously when the gear is fully extended. With the navigation lights on, the GEAR DN light is dim for night operation. All landing gear lights are out when the gear is fully retracted. The GEAR UNSAFE light is on during transition between landing gear fully extended and landing gear fully retracted position.

4 & 5. **LEFT FUEL and RIGHT FUEL - FUEL LOW INDICATORS**
LEFT and/or RIGHT, RED, FUEL LOW annunciator light comes on when there is a 2-1/2 to 3 gallons (9.5 to 11.4 liters) of useable fuel remaining in the respective tanks. The Press to Test Switch must be held for 3-5 seconds for Low Fuel Warning circuit to activate.

6. **SPEED BRAKE (If Installed)**
The "SPEED BRAKE" light is illuminated AMBER when the wheel mounted switch has been pushed once to the ON position and will go out when the switch is pushed a second time to the OFF position. The speed brakes should deploy UP in the ON position and return to the flush position when pushed OFF. The speed brakes may be vacuum or electrically operated depending upon the system installed.

7. **SPARE LEGENDS**
Used for optional equipment as needed for aircraft configuration.

8. **PROPELLER DE-ICE (If Installed)**
The "PROP DE-ICE" light is illuminated BLUE when the rocker switch is pushed ON. The light will cycle ON & OFF as the system cycles and will go out when the switch is pushed OFF.

9. **PITOT HEAT**
The "PITOT HEAT" light illuminates BLUE when the switch is pushed ON and the heating element inside the pitot heat tube is energized. Some foreign aircraft illuminate AMBER when not ON and operating.

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. **HI/LO VAC - VACUUM MALFUNCTION INDICATOR**
The RED HI/LO VAC annunciator light indicates a malfunction or improper adjustment of vacuum system. Vacuum is available for operation of the attitude gyro, and also the directional gyro, and will be shown in inches of mercury. The designated vacuum range is 4.25 to 5.5 in. Hg. The HI/LO VAC light will blink when vacuum is below 4.25 in. Hg and gives a steady light when vacuum is above 5.5 in. Hg. In either case the gyros should not be considered reliable during this warning time.

12. **ALT VOLTS - VOLTAGE IRREGULARITY INDICATOR**
The RED ALT VOLTS annunciator light comes on designating an improper voltage supply. A blinking light designates no voltage from the alternator; a steady light indicates over voltage or a tripped voltage relay.

13. **START POWER - STARTER ENGAGED INDICATOR**
The RED "START POWER" light illuminates when starter relay is activated and starter is engaged. Shut engine OFF as soon as practicable. Start Power should illuminate for engine start and MUST extinguish when starter switch is released. This light illuminates when Press-to-Test switch is pushed.

14. **STBY VAC - STAND-BY VACUUM ON INDICATOR (If Installed)**
The "STBY VAC" light is illuminated AMBER when the rocker switch is pushed ON. The light will go out when the switch is pushed OFF.

15. REMOTE RNAV - REMOTE AREA NAVIGATION (If RNAV installed)
The "REMOTE RNAV" light is illuminated AMBER anytime the DME is not slaved to the RNAV.

16. BOOST PUMP
Illuminates BLUE when electrical power is supplied to auxiliary fuel boost pump for normal takeoffs and landings and when ON due to failure of engine driven fuel pump.

17. EMERGENCY LOCATOR TRANSMITTER (ELT) SWITCH
The ELT switch manually activates the emergency locator transmitter located in the tailcone. Reference should be made to the Emergency Locator Transmitter description in this section for proper and lawful usage of ELT. Switch configuration (and location may vary).

GROUND CONTROL

NOSE GEAR STEERING

The nose gear steering system consists of the steering horn on the gear leg linked to the rudder pedal torque tube by push-pull tubes and bellcranks. Gear retraction automatically disengages steering mechanism from nose wheel and centers nose wheel for entry into 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 aircraft. Care must be used to not swivel nose wheel beyond 14 degrees from center. Adjustable steering stops are incorporated on nose gear leg assembly.

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~ CAUTION ~
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Exceeding steering 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 leg attaching points pivot in bearing surfaces on forward and stub 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 a 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 on the left hand, forward side panel, is incorporated in the electrical system to prevent landing gear retraction while on the ground and until a safe takeoff speed is reached, (approximately 60 +/-5 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 assist in holding 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 manually holding this switch bypasses the airspeed safety switch and allows the gear to retract.

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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 parking brake control on console sets the brakes. Pushing parking brake control forward releases the brakes.
It is not advisable to set parking brake when 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

A manual landing gear extension mechanism is provided to allow emergency lowering of landing gear. The control mechanism is located between and aft of pilot and co-pilot seats. The red lever must be released and pulled up (aft) to disengage actuator gear from the electric drive mechanism 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) landing gear condition lights, GREEN for "GEAR DOWN" and RED for "GEAR UNSAFE", and 2) a warning horn activated when the gear is not down-and-locked and throttle is approximately 1/4 inch from idle position. The green light shows continuously when gear is fully extended. The red light shows whenever the gear is in transit or not locked down but is off when gear is fully retracted. A visual gear-position indicator, located on floorboard, aft of fuel selector, shows when landing gear is down when 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 nose wheel well. The minimum turning radius on the ground is 41 feet (12.3 m). Adjustable steering stops have been incorporated on nose gear leg assembly.

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The nose wheel must not be swiveled beyond 14° 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 15.3 cubic feet (.43 cu. m) of baggage or cargo space. A maximum of 120 pounds (54 Kg) may be loaded in this area. There are two pairs of floor tiedown straps provided. Children should not be allowed to occupy this space. Additional cargo space is available by removing rear seat bottom cushion and seat back cover (fold seat back forward and slide cover up and off frame; store as desired). To fold rear seat back down, pull lock pin (left side frame). Pull seat frame from pivot rods. Place pivot rods into portion of seat frame that carpet is attached to. Slide frame down until approximately bottomed out. Pull seat back release handle UP to move catch down. Pivot seat back forward and down into seat cushion cavity. Both seats can be folded down together or independent of each other.
The hat rack compartment is restricted to 10 pounds (4.5 Kg).

CARGO RESTRAINT

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

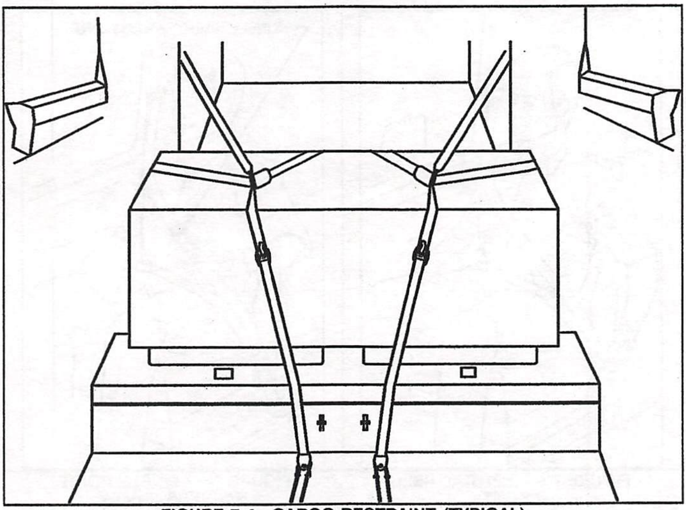

FIGURE 7-4 - CARGO RESTRAINT (TYPICAL)

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~ CAUTION ~
~ ~ ~ ~ ~ ~

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

SEATS

The front seats are individually mounted and may be adjusted fore and aft to fit individual comfort preferences. The front seat back may be adjusted by turning hand crank until seat back is in desired position.
Both optional front seat configurations allow vertical seat height adjustment by turning a hand crank or knob 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° to 40° recline position.

SEAT BELTS/SAFETY HARNESS

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. Inertial reel restraint systems are provided for the front seat occupants. Single point adjustment seatbelt/shoulder harnesses are provided for rear seat occupants. All restraint systems **MUST** be fastened for take-off and landing operations.

The single diagonal type inertial reel harness is designed so the chest strap crosses diagonally from the out-board shoulder to a point as low on the inboard hip as possible and then across occupant's lap. 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 comfortably tight as the inertial reel mechanism allows necessary belt length out to attach to buckle point on inboard side of seat. As a result the body is restricted from rolling out toward the unrestricted shoulder, or "open" side of the harness, upon forward impact.
Refer to Figure 7-5 & 7-6 for proper seat belt/harness adjustment.

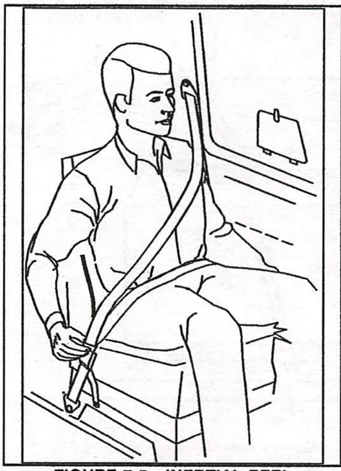


FIGURE 7-5 - INERTIAL REEL (FRONT)

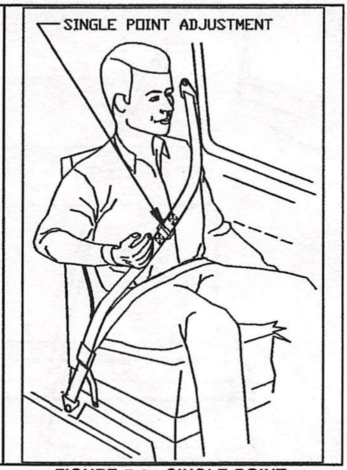


FIGURE 7-6 - SINGLE POINT HARNESS (REAR)

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

EMERGENCY EXITS

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

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 red handle**. To verify re-engagement of latching mechanism; open outside handle fully, close inside handle to engage pin in cam slide of latch mechanism; insert locking pin into hole of clip/pin assembly to hold red handle down. Replace ABS cover. Operate outside handle in normal method.

ENGINE

GENERAL

The engine installed in this aircraft is an TEXTRON-Lycoming Model IO-360-A3B6D. The IO-360 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

Engine controls are centrally located, between pilot and co-pilot, on engine control console. The THROTTLE control regulates manifold pressure. Pushing the BLACK knob forward increases the manifold pressure; pulling the knob aft decreases the manifold pressure.
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. 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 types and fine adjustments can be made by turning knobs clockwise or counter-clockwise. Vernier controls should not be turned closer than 1/8" to the panel nut face. Rapid or large adjustments can be made by depressing button on end of control knob and reposition control as desired
The throttle has an integral friction device.

The STANDARD cowl flaps are mechanically actuated and may be positioned either FULL OPEN or FULL CLOSED for ground operations or partially opened to a trail position, during cruise, to maintain oil and cylinder head temperatures within their normal operating ranges. This may be accomplished by PULLING the control AFT approximately three inches.

The OPTIONAL cowl flaps are electrically actuated and may be placed in any position from FULL OPEN to FULL CLOSED to maintain oil and cylinder head temperatures within normal operating ranges. This may be accomplished by placing cowl flap switch, located under the mixture control, in the UP or DOWN position. Observe the position indicator, located on the center console below wing flap switch, until the desired position is obtained and then return cowl flap switch to CENTER or OFF position.

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 mechanical tachometer operates by a cable/housing assembly mechanically linked to an adapter on engine case. Electric tachometer is optional.

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 selecting 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 required limits. Servicing of the engine should be accomplished by qualified personnel. Refer to current TEXTRON-Lycoming Overhaul and Service Manuals and Bulletins.

The engine receives a run-in operation before leaving the factory. 75% power should be used for the first 25 hours to correctly condition the cylinder walls. Mineral oil (MIL-C-6529 Type II) should be used for the first oil & filter change period (25 Hours). Continue to use mineral oil for **50 operating hours** or until oil consumption stabilizes, then change to oil conforming to Lycoming Specification 301F.

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 system with an 8 quart (7.6 liters) capacity. A conventional dip stick is provided for determining the oil quantity.

An automatic bypass temperature 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 ignition switch to start and pushing in closes the starter solenoid, engages starter and allows impulse coupling to automatically retard the magneto until the engine is at its retard firing position. The spring action of the impulse coupling is then released to spin the rotating magnet and produce the spark to fire the engine. After engine starts, the impulse coupling fly-weights do not engage due to centrifugal action. The coupling then acts as a straight drive and the magneto fires at 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 starter in excess of 30 seconds or re-engage starter without allowing it time to cool.

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

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

AIR INDUCTION SYSTEM

Should the induction air filter clog, a spring-loaded door in the induction system will open, by induction vacuum, to allow alternate air (warm cowling air) to enter the engine. Refer to Figure 7-7 for illustration.

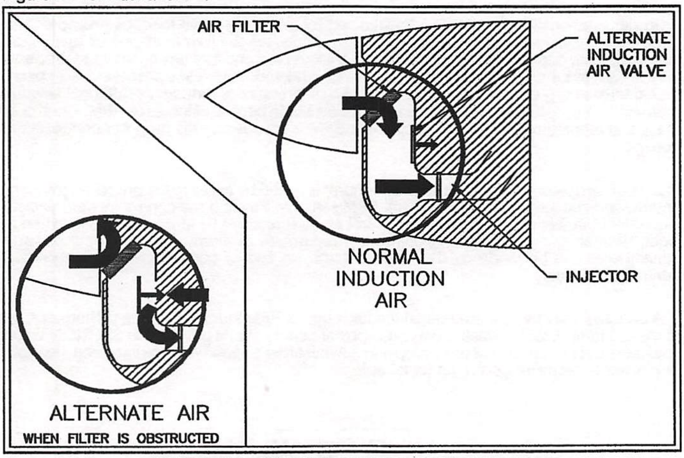


FIGURE 7-7 - ENGINE AIR INDUCTION SYSTEM

ENGINE COOLING

The down-draft engine cooling system provides ground and inflight power plant cooling. Engine baffling directs air over and around cylinders and out cowl flap openings. Opening the cowl flaps allows proper air flow on the ground and during low-speed high-power climbs. On standard configuration pull cowl flap control AFT to open cowl flaps. Manual cowl flaps can be partially opened, during cruise, to a trail position, if necessary, to maintain oil and cylinder head temperature within normal operating range. Optional electric cowl flaps can be opened to any position between full closed and full open for proper cooling.

ENGINE STARTING SYSTEM

Engine starting is provided by a 24 volt (12 volt-optional) starter. Ignition is provided by impulse coupled magnetos. A starter engaged warning light (START POWER) is incorporated as standard equipment in the annunciator panel.

ACCESSORIES

VACUUM PUMP

An engine-driven vacuum pump supplies suction for vacuum-operated gyroscopic flight instruments. Air entering vacuum-powered instruments is filtered; hence, sluggish or erratic operation of vacuum-driven instruments may indicate that a clogged vacuum filter 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 28 volt, 70 ampere alternator (14 volt, 70 amprere alternator - Optional)

PROPELLER

The propeller is an all metal, two blade, constant speed, governor regulated unit. Constant propeller rotational speed (RPM) is maintained by a balance of air load, oil pressure 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 acting on a piston and spring increase propeller blade pitch, thus decreasing propeller and engine RPM. As oil pressure is reduced, centrifugal twisting moments on propeller blades decrease propeller blade pitch and increase RPM. Control of these and other forces to maintain a constant RPM is provided by the propeller control in the cockpit.

The BLUE propeller control (with vernier feature) is linked by cable to the propeller governor and determines a wide range of in-flight RPM settings. Pushing the control forward selects higher RPM (lower pitch). Pulling the control aft selects lower RPM (higher pitch). When in flight, RPM should not fluctuate significantly, regardless of throttle setting. Rapid or large adjustments can be made by depressing button on end of control knob and reposition control as desired.

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 power setting charts provided in SECTION V. On cold days during run-up, exercise propeller several times to flow warm oil into propeller hub. This assures propeller governing for takeoff.

FUEL SYSTEM

Fuel is carried in two integrally sealed sections of forward, inboard area of wing. Total usable fuel capacity is 64 gallons (242.4 liters)(53.3 Imp. Gal.). Both tanks have fuel level indicators (tabs) 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 valve handle, aft of 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 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.

Electro/mechanical 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 (if installed) is presented digitally and indicates volume of fuel being used in GPH (pounds or liters optional), total fuel used or fuel remaining or time remaining. Optional fuel flow systems are available and each depicts information differently. Refer to appropriate operational procedure for specific data. A "Fuel Flow Memory" switch is located on the panel to shut off memory circuit if aircraft is to be stored for long periods of time.

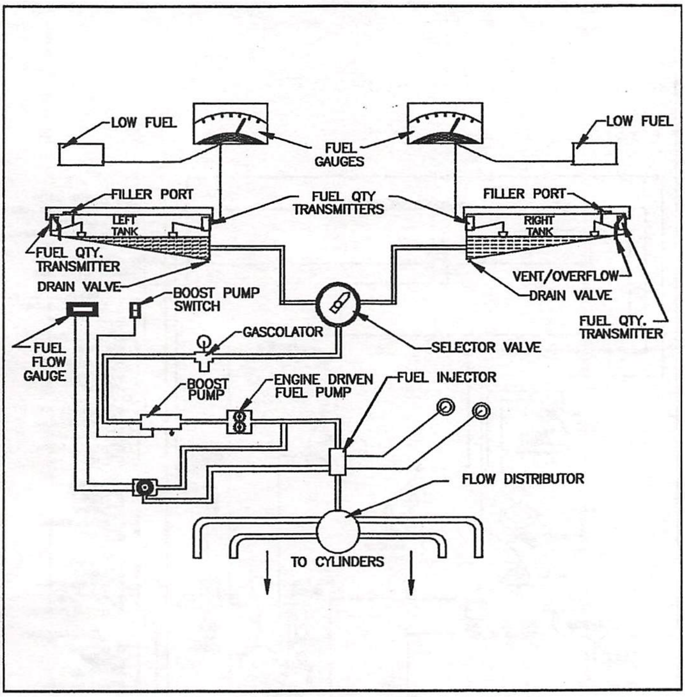


FIGURE 7-8 - FUEL SYSTEM SCHEMATIC

ELECTRICAL SYSTEM

ALTERNATOR & BATTERY

A 24 volt/10-ampere-hour (12 volt/35 ampere-hour optional) storage battery (in the tailcone) and a 28 volt/70 ampere (14 volt/70 ampere-optional) self-rectifying alternator supply electrical power for equipment operation. The ammeter depicts battery charge/discharge rate. Low or "zero" alternator output will be shown as a discharge reading on the ammeter. A discharged battery will be indicated by 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 voltage is low.

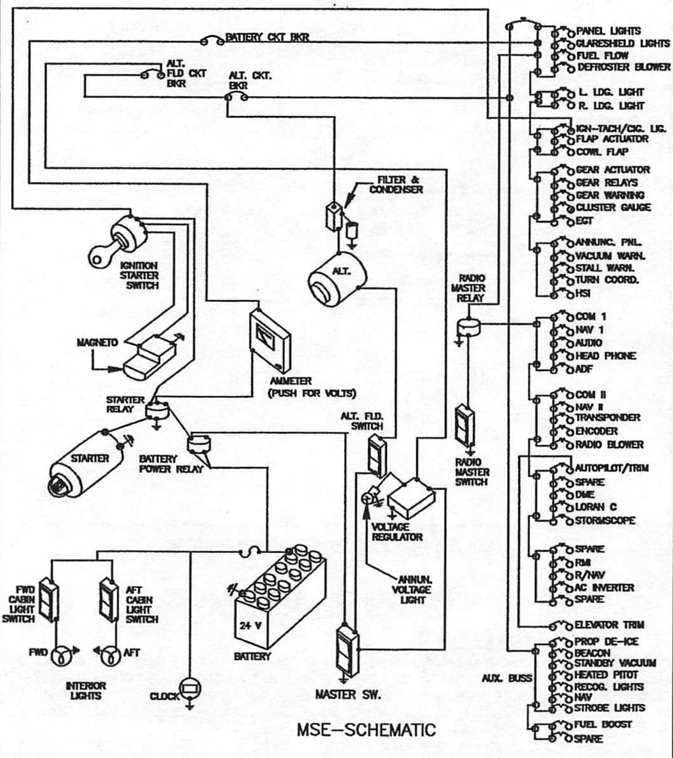
~ ~ ~ ~ ~ ~

~ CAUTION ~

~ ~ ~ ~ ~ ~

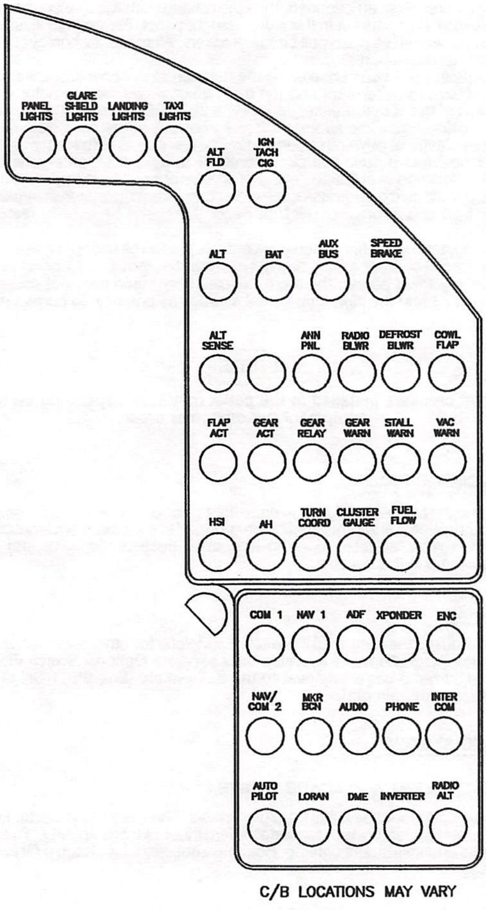
Starting with an external power source should not be done while the battery is completely depleted. It will not accept the high charge rate from the alternator and electrical failure may result.

SCHEMATIC (SEE FIGURE 7-9)



28 volt electric system shown - Optional 14 volt electric schematic will vary. Refer to applicable master schematic in Service and Maintenance Manual for specific information.

FIGURE 7-9 M20J ELECTRICAL SCHEMATIC



Standard circuit breaker panel depicted - Optional circuit breaker panel may vary in shape as well as in location of C/B's for each aircraft configuration.

FIGURE 7-10 - CIRCUIT BREAKER PANEL (POSITIONS VARY)

CIRCUIT BREAKER PANEL (SEE 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 alternator and the main buss. Since the alternator is incapable of output in excess of the circuit breaker 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 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 regulator output voltage exceeds limits, the red voltage warning light illuminates steadily and the alternator field circuit breaker will trip. Reset the circuit breaker to restore alternator power.
The overvoltage annunciator light should extinguish. If overvoltage light comes on again, the alternator-field circuit breaker will trip and cut alternator output. 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 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 lights, vacuum warning light, starter engaged light and various optional equipment lights are grouped in standard annunciator panel. A test switch and dim switch, are also found in the panel. Each of the lights and switches are discussed elsewhere in this section.

ELT PANEL

The ELT Panel houses the remote ELT Switch. Provisions for other switches, as required for optional avionics installations are available on a separate Optional Switch Placard located on the upper right radio panel adjacent to the ELT switch. (See SECTION IX for Avionics Systems installed in this aircraft).

LIGHTING SYSTEM

INSTRUMENT & PLACARD LIGHTS

All placards are floodlighted by lights from glareshield. There are two rheostat knobs on right hand radio panel. The left control regulates intensity of placard lighting. The right control provides avionic and instrument lighting. Rotating knobs clockwise turns ON and increases light intensity.

MAP LIGHT

The map light switch is located on top of pilot's control wheel (co-pilot's optional).

CABIN LIGHTING

Four headliner light positions illuminate cabin. The forward lights are controlled by a BRIGHT-OFF-DIM switch located in headliner above co-pilot. The rear lights are controlled by another BRIGHT-OFF-DIM switch located overhead.

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

The cabin light rocker switches are connected directly to battery.

EXTERIOR LIGHTING

Conventional navigation and high intensity strobe lights are installed on wing tips and on rudder trailing edge. The landing/taxi lights are installed in wing leading edges (left and right sides). All exterior lights are controlled by rocker type switches on lower right hand portion of pilots panel.

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 wing tips for use as desired or when requested by ATC.

CABIN ENVIRONMENT

HEATING & VENTILATION SYSTEMS

Four ventilating systems provide cabin environmental conditions that can be regulated to individual pilot and/or passenger preferences.

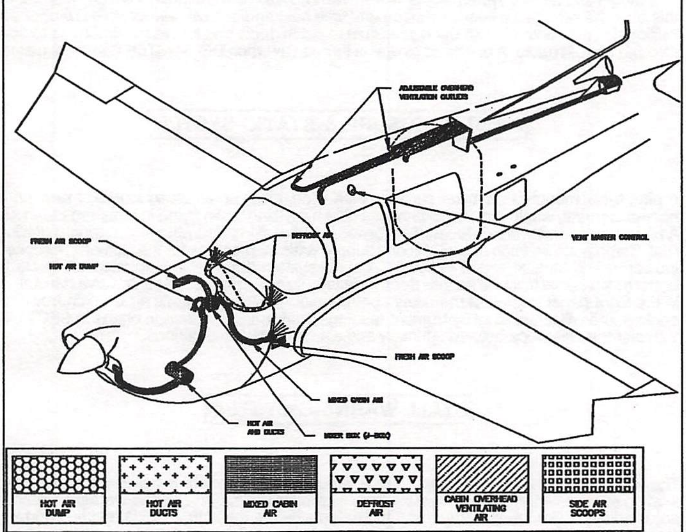


FIGURE 7-11 - CABIN AIR FLOW

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

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

CABIN HEAT - Fresh air, heated by engine exhaust muff, and cool air from air duct on co-pilot side can be individually controlled and mixed to desired temperatures by use of Cabin Heat and Cabin Vent controls. Pulling CABIN HEAT control supplies heat to cabin and defroster system. Hot and cold air may be mixed by adjusting both heat and vent controls. These controls may be adjusted anywhere between full open and full closed. Cabin heat will be more effective when cowl flaps are closed.

OVERHEAD VENTILATION - The cabin overhead ventilating system works independently of cabin heating and ventilating system. Fresh air enters a NACA duct on 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.

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 heat and/or fresh air controls are opened. Pulling defrost control full aft decreases flow to cabin ducts and forces maximum air to flow through defrost ducts. A defroster blower is turned ON when DEFROSTER control is pulled.

PITOT PRESSURE & STATIC SYSTEM

A pitot tube, mounted on lower surface of left wing, picks up airspeed indicator ram air. A heated element, within pitot head prevents pitot tube icing when flying in moisture-laden air. A pitot system drain valve is located on forward bottom skin of left wing just outboard of wing fillet. Static ports on each side of tailcone supply static air pressure for the altimeter, airspeed indicator, and vertical speed indicator. A static system drain valve is located on fuselage bottom skin below tailcone access door. An alternate static pressure source valve is installed in the flight panel just 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 5 to 10 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 radio access panel on left side of 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 battery is drained to depletion or until switch is manually moved to "OFF" position. The "ARM" position is selected when 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 or FCC representative (or other applicable Authority) or in accordance with current regulations. Test transmission should be kept to a minimal duration. Testing of ELT should be conducted only during the first five (5) minutes after any hour and no longer than three (3) audible sweeps.

The ELT should be checked during 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.

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INTRODUCTION

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

It is recommended that all aircraft undergo a complete inspection (ANNUAL) each twelve calendar months. In addition to the required ANNUAL inspection, aircraft operated commercially (for hire) should have a complete inspection every 100 hours of operation. All inspections must be performed by a designated representative of the FAA or the Aviation Authority of the country in which the aircraft is licensed..

The FAA may require other inspections by the issuance of Airworthiness Directives applicable to the airplane, engine, propeller and other components. It is the responsibility of the owner/operator to ensure compliance with all applicable airworthiness directives and recommended "MANDATORY" Mooney Aircraft Service Bulletins/Instructions. When inspections are repetitive the owner/operator should take appropriate steps to prevent inadvertent non-compliance.

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

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

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

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

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

Service & Maintenance, Illustrated Parts and Service Bulletin/Service Instruction Manuals may be obtained for your airplane from your Mooney Service Center.

Avionics and Navigation Systems information should be obtained from applicable manufacturers.

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

GROUND HANDLING

TOWING

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

(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° either side of center. Exceeding turn limits shown on 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 out board 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

Integrally sealed tanks, in the forward inboard sections of the wing, carry the standard fuel. With aircraft standing on level ground, service each fuel tank after flight with 100 octane or 100LL 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 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 octane or 100 LL.

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

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

Allow five minutes after refueling for water and sediment to settle in the tank and fuel 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 as loose equipment for obtaining fuel samples. To collect a fuel sample, insert the cup actuator prong in the sump drain receptacle; push upward to open the valve momentarily; drain fuel into the cup. If water is in 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 is on the cabin floor forward of the pilot's seat. To flush the gascolator sump and lines leading from the wing tanks to the selector valve, turn selector handle to the left, and pull fuel drain valve (ring) for about five seconds. Repeat procedure for the right tank, being sure that the fuel drain valve is returned to the closed position and that the drain valve is not leaking.

ENGINE LUBRICATION

Operate the new engine at full power within the limitations given in SECTION II.

|NOTE|

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

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 top cowling. Any lubricating oil, either mineral or compounded, must conform with TEXTRON-Lycoming Specification No. 301F to be acceptable for use in engines. New or newly overhauled engines should be operated on aviation grade 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 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 mineral oil for several hundred hours, a change to additive oil should be undertaken with caution.

If engine is in extremely dirty condition, switching to additive oil should be deferred until after engine has been overhauled. When changing from mineral oil to additive or compounded oil after several hundred hours of operation on 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 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 TEXTRON-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° F	SAE 60	SAE 60
Above 60° F	SAE 50	SAE 40 or SAE 50
30° to 90° F	SAE 40	SAE 40
0° to 70° F	SAE 30	SAE 30, SAE 40 or SAE 20W-40
0° to 90° F	------	SAE 20W-50
Below 10° F	SAE 20	SAE 30 or SAE 20W-30

Refer to the latest edition of TEXTRON-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

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 a nozzle pressure greater than 100 PSI.

   d. After cleaning, inspect filter and gasket for damage. Discard a ruptured filter or broke 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° F (82° 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.

GEAR & TIRES

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 approximately 12 inches manifold pressure.

BATTERY

The 24 volt/10-ampere-hour (12 volt/35 ampere hour - optional) 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, check terminals and connectors for corrosion. Add distilled water to each battery cell as necessary; keep the fluid at one-quarter inch over the separator tops. Check the fluid specific gravity for a reading of 1.265 to 1.275. A recharge is necessary when the specific gravity is 1.240 or lower. Start charging at four amperes and finish at two amperes; do not allow battery temperature to rise above 120°F. during recharging. Keep the battery at full charge to prevent freezing in cold weather and to prolong service life.

~ CAUTION ~

The alternator and voltage regulator operates 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 area with a solution of baking soda and water. Do not allow soda to enter the battery cells. Keep cable connections clean and tightly fastened, and keep overflow 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 (5 cm) below 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 (0.3 cm). 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 exterior, be certain 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 acrylic. An anti-static acrylic 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.

~ CAUTION ~

Never use denatured alcohol, benzene, carbon tetrachloride, acetone, or gasoline for cleaning acrylics or interior plastics. Carefully follow 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.

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SUPPLEMENT INSERTED	DATE
AA80 "INTERVOX" INTERCOM SYST.	0108.90
KING 150 SERIES FCS	08.05.85
STAND BY VACUUM PUMP INST.	04-25-90
MTV-12-B/180-17 PROPELLER	02-22-94
~~KING KLN-89B GPS~~	~~11-02-98~~
BF Goodrich WX-900 STORMSCOPE	07-01-91
SHADIN Miniflo-L DFMS	
Garmin GTN 650	

SUPPLEMENT INSERTED	DATE

INTRODUCTION

This Section contains **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 in SECTION VII.

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MOONEY AIRCRAFT CORPORATION
P.O. BOX 72
KERRVILLE, TEXAS 78029-0072

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

Mooney Aircraft Models

M20J, M20K, M20L, M20M

WITH

AA80 "InterVOX" Intercom System

REG. NO. N9139V

SERIAL NO. 24-3240

This Supplement must be attached to the applicable FAA Approved Pilot's Operating Handbook and Airplane Flight Manual (POH/AFM) when the AA80 InterVOX Intercom System, is installed in accordance with Mooney Drawing number 810417 (M20J & M20K), 810202 (M20L & M20M). The information contained herein supplements or supersedes the basic manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Airplane Flight Manual.

FAA APPROVED: Henry A Armstrong

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

Date: 1-8-90

MOONEY AIRCRAFT CORPORATION

P. O. BOX 72
Kerrville, Texas 78029-0072

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date

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

SECTION I - GENERAL

The AA80 intercom system provides one central control for all aircraft audio, allowing existing radio and entertainment audio to be mixed with live or voice activated intercom audio. Boom microphone control is also provided for two places (pilot & co-pilot), with pilot's control having priority. Muting of the entertainment audio is provided during ICS or TX operation. An emergency/isolation mode is also provided for the pilot.

Control over radio receive level (internal), transmit sidetone level (internal), music level (internal), intercom level (front panel), and VOX threshold (front panel) is provided. The vox threshold or squelch also allow for a "live" mode, by defeating the squelch, and allowing continuous ICS operation.

Operation of the ICS is transparent, allowing transmit during any ICS mode simply by use of the TX PTT switch.

SECTION II - LIMITATIONS

The AA80 intercom system imposes no limitations on the original airframe or other systems.

SECTION III - EMERGENCY PROCEDURES

The AA80 intercom system does not affect the emergency procedures of the aircraft.

Refer to the following for emergency procedures for the AA80 intercom system.

EMERGENCY OPERATION

If power is lost to the AA80 for any reason, it will drop into the power-fail mode and the pilot will be connected directly to the radios for emergency operation. The external PTT switch will still function. This mode is similar to the "PILOT ISOLATE" mode, except that all co-pilot & passenger functions are lost since they depend on external power. A power failure has occurred when the panel indicator fails to light under any condition.

If a catastrophic relay failure of the AA80 should occur or the rear connector becomes loose or disengaged, the designated emergency hand microphone and headset jacks will allow operation to continue, as they have no connection directly through the AA80.

The "PILOT ISOLATION" mode requires no power and will operate even if other circuitry should fail in the AA80.

NOTE

During this mode the co-pilot's microphone IS NOT locked out and he could transmit if necessary; however he will NOT BE ABLE TO RECEIVE the incoming audio.

All aspects of emergency operation should be confirmed to be working by the pilot before accepting the aircraft into service. This can be accomplished by pulling the intercom circuit breaker during the pre-takeoff ground check to turn all power OFF from the AA80 and checking operation per procedures above.

SECTION IV - NORMAL PROCEDURES

SELECTION OF TRANSMIT FUNCTIONS

Keying the external TX PTT switch activates the AA80 for transmit with the pilot's switch having priority in normal or "INTERVOX" mode. Proper TX operation is annunciated by a green light on the front of the AA80.

Sidetone is normally heard from the radio(s) connected to the AA80, but if not available, an internal potentiometer will adjust the level of artificial sidetone generated within the AA80 system for the pilot's convenience.

NOTE
This artificial sidetone is only available through the amplifier in the AA80 and will be lost to the pilot in the "PILOT ISOLATION" mode, but will be heard by the passenger(s).

SELECTION OF RECEIVE FUNCTIONS

Receive audio is always enabled through the AA80 and has a separate internal adjustment to allow balancing of this level to suit the pilot''s preference and equalize iso/normal operation.

An additional input is provided for entertainment audio (tapes,etc.) with a separate level adjustment. This line is muted during transmit functions and when the intercom is active.

If the "ISO" function is selected, the pilot will be connected directly to the radios, while the co-pilot and rear seat passenger(s) remain on the ICS bus with the entertainment audio. In the "INTERVOX" mode all stations hear the same audio.

ICS FUNCTION

Intercom audio may be generated in two modes between users, "live" (on constantly) or "VOX" (voice activated). This is selected, along with the squelch threshold of the VOX circuit, by the "VOX SQUELCH" control on the front of the AA80. When the VOX trigger is activated, the front panel indicator will light up amber, indicating that the ICS system is ON.

Intercom level or volume is set by the "ICS VOLUME" control on the front of the AA80. It does not affect the level of other audio within the system.

ICS functions are available to all users when the system switch is in the "INTERVOX" mode. When switch is in the "PILOT ISOLATION" mode, only the co-pilot and the passenger(s) have ICS capability.

SECTION V thru X

No change to these Sections when the AA80 intercom system is installed except that the weight and balance information will require updating.

MOONEY AIRCRAFT CORPORATION
P. O. Box 72
Kerrville, Texas 78029

LOG OF REVISIONS

Revision Number	Revised Pages	Description of Revision	FAA. Approved*	Date
B	(General Pages) ALL	Reformatted entire Supplement per King's Revision #3 and 4. Revised data to agree with new illustration nos.	C. L. Stoner	8/5/85
	(Specific Pages) 1,3,6,10,19, 20,21,24,26, 27,28,29	Corrected data, Revised data		

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

*Calvin L. Stoner, Mgr., Airplane Certification Division

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. N9139V

SER. NO. 24-3240

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 30 1981

Revision B
Date: 8/5/85

MOONEY MODELS M20J & M20K

FAA APPROVED

AUTOPILOT FLIGHT MANUAL SUPPLEMENT

006-0396-01

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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 as described in Figure 1.

The 150 Series AFCS has an 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 successfully preflight tested.

The following conditions will cause the Autopilot to automatically disengage:

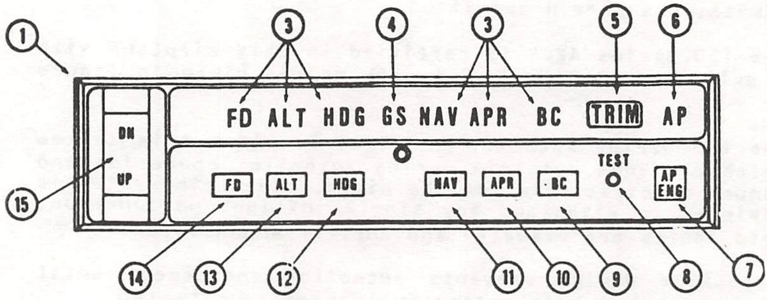
A. Power failure.

B. Internal Flight Control System failure.

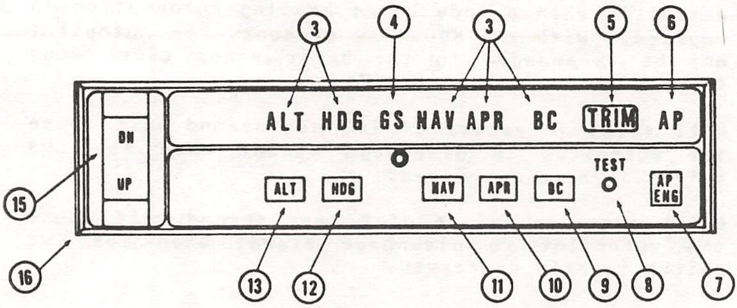
C. With the KCS 55A Compass System, a loss of compass valid (displaying HDG flag) disengages the Autopilot when a mode using heading information is engaged. With the HDG flag present, the Autopilot may be re-engaged in the basic wings level mode along with any vertical mode.

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.

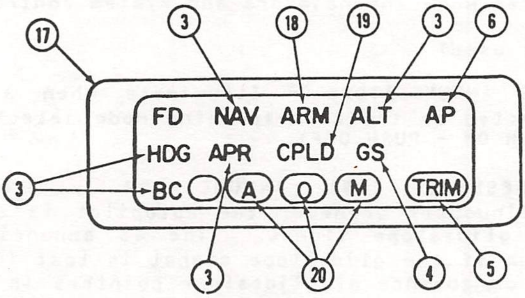


KC 192 AUTOPILOT & FLIGHT DIRECTOR COMPUTER

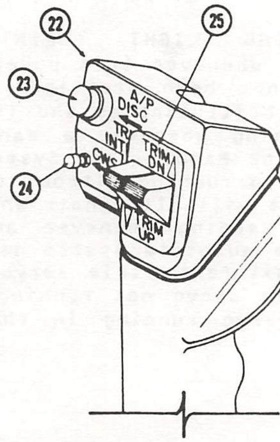


KC 191 AUTOPILOT COMPUTER

FIGURE 1 KING 150 AUTOPILOT SYSTEM CONTROLS AND INDICATORS



KA 185 REMOTE MODE ANNUNCIATOR
(OPTIONAL)



AUTOPILOT CONTROL WHEEL SWITCH CAP

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

SECTION I
GENERAL

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

2. (Not used)

3. MODE ANNUNCIATORS - Illuminate when a mode is selected by the corresponding mode selector button (PUSH ON - PUSH OFF).

4. GLIDESLOPE (GS) ANNUNCIATOR - 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.

5. TRIM WARNING LIGHT (TRIM) - Illuminates continuously whenever trim power is not on or the system has not been preflight tested. THE TRIM warning light illuminates and is accompanied by an audible warning whenever a manual trim fault is detected. The Manual Trim System is monitored for the Trim Servo running without a command. The TRIM warning light will illuminate and be accompanied by an audible warning 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.

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

6. AUTOPILOT (AP) ANNUNCIATOR - 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).

7. AUTOPILOT ENGAGE (AP ENG) BUTTON - When pushed, engages autopilot if all logic conditions are met. When pushed again, disengages autopilot.

8. 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, 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 autopilot preflight tests are successfully passed.

9. 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.

10. 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° (with 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 on the Autopilot Computer will flash until the automatic capture sequence is initiated. On the KA 185 Remote Mode Annunciator, APR ARM will annunciate until the automatic capture sequence is initiated. At beam capture, APR CPLD will annunciate.

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

11. 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° (with DG), automatic beam capture and tracking of VOR, RNAV or LOC signals. The NAV annunciator on the Autopilot Computer will flash until the automatic capture sequence is initiated. On the KA 185 Remote Mode Annunciator, NAV ARM will annunciate until the automatic capture sequence is initiated. At beam capture, NAV CPLD will annunciate.

12. 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 22°. Selecting HDG mode will cancel NAV, APR or BC track modes.

13. 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.

14. FLIGHT DIRECTOR (FD) MODE SELECTOR BUTTON - When Pushed will select the Flight Director mode (with KC 192 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.

15. 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 about 500 fpm; when not in ALT will adjust pitch attitude at a rate of .7 deg/sec.

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Will cancel GS couple. The aircraft must pass through the glideslope again to allow GS recouple.

16. KAP 150 SYSTEM KC 191 AUTOPILOT COMPUTER - Complete Autopilot computer, including system mode annunciators and system controls.

17. KA 185 REMOTE MODE ANNUNCIATOR (OPTIONAL) - Provides mode annunciation in the pilots' primary scan area as well as three Marker Beacon lights.

18. ARMED (ARM) ANNUNCIATOR - Illuminates continuously along with NAV or APR when either the NAV or APR mode selector button is depressed. The ARM annunciator will continue to illuminate until the automatic capture sequence is initiated at which time ARM will extinguish and CPLD will annunciate.

19. COUPLED (CPLD) ANNUNCIATOR - Illuminates continuously along with NAV or APR at the initiation of automatic beam capture sequence in either the NAV or APR modes. Normally the CPLD condition follows an ARM condition but may be entered into directly if the beam capture criteria is met when NAV or APR is selected.

20. REMOTE MARKER BEACON LIGHTS - Remote Airway, Outer and Middle Marker Beacon lights driven by the Marker Beacon receiver.

21. (Not used)

22. AUTOPILOT CONTROL WHEEL SWITCH CAP - Switch assembly mounted on the pilot's control wheel associated with the autopilot and manual electric trim systems.

23. AUTOPILOT DISCONNECT/TRIM INTERRUPT (A/P DISC/TRIM INTER) Switch - When depressed will disengage the autopilot and cancel all operating Flight Director modes. When depressed and held will interrupt all

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

electric trim power (stop trim motion), disengage the autopilot and cancel all operating Flight Director modes.

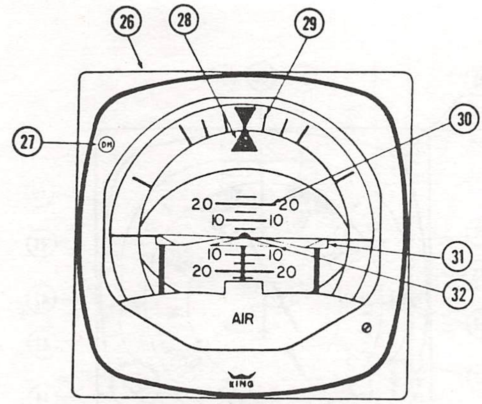
24. CONTROL WHEEL STEERING (CWS) BUTTON - When depressed, allows pilot to manually control the aircraft (disengages the pitch and roll servos) without cancellation of any of the selected modes. Will engage the Flight Director mode if not previously engaged. Automatically synchronizes the Flight Director/Autopilot 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.

25. 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 coperate in the desired direction. When the autopilot is engaged, operation of the manual electric trim will automatically disconnect the autopilot.

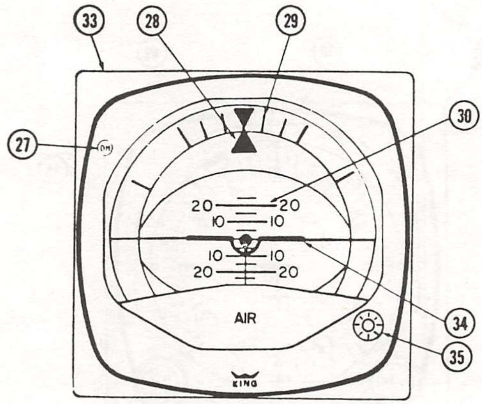
26. KI 256 FLIGHT COMMAND INDICATOR (FCI) - Displays airplane attitude as a conventional attitude gyro and displays commands for flight director operation. The gyro is air driven.

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

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

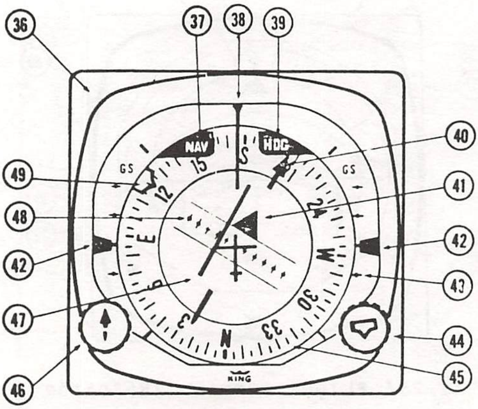


KI 256 FLIGHT COMMAND INDICATOR

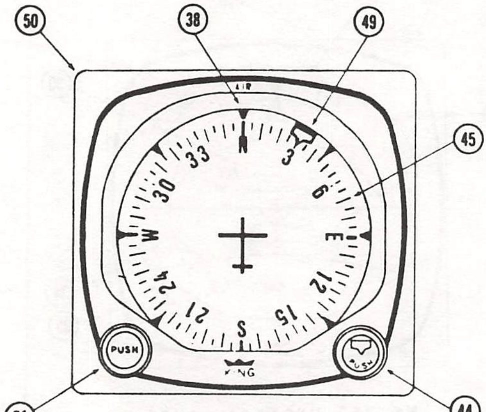


KG 258 VERTICAL GYRO

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

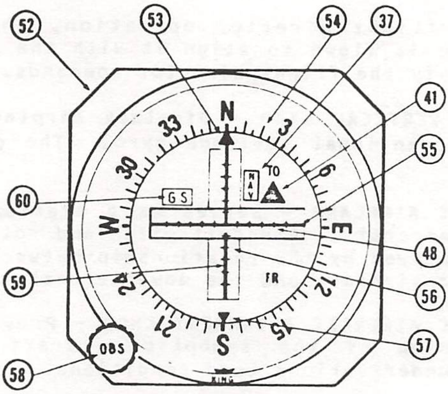


KI 525A HSI



KG 107 DG

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS



KI 204/206 VOR/LOC/GS INDICATOR

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

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

30. 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.

31. 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.

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

32. 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.

33. KG 258 VERTICAL GYRO - Displays airplane attitude as a conventional attitude gyro. The gyro is air driven.

34. 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.

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

36. 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.

37. 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.

38. LUBBER LINE - Indicates aircraft magnetic heading on compass card (45).

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

39. 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 Autpoilot may be re-engaged in the basic wings level mode along with any vertical mode. The CWS switch would be used to manually maneuver the aircraft laterally.

40. COURSE BEARING POINTER - Indicates selected VOR course or localizer course on compass card (45). The selected VOR radial or localizer heading remains set on the compass card when the compass card (45) rotates.

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

42. DUAL GLIDESLOPE POINTERS - Indicate on glideslope scale (43) aircraft displacement from glideslope beam center. Glideslope pointers in view indicate a usable glideslope signal is being received.

43. 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.

44. HEADING SELECTOR KNOB () - Positions heading bug (49) on compass card (45) by rotating the heading selector knob. The Bug rotates with the compass card.

45. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (38) on HSI or DG.

46. COURSE SELECTOR KNOB - Positions course bearing pointer (40) on the compass card (45) by rotating the course selector knob.

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

47. COURSE DEVIATION BAR (D-BAR) - The center portion of omni bearing pointer moves laterally to pictorially 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.

48. 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.

49. HEADING BUG - Moved by knob (44) to select desired heading.

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

51. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (45) 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.

52. KI 204/206 VOR/LOC/GLIDESLOPE INDICATOR - Provides rectilinear display of VOR/LOC and Glidelope deviation.

53. COURSE INDEX - Indicates selected VOR course.

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

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

56. GLIDESLOPE SCALE - Indicates displacement from glideslope beam center. A glideslope deviation needle displacement of 5 dots, represents full

FIGURE 1 KING 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

scale (0.7°) deviation above or below glideslope beam centerline.

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

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

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

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

FIGURE 1 KING 150 AUTOPILOT SYSTEM CONTROLS AND INDICATORS

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

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. (THE AUTOPILOT AND MANUAL ELECTRIC TRIM WILL BE INOPERATIVE).

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 pilot's 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 or CWS button.

7. AP ENG Button - PRESS to engage autopilot.

8. Flight Controls - 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/P DISC/TRIM INTER switch - PRESS.

2. Inflight 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.

CAUTION

DO NOT HELP THE AUTOPILOT AS THE AUTOPILOT WILL RUN THE PITCH TRIM TO OPPOSE YOUR HELP.

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 about 500 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.

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 (unless HDG not selected) 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 approac 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 (unless HDG not selected) and APR flashing; when the computed capture point is reached the HDG annunciator will go out, the APR annunciator will illuminate steady and the selecte 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 BC and APR annunciators 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.

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 t dots: the autopilot w... annunciate HDG (unless HDG not selected) and BC modes with APR flashing; when the computed capture point is reached the HDG annunciator will go out, the BC and APR annunciators 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 BC and APR annunciators 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 OCC' 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.

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/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

No change.

SECTION VI THRU X

No change.

MOONEY AIRCRAFT CORPORATION

P.O. Box 72

Kerrville, Texas 78028

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

MOONEY AIRCRAFT MODELS

M20J (14 Volt or 28 Volt) Aircraft
M20K (14 Volt or 28 Volt) Aircraft

WITH

STANDBY VACUUM PUMP INSTALLATION

MODEL NO. M20J

REG. NO. N9139V

SERIAL NO. 24-3240

This supplement must be attached to the applicable FAA Approved Airplane Flight Manual and/or Pilots Operating Handbook (AFM/POH) when the Standby Vacuum Pump is installed in accordance with Mooney Drawing Number 860060. The information contained herein supplements the information of the basic AFM/POH.

FAA APPROVED: James D. [illegible]

for Don P. Watson, Manager
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LOG OF REVISIONS

Revision Number	Revised Pages	Description of Revision	FAA Approved*	Date
	Title Page	Revised Data		
A	2 of 6	Revised and added data		
	4 of 6	Revised Graph to reflect 28,000 ft. values	C L Stone	1-6-86
B	Title Page	Revised Data Added 28 Volt App. for M20J A/C.	C L Stone	6/12/86
C	Title Page	Added Rev. C revision.	M.M. Cooley	4/25/90
	2 of 6 3 of 6	Revised Data to limit effectivity.		

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

*Don P. Watson, Manager, Airplane Certification Division

STANDBY VACUUM PUMP INSTALLATION

SECTION I - GENERAL

The standby dry air vacuum pump installation is designed to provide an alternate vacuum source for the attitude gyro and directional gyro instruments in the event of a malfunction in the primary engine driven vacuum pump system. The standby vacuum pump is driven by a DC electric motor, and the combination pump/motor assembly is mounted on the radio racks behind the aft cabin bulkhead in the tailcone. The standby pump can be operated at any time by activating a circuit breaker/rocker switch labeled "STBY VAC" mounted on the lower instrument subpanel in front of the pilot.⊛ A separate panel mounted amber annunciator labeled "STBY VAC ON" and a vacuum gage are provided for monitoring proper operation of the standby system. The vacuum gage will indicate vacuum, in inches of mercury, for both the engine driven pump when operating normally, and for the standby vacuum pump system.

⊛ M20J-S/N 24-0001 thru 24-3153 only
M20K-S/N 25-0001 thru 25-1224 only

SECTION II - LIMITATIONS

This supplement advises that use of the standby vacuum pump system may impose a limit on the installed equipment in operation.

NOTE

Weather radar will be inoperative with only the standby vacuum pump system in operation.

1. The maximum allowable continuous current drain for all optional electrical equipment in alternator equipped aircraft is 39.0 amperes, day flight, and 32.0 amperes, night flight (14V);46.0 amps day,& 36.0 amps night (28V).

CAUTION

If operation of optional electrical equipment exceeds these ratings, this equipment must be selected OFF to prevent exceeding the maximum allowed alternator load.

2. The standby vacuum motor will require 15 amps at sea level and 11 amps at 15,000 ft.(14V); 8 amps S/L & 6 amps 15,000 ft. (28V). This amperage reduction is basically linear as altitude increases.

⊛⊛ **CAUTION**

When standby vacuum pump system is activated the ammeter should be monitored for a current discharge indication. If a discharge is observed

⊛⊛ S/N's-M20J-24-0001 thru 24-2999,24-3154 thru TBA
-M20K-25-0001 thru 25-0999,25-1225 thru TBA

SECTION II - LIMITATIONS Cont...

⊛⊛ turn off any non-essential electrical equipment until a discharge indication no longer exists on the ammeter.

3. Placards.

CAUTION - When "STBY VAC" is ON - LOW VAC light inop.

Located adjacent to annunciator panel.

SECTION III - EMERGENCY PROCEDURES

Any time that the red "LOW VAC" annunciator flashes indicating the engine driven vacuum pump is providing insufficient vacuum for the gyro instruments, the standby vacuum pump system should be operated in the following manner:

1. "STBY VAC" switch - ON.
2. Flashing "LOW VAC" Annunciator - Verify EXTINGUISHED.
3. "STBY VAC ON" Annunciator - ILLUMINATED.
4. All non-essential electrical equipment - OFF.
5. Vacuum Gage - Monitor for proper standby vacuum pump operation.

NOTE

Minimum vacuum required for satisfactory gyro instrument operation is a function of aircraft pressure altitude. Use the graph on page 4 to verify adequate standby vacuum pump output for the particular operating altitude.

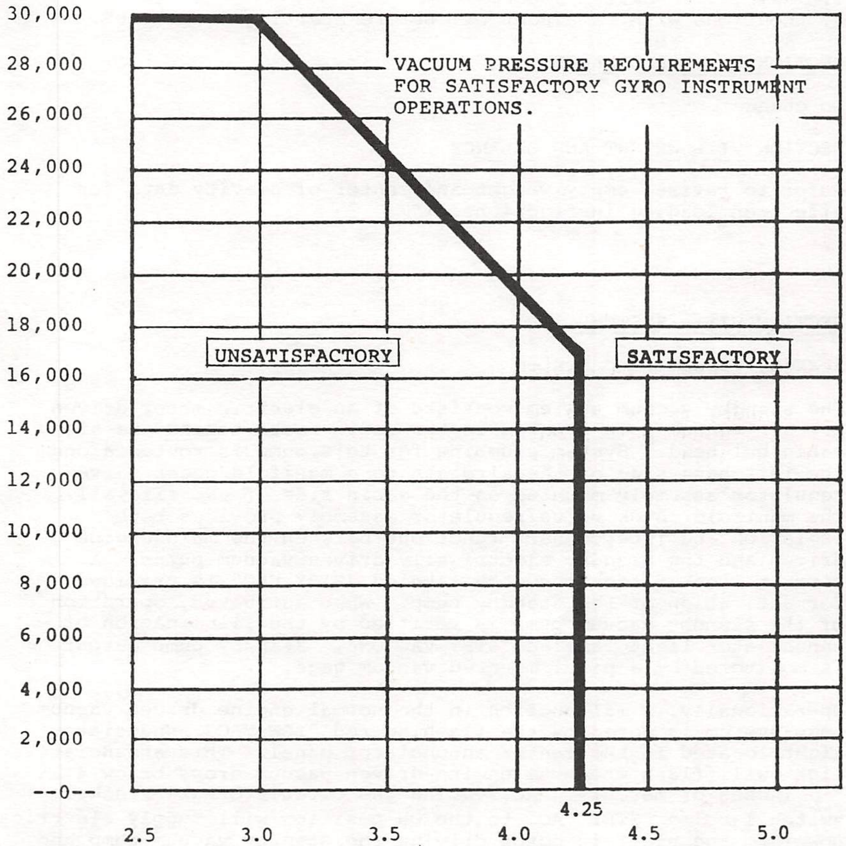
6. Continue flight and upon landing inspect engine driven vacuum pump system for cause of malfunction.

SECTION IV - NORMAL PROCEDURES

Before Starting Check

The following pre-engine start check should be performed on the standby vacuum system before each flight where use of standby system may be desired.

SECTION III -EMERGENCY PROCEDURES- cont. ...



SECTION IV - NORMAL PROCEDURES Cont...

1. Master Switch - ON.
2. "LOW VAC" Annunciator Light - FLASHING.
3. "STBY VAC" Switch - ON.
4. Flashing "LOW VAC" Annunciator Light -EXTINGUISHED
5. "STBY VAC ON" Annunciator Light - ILLUMINATED.
6. Vacuum Gage - Monitor for proper standby vacuum pump operation.
7. "STBY VAC" Switch - OFF.
8. Continue with remainder of "Before Starting Checklist".

SECTION V - PERFORMANCE

No change.

SECTION VI - WEIGHT AND BALANCE

Refer to revised empty weight and center of gravity data for effect on loading instructions.

SECTION VII - SYSTEMS

Standby Vacuum Pump System

The standby vacuum system consists of an electric motor driven dry air vacuum pump mounted in the radio racks behind the aft cabin bulkhead. System plumbing for this pump is routed along the left-hand side of the aircraft to a manifold/check valve/ regulator assembly mounted on the cabin side of the firewall. The manifold/check valve/regulator assembly provides both isolation and interconnect functions between the main engine driven and the standby electrically driven vacuum pumps. A circuit breaker/rocker switch labeled "STBY VAC" is provided for activation of the standby pump. When activated, operation of the standby vacuum pump is verified by the illumination of annunciator light labeled "STBY VAC ON". Standby pump output is monitored by a panel mounted vacuum gage.

Operationally, a malfunction in the normal engine driven vacuum pump system is noted by the flashing red "LOW VAC" annunciator light located in the center annunciator panel. This annunciator light will flash whenever engine driven vacuum drops below 4.25 $^{+.2}_{-.2}$ inches of mercury. Activating the circuit breaker/rocker switch labeled "STBY VAC" to the ON position will supply electrical power to the electric motor driving the standby vacuum pump and electrically extinguish the red flashing "LOW VAC" annunciator light. Verification of proper standby vacuum system operation is determined by the illumination of the amber "STBY VAC ON"

SECTION VII - SYSTEMS Cont...

annunciator and monitoring the panel mounted vacuum gage for adequate standby vacuum pump output.

The standby vacuum pump system can be used whenever a malfunction is suspected in the primary engine driven vacuum pump system. Should a short occur in the standby electrical system, the combination switch/circuit breaker will automatically trip to the OFF position.

SECTION VIII thru X

No change.

mt-propeller
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LBA I-C 66
I-EC 34

ANHANG ZUM FLUGHANDBUCH NR. E - 337

für die hydraulische Constant - Speed Propelleranlage

mit dem 3 - Blatt - Verstellpropeller

MTV-12-B/180-17

an MOONEY M 20 E (alle Werk-Nummern)

und MOONEY M 20 F (alle Werk-Nummern)

und MOONEY M 20 J (bis Werk-Nummer 24-3200)

STRAUBING, DEN 24.06.1992

02. JULI 1992

LBA - ANERKANNT : ....

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Anhang zum Flughandbuch Nr. E-337
für Mooney M20E, M20F, M20J
Ausgabe vom 24.06.1992

Dieser Anhang zum Flughandbuch gehört zum Flugzeug:

Kennzeichen : HB-DIC

Werk - Nr. : 24-3240

Baujahr : 1992

Kennblatt-Nr.: 555

22.2.94

LBA Luftfahrtgerät Lizenzierter Prüfer von Ausweis-Nr. 1086 Klasse 1

Dieser Anhang zum Flughandbuch enthält alle ergänzenden Informationen, die für den Betrieb des Flugzeuges mit der hydraulischen Constant-Speed Propelleranlage MTV-12-B/180-17 erforderlich sind.

Falls Flugzeuge Mooney M20J mit einer elektrischen Propeller-Enteisungsanlage ausgerüstet sind, ist der Anhang zum Flughandbuch Nr. E-209 zu beachten!

Die Angaben des Originalflughandbuches behalten weiterhin ihre Gültigkeit, sofern in diesem Anhang nichts anderes festgelegt!

ACHTUNG	Da die zulässige Dauerdrehzahl auf 2.500 U/min begrenzt ist, sind die Angaben im Original-Flughandbuch , die sich auf 2.700 U/min oder 2.600 U/min beziehen, ausgenommen die Startleistung, nicht anwendbar!

Straubing, den 24.06.1992

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LBA I-C 66
I-EC 34

Änderungsverzeichnis

Ausgabe: 24.06.1992 LBA-anerkannt:

Anzahl der gültigen Seiten: Seite 1 bis 5 und Deckblatt

Änderung Nr.	Seiten Datum	Art	LBA anerkannt
keine			

mt-propeller
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ABSCHNITT I:
Allgemeines

Zulässig ist die Ausrüstung mit dem hydraulisch verstellbaren 3-Blatt-Propeller MTV-12-B/180-17.

ABSCHNITT II:
Betriebsgrenzen

Propeller MTV-12-B/180-17:

Durchmesser: 180 cm
Kürzung auf 177cm für Reparaturzwecke zulässig

Blattwinkel: bei Referenzstation 63 cm gilt:
kleine Steigung: 13,0 ±0,2
große Steigung : 30,0 ±1,0

Drehzahlen: max. Startleistung (5 min): 2.700 RPM (149 kW)
max. Dauerleistung : 2.500 RPM (138 kW)

Drehzahlmessermarkierungen, geändert in:
Grüner Bogen: 1.500 RPM bis 2.500 RPM
Gelber Bogen: 2.500 RPM bis 2.700 RPM
Roter radialer Strich: 2.700 RPM (wie bisher)
Die für die 2-Blatt-Propeller gültigen Hinweisschilder entfallen.

Propellerregler: unverändert (nach Mooney Ausrüstungsliste)

Propeller-Spinner: MT-Propeller Nr. P-328 für M-20-E, -F
MT-Propeller Nr. P-285 für M-20-J
Das Flugzeug darf auch ohne Spinner betrieben werden. Dann auch Bleche an den Blattausschnitten abbauen.

Propeller-Enteisung: Nur bei der die Mooney M20J kann eine elektrische Propeller-Enteisungsanlage von Goodrich montiert werden. Der Einbau hat nach dem Goodyear-Manual 70-04-700() oder der Mooney Drawing No. 69 0000 zu erfolgen. Hinweise zum Betrieb sind im Anhang zum Flughandbuch Nr. E-209 enthalten.

ABSCHNITT III:
Notverfahren

Keine Änderungen

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ABSCHNITT IV:
Normale Verfahren

Mit dem Propeller MTV-12-B/180-17 gilt für Steig- und Reiseflüge die max. Dauerdrehzahl 2.500 U/min.

Die mit "Vorsicht" gekennzeichneten Angaben zum Sinkflug in den Original-Flughandbüchern treffen für den Propeller MTV-12-B/180-17 nicht zu.

ABSCHNITT V:
Flugleistungen

Zulässige Dauerdrehzahl mit dem Propeller MTV-12-B/180-17:
2.500 U/min.
Zulässige Startleistung (5min) mit dem Propeller MTV-12-B/180-17:
2.700 U/min

Die Tabellen für die Steigflugleistungen in den Original-Flughandbüchern gelten für den Propeller MTV-12-B/180-17 weiterhin, als Dauerdrehzahl ist jedoch 2.500 U/min einzustellen!

Die übrigen Angaben in Original-Flughandbuch sind weiterhin anzuwenden.

Lärm
Mit dem Propeller MTV-12-B/180-17 wird erhöhter Schallschutz erreicht.

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ABSCHNITT VI:
Gewicht- und Schwerpunktlage

Originalpropeller McCauley B2D34C214/90DHB-16E mit Enteisung	: 25,98 kg
Originalpropeller McCauley B2D34C214/90DHB-16E ohne Enteisung	: 24,68 kg
Der zugehörige Hebelarm ist	:-90,09 cm
Der Propeller MTV-12-B/180-17 (enteist) wiegt	: 22,20 kg
Der Propeller MTV-12-B/180-17 (nicht enteist) wiegt	: 21,00 kg
Der zugehörige Hebelarm ist	:-90,55 cm

Die Propellergewichte sind jeweils komplett mit Spinner.

Das Leergewicht des Flugzeuges vermindert sich max. um:
4,98 kg

Das Leergewichtsmoment des Flugzeuges erhöht sich max. um:
439,01 kgcm

Bei Einbau des Propellers MTV-12-D/180-17 ist in das Ausrüstungsverzeichnis aufzunehmen:

Propeller MTV-12-B/180-17, komplett mit Spinner:

Gewicht: 21,0 kg (nicht enteist)
22,2 kg (enteist)
Hebelarm: - 90,55 cm

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: HB-DIC Serial Number: 24-3240

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: Michael Warren

Michael Warren
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 12-APR-2013

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or

SUPPLEMENTAL [illegible] FLIGHT [illegible]

for

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[illegible]

Make and Model Airplane

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[illegible] Flight Manual supplies [illegible]

[illegible] FAA Approved Airplane Flight Manual [illegible] Flight Manual [illegible]

FAA Approved by [illegible]

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Revision Number	Date	Number	Description	FAA Approved
1	03/18/11	All	Complete Supplement	Robert Grove Robert Grove ODA STC Unit Administrator GARMIN International, Inc. ODA-240087-CE Date: 3/18/11
2	12/18/12	6	Table 1 • Added new functions	See Page 1
		8	Section 1.2 • Added capabilities checkboxes • Added GPS approaches without vertical • Added reference to EASA AMC 20-4	
		10	Section 1.3 • Removed suggestion for secondary charts • Changed to Type B Software in accordance with AC 120-76B.	
		10	Section 1.4 • Added ADS-B, AEG, FIS-B, NOTAM, TFR	
		12	Section 2.2 • Removed VFR only limitation	
		12	Section 2.3 • Clarified secondary navigation source requirement	

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		18	Section 2.14 • Modified datalinked weather limitations	
		18	Section 2.16 • Modified limitation	
		19	Section 2.17 • Modified limitation	
		19	Section 2.21 • New limitation	
		24 & 25	Section 3.2.8 and 3.2.9 • Modified section title	
		25	Section 3.2.10 • New section	
		26	Section 4.1 • Added telephone audio deactivation	
		27	Section 4.3 • Modified caution statement	
		27	Section 4.4 • Added caution statement	
		29	Section 4.6 • New section	
		31	Section 7.7 • Added TCAD and GDL 88 as optional traffic systems	
		32	Section 7.8 • Modified Heading Not Available operation	
		34 - 35	Sections 7.12 – 7.16 • New sections	

3	03/26/13	20	Section 2.17 • Modified limitation	See Page 1

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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 approved GPS/SBAS antenna(s). The GTN navigation system is installed in accordance with AC 20-138A.

GTN system functions are shown in Table 1.

	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
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-C151b 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

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.

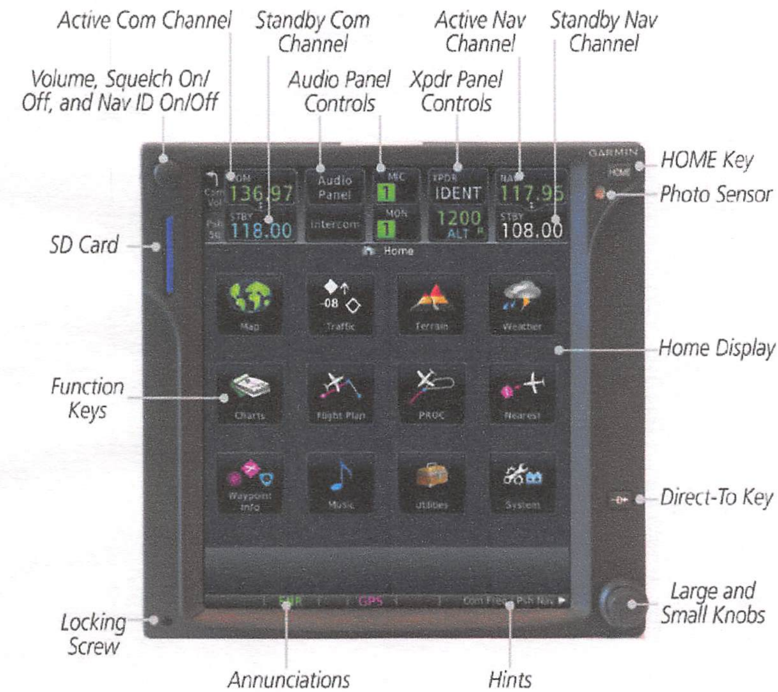

Figure 1 - GTN 750 Control and Display Layout

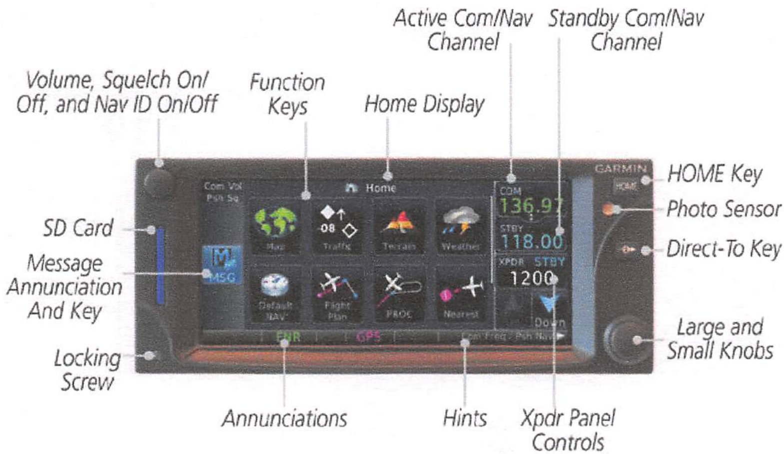

Figure 2 - GTN 635/650 Control and Display Layout

1.2 System Capabilities

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-C151b Terrain Awareness and Warning System – See section 2.13

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 en route, 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," within the U.S. National Airspace System.

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 without RF (radius to fix) legs. 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 has 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.

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.

1.4 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
EFB:	Electronic Flight Bag
EHSI:	Electronic Horizontal Situation Indicator
FIS-B:	Flight Information Services Broadcast
GNSS:	Global Navigation Satellite System
GPS:	Global Positioning System
GPSS:	GPS Roll Steering
GTN:	Garmin Touchscreen Navigator
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
MLS:	Microwave Landing System
NOTAM:	Notice to Airmen
OBS:	Omnibearing Select
RAIM:	Receiver Autonomous Integrity Monitoring

RMT:	Remote
RNAV:	Area Navigation
RNP:	Required Navigational Performance
SBAS:	Satellite Based Augmentation System
SD:	Secure Digital
SDF:	Simplified Directional Facility
SUSP:	Suspend
TACAN:	Tactical Air Navigation System
TAS:	Traffic Awareness System
TAWS:	Terrain Awareness and Warning System
TCAS:	Traffic Collision Avoidance System
TFR:	Temporary Flight Restriction
TIS:	Traffic Information Service
VHF:	Very High Frequency
VFR:	Visual Flight Rules
VLOC:	VOR/Localizer
VMC:	Visual Meteorological Conditions
VOR:	VHF Omnidirectional Range
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 C
- GTN 7XX Cockpit Reference Guide P/N 190-01007-04 Rev C

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 annunciator 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.

- Within the United States, RAIM availability can be determined using the Garmin WFDE Prediction program, Garmin part number 006-A0154-04 (included in GTN trainer) software version 3.00 or later approved version with Garmin approved antennas or the FAA's en route and terminal RAIM prediction website: www.raimprediction.net, or by contacting a Flight Service Station.
- Within Europe, RAIM availability can be determined using the Garmin WFDE Prediction program or Europe's AUGER GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home.
- For other areas, use the Garmin WFDE Prediction program.

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight. The route planning and WFDE prediction program may be downloaded from the Garmin website on the internet. For information on using the WFDE Prediction Program, refer to Garmin WAAS FDE Prediction Program, part number 190-00643-01, 'WFDE Prediction Program Instructions'.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

> For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin 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 page.

Software Item	Software Version *(or later FAA Approved versions for this STC)*
Main SW Version	4.10
GPS SW Version	5.0
Com SW Version	2.10
Nav SW Version	6.02

Table 3 - Software Versions

2.7 SD Card

It is required that the SD card be present in the unit at all times.

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.

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 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, or LP)

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. 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. Users 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.

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.

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.

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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, or LP)
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. 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 restriction.
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. Users 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 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.

2.12 Terrain Proximity Function (All Units)

Terrain and obstacle information appears on the map and terrain display pages as red and yellow tiles or towers, and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain and obstacle 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.

2.13 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.

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.

2.14 Datalinked Weather Display (Optional)

This limitation applies to datalinked weather products from SiriusXM via a GDL 69/69A, FIS-B via a GDL 88, 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 may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GTN.

2.15 Traffic Display (Optional)

Traffic 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.

2.16 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 sources.

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.

2.17 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.

2.18 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 combination.

2.19 Demo Mode

Demo mode may not be used in flight under any circumstances.

2.20 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.

2.21 Telephone Audio

Telephone audio may not be distributed to the pilot or co-pilot unless a phone call is active.

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Telephone audio may not be distributed to the pilot or co-pilot unless a phone call is active.

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:
Power .... **MAXIMUM CONTINUOUS**
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.

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" or "LOI".

If the Loss Of Integrity annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight.

If the Dead Reckoning 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. Dead Reckoning is only available in Enroute and Oceanic modes. Terminal and Approach modes do not support Dead Reckoning.

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:

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.

3.2.1 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" or "LOI".

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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:

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 GPS LPV, 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 accordingly from LPV, L/VNAV, or LNAV+V to LNAV. The approach may be continued using the LNAV only minimums.

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 the crew and passenger intercom will function.

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.

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 features will not operate:

- GPSS 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.
- All overlaying traffic data from a TAS/TCAS I or GDL 88 interfaced to an on board traffic system on the main map display. The flight crew must use the dedicated traffic page on the GTN system to display TAS/TCAS I or GDL 88 traffic data.
- All overlaying StormScope® data on the main map display. The flight crew must use the dedicated StormScope® page on the GTN system to display StormScope® data.

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

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

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To Inhibit TAWS:

Home Hardkey .... PRESS
Terrain Button .... PRESS
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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 features will not operate:

- GPSS 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.
- All overlaying traffic data from a TAS/TCAS I or GDL 88 interfaced to an on board traffic system on the main map display. The flight crew must use the dedicated traffic page on the GTN system to display TAS/TCAS I or GDL 88 traffic data.
- All overlaying StormScope® data on the main map display. The flight crew must use the dedicated StormScope® page on the GTN system to display StormScope® data.

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

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

Without a barometric 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.

3.2.10 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

Remove power from all equipment which is not necessary for flight, including GTN #2 if installed.

Section 4. NORMAL PROCEDURES

Refer to the 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

Database .... **REVIEW EFFECTIVE 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**

Telephone Audio, if equipped:
Pilot, Co-pilot, Passenger.. **DEACTIVATED**

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.

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 GPSS mode.

CAUTION

> The GTN cannot provide course deviation to the autopilot for heading legs. Some autopilots do not allow the use of GPSS when course deviation is not provided.

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

4.5 Coupling the Autopilot during approaches

CAUTION

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

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

☐ 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.

4.6 Telephone & SMS Text (Optional)

Audio from the GSR 56 Iridium datalink is routed through your aircraft's audio panel Audio from the GSR 56 must be deactivated (turned off) unless making a phone call. The primary indication of an incoming phone call or SMS text are the visual indications on the GTN.

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 to the flight crew.

- GTN 6XX Pilot's Guide — P/N 190-01004-03 Rev C or later
- GTN 7XX Pilot's Guide — P/N 190-01007-03 Rev C 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

- The Obstacle Database has an area of coverage that includes the United States and Europe, and is updated as frequently as every 56 days.
- To avoid unwanted alerts, TAWS may be inhibited when landing at an airport that is not included in the airport 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.

7.6 GMA 35 Audio Panel (Optional)

The GTN 725 and 750 can interface to a GMA 35 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. Volume controls for the audio panel are accessed by pressing the "Intercom" button on the GTN display screen.

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 GDL 88 ADS-B traffic system is interfaced to the GTN.

☐ A Garmin GDL 88 ADS-B traffic system is interfaced to the GTN. The GDL 88 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 COMM (1/2)
- Power to the optional GMA 35 is powered through a circuit breaker labeled AUDIO.

7.10 Databases

Database versions and effective dates are displayed on the start-up page immediately after power-on. Database information can also be viewed on the System – System Status page.

The Obstacle Database coverage area includes the United States and Europe.

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.

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7.10 Databases

Database versions and effective dates are displayed on the start-up page immediately after power-on. Database information can also be viewed on the System – System Status page.

The Obstacle Database coverage area includes the United States and Europe.

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.

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 GDL 88 ADS-B Traffic System Interface (Optional)

The GDL 88 is an ADS-B traffic system that can interface 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.

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.

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

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The GDL 88 is an ADS-B traffic system that can interface 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 locations 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.

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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 provide advanced features to the flight crew such as turbulence detection and ground clutter suppression. These features that rely on Doppler technology are only supported by GWX 70 units that have a 12 inch antenna or lager. Turbulence detection is only supported at display ranges 40-160 nautical miles.

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 datalinked 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.

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

EASA 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: HB-DIC Serial Number: 24-3240

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate 10037574 for the installation and operation of the Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System. This document must be carried in the airplane at all times.

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

EASA APPROVED

J. Neumann

Date: 7th August 2013

European Aviation Safety Agency
Certification General Aviation

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	EASA Approval
1	08/07/13	All	Complete Supplement	See Page 1

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Section 1. GENERAL

1.1 Garmin GTN Navigators

The information in this supplement is EASA-approved material and must be attached to the FAA Approved STC Airplane Flight Manual Supplement, P/N 190-01007-A2 or 190-01007-A5, when the airplane has been modified by installation of the Garmin GTN Navigation System in accordance with STC 10037574.

This EASA approved Airplane Flight Manual Supplement is required in addition to the FAA approved Airplane Flight Manual Supplement, P/N 190-01007-A2 or 190-01007-A5.

All references to TSO-C146c in 190-01007-A2 or 190-01007-A5 are replaced by ETSO-C146.

Electronic Flight Bag section information is pertinent to FAA certified aircraft only.

<u>Additional References:</u>

Temporary Guidance Leaflet 10, Rev 1: Airworthiness and Operational Approval for Precision RNAV Operations in Designated European Airspace

Acceptable Means of Compliance 20-4, Airworthiness Approval and Operational Criteria for the Use of Navigation Systems in European Airspace Designated for the Basic RNAV Operations

Acceptable Means of Compliance 20-27, Airworthiness Approval and Operational Criteria for RNP APPROACH (RNP APCH) Operations Including APV BARO-VNAV Operations

Acceptable Means of Compliance 20-28, Airworthiness Approval and Operational Criteria for RNAV GNSS Approach Operation to LPV Minima using SBAS

Section 1. GENERAL

1.1 Garmin GTN Navigators

The information in this supplement is EASA-approved material and must be attached to the FAA approved STC Airplane Flight Manual Supplement, P/N 190-01007-A2 or 190-01007-A5, when the airplane has been modified by installation of the Garmin GTN Navigation System in accordance with STC 10037574.

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All references to TSO-C146c in 190-01007-A2 or 190-01007-A5 are replaced by ETSO-C146.

Emergency Flight Navigation information is pertinent to FAA certified aircraft only.

<u>Additional References</u>

Temporary Guidance Leaflet 10, Rev 1: Airworthiness and Operational Approval for Precision RNAV Operations in Designated European Airspace

Acceptable Means of Compliance 20-4: Airworthiness Approval and Operational Criteria for the Use of Navigation Systems in European Airspace Designated for the Basic RNAV Operations

Acceptable Means of Compliance 20-27: Airworthiness Approval and Operational Criteria for RNP APPROACH (RNP APCH) Operations Including APV BARO-VNAV Operations

Acceptable Means of Compliance 20-28: Airworthiness Approval and Operational Criteria for RNAV GNSS Approach Operation to LPV Minima using SBAS

Section 2. LIMITATIONS

2.1 Display of Distance to Waypoint (for European registered aircraft only)

During installation, the GTN was configured to display distance to current waypoint on the Map Page (GTN 7XX) or Default Navigation Page (GTN 6XX). The display location of distance to current waypoint must not be altered or removed from these pages.

2.2 Phone/SMS Suppress Visuals Setting (for European registered aircraft only)

During installation, the GTN was configured to suppress visual alerts during approach, missed approach, and terminal operations for the GSR 56 Iridium Phone and SMS features. The Suppress Visuals setting on the Service-Phone page must not be changed from "On During APR/MAPR/TERM".

Section 3. EMERGENCY PROCEDURES

No Change.

Section 4. NORMAL PROCEDURES

No Change.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

No Change.

Section 7. SYSTEM DESCRIPTIONS

No Change.

AIRCRAFT FLIGHT MANUAL SUPPLEMENT

No. 3782-011

for PowerFlarm Collision Warning Device

A/C Make :	**Mooney**
A/C Model:	**M20J**
A/C S/N :	**24-3240**
Registration:	**HB-DIC**

This Supplement must be attached to the basic Airplane Flight Manual. It describes the operating procedures for a fix installed Power FLARM Collision Warning System and its interfaces in accordance with the FLARM/FLOICE Installation FOCA Policy 1.6 (42-00.02) or later versions.

The information contained herein supplements or supersedes the basic Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic Airplane Flight Manual.

**This Flight Manual Supplement Revision is EASA approved under:
EASA Project No. 0060037028-001.**

Log of Revisions

Rev.-Nr.	Pages	Date	Remarks/Change	
Original Issue	1 - 9	03.04.2014	Complete Supplement	

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SECTION 1
GENERAL

The gliding scene has been confronted since years to dramatic mid air collision accidents. With the extreme fine shape and relatively high cruise speed of modern gliders, the human vision has reached its limit of detection. Another aspect is the airspace restrictions to VFR that creates an augmentation of traffic density in certain areas and the associated airspace complexity that request more pilot attention on the navigation material. These have a direct impact on the probability of collision also affecting powered aircraft or rotorcraft operations.
These equipments in the general aviation are not required by technical specifications or by operation regulations, but are recognized by the regulators as an important step toward improved aviation safety. Therefore they are not considered as essential for flight and may be used for "situational awareness only" on basis of non interference to certified equipment required for safe flight/landing and no hazard to the persons on board.

Correct antenna installation has a great effect on the transmission/receiving range. The pilot shall care that no masking of the antenna occurs especially when the antennas (GPS, ADS-B and FLARM A/B) are located in the cockpit.
PowerFLARM will only give warnings of other aircraft that are likewise equipped with a compatible unit and from aircraft equipped with ADS-B-OUT (1090ES), Mode-C and Mode-S transponders (if interrogated by ground radar or TCAS). PowerFLARM is not detected by ACAS/ TCAS/TPAS or Air Traffic Control. Likewise PowerFLARM does not communicate with FIS-B or TIS-B systems.
The software version must be regularly updated as per the instructions given in the installation manual. If a version mismatch exists, error information is displayed during the equipment Power-ON and the system will not become operational.

An on/off switch on the PowerFLARM provides ready disconnection of the PowerFLARM system from the electrical bus in case of fume, fire, interferences or when flying over territories where the SRD frequency is not available for air-air communication.

SECTION 2
OPERATING LIMITATIONS

2.1 This POWERFLARM installation is compliant for "situation awareness only".

The following placard must be installed on the instrumental panel, at the proximity of the display'

For Situation Awareness only

2.2 Maneuvering must not be based solely on the use of the information presented on the PowerFLARM displays or aural annunciations.

PowerFLARM does not give any guidance on avoiding action. The azimuth and height accuracy of the computed traffic cannot always provide reliable warnings and only the most threatening traffic is announced. Therefore it is the pilot responsibility to evaluate by any means the real traffic position and altitude, the obstacle shape, the terrain and the meteorological situation prior executing any evasion maneuver.

Under no circumstances should a pilot or crewmember adopt different tactics or deviate from the normal principles of safe airmanship.

2.3 It is the pilot's responsibility to verify prior entering any states territory that the SRD frequency is permitted for use in air-air communication. When such an acceptance does not explicitly or implicitly exist, the equipment shall be turned OFF. This verification is part of the flight planning.

2.4 The pilot shall not intentionally generate uncoordinated warnings that might frighten other aircraft's pilot. Any intentional maneuver of this kind has to be carefully coordinated and agreed in advance. Unexpected reactions might be especially hazardous when lateral, vertical or time separations are small.

SECTION 3
EMERGENCY PROCEDURES

In case of Fire, Smoke, electrical burning smells or electromagnetic Interferences follow the Emergency procedure of the basic AFM.

The dedicated PowerFLARM switch will help to rapidly determine if the PowerFLARM installation is faulty or not, allowing to resume essential equipments as per the Emergency procedure of the basic Aircraft Flight Manual. The PowerFLARM is powered by the aircraft electrical bus. In case of malfunction turn the PowerFLARM System off and pull the dedicated PowerFLARM Circuit Breaker located in the CB Section of the aircraft

SECTION 4
NORMAL PROCEDURES

4.1 General

It is recommended to carry the PowerFLARM Operating Manual, current revision on board the aircraft. To make good use of the information contains in this manual the pilot should know the hardware version, the software version, the serial number and the obstacle database name currently installed in the PowerFLARM.

4.2 Self-test

To switch on the PowerFLARM, the aircraft electrical power shall be available on the corresponding bus and the unit must be turned ON. After switching on, the System performs a self-test routine. Detailed description of the power on procedure can be found in the current PowerFLARM Operating manual
When PowerFLARM shifts to normal operation it waits until it has acquired an adequate GPS position fix. When switching on the unit after a long break or in a totally new location, this procedure can take several minutes. Without a proper GPS position fix, the unit is not ready for operation.
Before departure the pilot should ensure that the System is "operational" (refer to the Operating Manual).

4.3 Operation Modes

PowerFLARM operates in several modes. Detailed operation descriptions can be found in the current operating manual. While warnings are suppressed, PowerFLARM nevertheless continues to transmit signals for reception by other aircraft.

4.4 Line of sight

Compatible FLARM/FLOICE/PowerFLARM units and Transponders must be within range in order to provide a warning. The range is very much determined by the type, installation and position of the radio antennas, plus the relative positions of the two aircraft. There is no FLARM/FLOICE/PowerFLARM signal between two aircraft on opposite sides of the same mountain.

4.5 GPS signal quality

PowerFLARM has to know its current position in order to operate. For this reason, PowerFLARM will only operate in the presence of good quality three-dimensional GPS reception. GPS reception is greatly influenced by the installation and position of the antenna, and aircraft attitude. This is particularly true during turns, when flying close to mountain slopes and in areas known for poor reception. If the installation is poor the GPS signal quality may be reduced. In particular, there can be rapid degradation of height calculations. PowerFLARM resumes operation as soon as the GPS reception quality is adequate.

4.6 Predicted flight path and accuracy

When close up, when two aircraft are at the same or similar height, or GPS reception is poor, the vertical bearing indication is imprecise and fluctuates. PowerFLARM calculates the predicted flight path of the aircraft to which it is fitted for less than the next 30 seconds. This prediction is based on immediate past data, current position- and movement data, plus a movement prediction model that is optimized for the respective user. This forecast is associated with a number of uncertainties that increase with an extension of the forecast time. There is no guarantee that an aircraft will actually follow the predicted flight path. For this reason, the warning issued will not be accurate in all cases.

4.7 Effect of wind

Movements calculated by the GPS relate to a fixed system of terrestrial coordinates. In strong wind there may be a substantial difference between aircraft heading and track, leading to a distortion of the threat bearing. If the wind speed is one third of True Airspeed (TAS) and the yaw free aircraft heading is 90° out of wind, then the threat indication displayed has an error of about 18°. If the wind is very strong, the track can deviate up to 180° from heading. Under such circumstances and when circling, the warnings given are unusable.

4.8 Data protection

The transmitter has no effect on what the receiver in the other aircraft does with the data. It is possible that this data may be captured and stored by other aircraft, or by ground stations, or used for other purposes. This opens up a range of possibilities, some of which may be in the pilot's own interest, (e.g. automated generation of an sailplane launch logging system, aircraft tracking, last position recovery), while others may not be (e.g. detecting tailing of other aircraft, airspace infringements, failure to take avoiding action prior to a collision). When PowerFLARM makes a transmission, the signal also bears identification.

SECTION 5
PERFORMANCE

No Change to basic flight manual

SECTION 6
WEIGHT AND BALANCE

No Change to basic flight manual

SECTION 7
SYSTEM DESCRIPTION

7.1 System description

PowerFLARM receives position and movement information from an internal GPS receiver with an external GPS antenna. The predicted flight path is calculated by PowerFLARM and the information transmitted by radio. Provided they are within receiving range, the signals are received by further aircraft also equipped with FLARM/FLOICE/PowerFLARM or compatible devices. The incoming signal is compared with the flight path predicted by calculation for the second aircraft. At the same time, PowerFLARM compares the predicted flight path with known data on obstacles stored in an internal database.

The PowerFLARM traffic situation will be displayed on the PowerFLARM Display/Controller located in the Cockpit. The PowerFLARM will generate also audio messages. The PowerFLARM is connected to the aircraft radio auxiliary audio input. Audio volume may be adjusted by the volume control menu on the PowerFLARM device. The Display of the PowerFLARM front panel may be dimmed by settings available in the setup menu.
The PowerFLARM software and database can be updated via a SD card.

This aircraft is equipped with several antennas for the PowerFLARM System. One GPS antenna, one ADS-B antenna and one or two FLARM (A / B) antennas.
The PowerFLARM system is electrically protected by a 1 Amp. Circuit breaker located in the CB panel labelled as FLARM.
Obstacle information stored has been simplified; for example, PowerFLARM assumes that a power wire is slung absolutely straight between two fixed points with no sag. Likewise, data for power lines does not include all intermediate masts.

7.2 Radio transmission

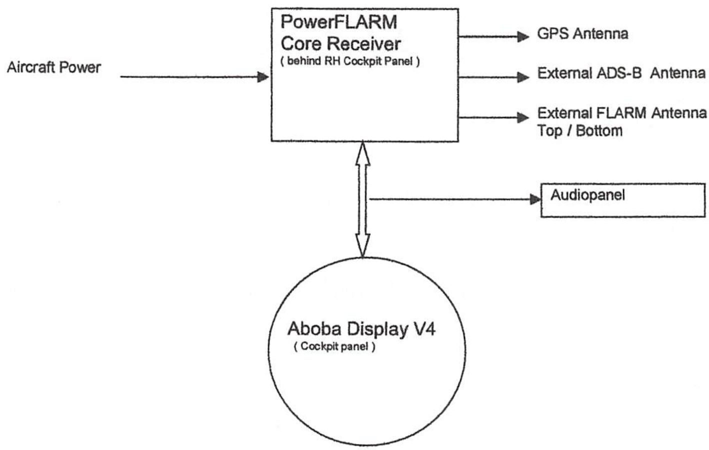
The PowerFLARM system uses a data communication frequency in the tree Non-Specific Short Range Device (SRD), sub band f, between 868.0- 868.6 MHz and with an ERP power of less than 10 mW (duty cycle 1%). This band is ruled tor European applications in the documents ERC/REC 70-03 annex 1 (f) and ERC/DEC/(01)04. The band is free for any ground-ground applications and gets no official protection against external interferences. ITU's recommendation for this band in region 1 is "mobile except aeronautical mobile". POWERFLARM is not considered as aeronautical mobile radio.
There are national differences in frequency allocation and operating conditions between countries. To be used for air-air application some countries require an authorization to be granted by each national communication authority. In Switzerland, BAKOM has granted this authorization for the FLARM/FLOICE/PowerFLARM application on the 23 March 2004. On the 29 May 2005 FOCA confirmed to BAKOM, that no Radio License will be required for FLARM/FLOICE/PowerFLARM.
The aircraft commander is solely responsible for ensuring that their use of PowerFLARM conforms to local regulations.
The radio transmission protocol employed places no limit on the number of units that may be operated within a given range. However, an increasing number of units within range is associated with a reduction in the probability that a single coded signal will be received ('graceful degradation'). The probability is small that subsequent signals will not be received from the same transmitter.

7.3 Electrical installation

This FLARM installation is protected with a Circuit Breaker, which is provided with this installation to readily disconnect the PowerFLARM installation when required by Emergency or operational needs. The pilot must be confident with his electrical bus topology and the FLARM installation.

7.4 Personalized PowerFLARM System overview

Below a System overview installed in this aircraft. Detailed wiring interconnection No 3782-FLARM can be found in the aircraft maintenance records.



LUFTFAHRZEUG - FLUGHANDBUCH
MANUEL DE VOL DE L'AERONEF (AFM)

für das Luftfahrzeug
pour l'aéronef HB - DIC

Die den Betrieb des Luftfahrzeuges betreffenden Unterlagen sind vom Bundesamt für Zivilluftfahrt als Luftfahrzeug-Flughandbuch genehmigt oder anerkannt. Sie bilden eine Grundlage des Lufttüchtigkeitszeugnisses und dürfen nur durch das Bundesamt für Zivilluftfahrt oder in dessen Auftrag geändert werden.

Les documents relatifs à l'exploitation de l'aéronef sont approuvés ou reconnus par l'Office fédéral de l'aviation civile en tant que manuel de vol de l'aéronef. Ils forment une base du certificat de navigabilité et ne peuvent être modifiés que par l'Office fédéral de l'aviation civile ou sur son ordre.

Bei Aenderungen in der Ausrüstung ist dem Bundesamt für Zivilluftfahrt unverzüglich ein Arbeitsbericht im Doppel unter Angabe von Gewicht und Hebelarm der ein- und ausgebauten Teile zusammen mit dem vorliegenden Flughandbuch zuzustellen.

Lors de changements dans l'équipement, il y a lieu d'envoyer immédiatement à l'Office fédéral de l'aviation civile, avec le présent manuel de vol, un rapport de travail en deux exemplaires, et d'indiquer le poids ainsi que le bras de levier des parties installées ou déposées.

Das Luftfahrzeug darf nur nach diesem Flughandbuch, das an Bord mitzuführen ist, betrieben werden.

L'aéronef ne peut être exploité que d'après le présent manuel de vol, qui doit se trouver à bord.

Der Zulassungsbereich des Luftfahrzeuges ist im Anhang zum Lufttüchtigkeitszeugnis festgelegt.

Le champ d'utilisation de l'aéronef est fixé dans l'annexe du certificat de navigabilité.

3003 Bern, den
3003 Berne, le 17.05.1994

BUNDESAMT FUER ZIVILLUFTFAHRT, Sektion Leichtluftfahrt
OFFICE FEDERAL DE L'AVIATION CIVILE, Section des aéronefs légers
i.A. / p.o.

Reto Senn

Bemerkungen / Observations

2. Anzahl Personen an Bord
Nombre de personnes à bord

2.1 Mindestflugbesatzung * Equipage minimal de conduite	1			
2.2 Höchstzulässige Anzahl Passagiere Nombre maximal de passagers	3			

* Allfällige besondere Betriebsvorschriften bleiben vorbehalten
D'éventuelles prescriptions d'exploitation particulières restent réservées.

Hauptsächlichste Daten des Luftfahrzeuges HB - DIC
Données principales de l'aéronef

1. Masse und Schwerpunktlage
Masse et position du centre de gravité

1.1 Höchstzulässige Abflugmasse Kat. N* 1315 kg 2900 lbs
Masse maximale autorisée au décollage Cat.

* Andere Kategorien siehe Flughandbuch
Autres catégories voir manuel de vol

1.2 Höchstzulässige Landemasse 1315 kg 2900 lbs
Masse maximale autorisée à l'atterrissage

1.3 Leermasse
Masse à vide

In der Leermasse sind inbegriffen:
Dans la masse à vide sont compris:

- (X) Ausrüstung gemäss Ausrüstungsliste
  L'équipement selon la liste d'équipement
- (X) Nicht verwendbarer Treibstoff
  Le carburant non utilisable
- (X) Nicht verwendbarer Schmierstoff
  Le lubrifiant non utilisable
- (X) Verwendbarer Schmierstoff
  Le lubrifiant utilisable
- ( ) Hydraulikflüssigkeit
  Le liquide hydraulique
- ( ) Ballast (sofern eingebaut)
  Lest (si installé)
- ( ) Getriebeöl
  Le lubrifiant de boîtes de transmission
- ( )

Datum Date	Leermasse Masse à vide	Schwerpunktlage Position du centre de gravité	Leermasse-Moment Moment de la masse à vide	Zuladung Charge utile
	kg / lbs	m / in	mkg / in. lbs.	kg / lbs

SEE WEIGHT & BALANCE RECORD

PAGE 6-5

Datum Date	Leermasse Masse à vide	Schwerpunktlage Position du centre de gravité	Leermasse-Moment Moment de la masse à vide	Zuladung Charge utile
	kg / lbs	m / in	mkg / in. lbs.	kg / lbs

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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/Service Center as soon as possible.

For your added protection and safety, we have added this special section to the Pilot's Operating Handbook to refresh your knowledge of a number of safety subjects. You should review these subjects periodically.

Topics in this section are mostly excerpts from FAA Documents and other articles pertaining to the subject of safe flying. They are not limited to any particular make or model airplane and do not replace instructions for particular types of airplanes.

Your Mooney Aircraft was designed and built to provide you with many years of safe and efficient transportation. By maintaining it properly and flying it prudently, you should realize its full potential.

GENERAL

Flying is one of the safest modes of travel. Remarkable safety records are being established each year. As a pilot you are responsible to yourself, your relatives, to those who travel with you, to other pilots and to ground personnel to fly wisely and safely.

The following materials in this Safety section covers several subjects in limited detail. Here are some condensed Do's and Don'ts.

DO'S

1. Be thoroughly familiar with your airplane and be current in it, or get a check ride.
2. Pre-plan all aspects of your flight-including weather. FLY YOUR PLAN.
3. Use services available-FSS, Weather Bureau, etc.
4. Pre-flight your airplane thoroughly.
5. Use your check lists.
6. Have more than enough fuel for takeoff, the planned trip, and adequate reserve.
7. Be sure your weight loading and C.G. are within limits.
8. Be sure articles and baggage are secured.
9. Check freedom of all controls.
10. Maintain appropriate airspeed in takeoff, climb, descent and landing.
11. Avoid other aircraft wake turbulence.
12. Switch fuel tanks before engine starvation occurs.
13. Practice engine out, emergency landing gear extension and other emergency procedures at safe altitude; preferably with a check pilot.
14. Use caution in mountainous terrain.
15. Keep your airplane in good mechanical condition.
16. Stay informed and alert, fly in a sensible manner.

DON'TS

1. Don't take off with frost, ice or snow on the aircraft surfaces.
2. Don't take off with less than minimum recommended fuel, plus reserves.
3. Don't fly in a reckless, show off, careless manner.
4. Don't fly in thunderstorms or severe weather.
5. Don't fly in possible icing conditions. If you encounter icing conditions, alter altitude or course to minimize exposure.
6. Don't apply controls abruptly or with high forces that could exceed design loads of the airplane.

7. Don't fly when physically or mentally exhausted.
8. **DON'T RELY ON LUCK.**

GENERAL SOURCES OF INFORMATION

There is a wealth of information available to the pilot created for the sole purpose of making your flying easier, faster, and safer. Take advantage of this knowledge and be prepared for an emergency in the remote event that one should occur. You as a pilot also have certain responsibilities under government regulations. These are designed for your own protection. Compliance is not only beneficial but mandatory.

RULES AND REGULATIONS

Federal Aviation regulations, Part 91, General Operating and Flight Rules, is a document of law governing operation of aircraft and the owner's and pilot's responsibilities.

This document covers such subjects as:

Responsibilities and authority of the pilot in command
Certificates required
Liquor and drugs
Flight plans
Pre-flight action
Fuel requirements
Flight rules
Maintenance, preventative maintenance, alterations, inspections and maintenance records

These are only some of the topics covered. It is the owner's and pilot's responsibility to be thoroughly familiar with all items in FAR Part 91 and to follow them.

FEDERAL AVIATION REGULATIONS, PART 39, AIRWORTHINESS DIRECTIVES

This document specifies that no person may operate a product to which an airworthiness directive issued by the FAA applies, except in accordance with the requirements of that airworthiness directive.

AIRMAN INFORMATION, ADVISORIES, AND NOTICES -FAA AIRMAN'S INFORMATION MANUAL

This document contains a wealth of pilot information for nearly all realms of flight, navigation, ground procedures and medical information. Among the subjects are:

Controlled Air Space
Services Available to Pilots
Radio Phraseology and Technique
Airport Operations
Clearances and Separations
Pre-flight
Departures - IFR
Enroute - IFR
Arrival - IFR
Emergency Procedures
Weather
Wake Turbulence
Medical Facts for Pilots
Bird Hazards
Good Operating Practices
Airport Location Directory

We urge all pilots to be thoroughly familiar with and use the information in this manual.

ADVISORY INFORMATION

Airmen can subscribe to services to obtain FAA NOTAMS and Airman Advisories, and these are also available at FAA Flight Service Stations. NOTAMS are documents that have information of a time-critical nature that would affect a pilot's decision to make a flight; for example, an airport closed, terminal radar out of service, enroute navigational aids out of service, etc.

GENERAL INFORMATION ON SPECIFIC TOPICS

FLIGHT PLANNING

FAR Part 91 requires that each pilot in command, before beginning a flight, familiarize himself with all available information concerning that flight.

All pilots are urged to obtain a complete preflight briefing. This would consist of weather; local, enroute and destination, plus alternates, enroute nav-aid 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.

TURBULENT WEATHER

A complete weather briefing prior to beginning a flight is the start of assurance of a safe trip. Updating of weather information enroute is another assurance. However, the wise pilot also knows weather conditions change quickly at times and treats weather forcasting as professional advice rather than as absolute fact. He obtains all the advice he can, but still stays alert through knowledge of weather changes, observations, and conditions.

Plan the flight to avoid areas of severe turbulence and thunderstorms. It is not always possible to detect individual storm areas or find the in- between clear areas.

Thunderstorms, squall lines and violent turbulence should be regarded as extremely dangerous and MUST be avoided. Hail and tornadic wind velocities can be encountered in thunderstorms that can destroy any airplane, just as tornados destroy nearly everything in their path on the ground.

A roll cloud ahead of a squall line or thunderstorm is visible evidence of violent turbulence, however, the absence of a roll cloud should not be interpreted as denoting the lack of turbulence.

FLIGHT IN TURBULENT AIR

Even though flight in severe turbulence is to be avoided, flight in turbulent air may be encountered under certain conditions.

Flying through turbulent air presents two basic problems, to both of which the answer is PROPER AIRSPEED. On the one hand, if you maintain an excessive airspeed, you run the risk of structural damage or failure; on the other hand, if your airspeed is too low, you may stall.

If turbulence encountered in cruise or descent becomes uncomfortable to the pilot or passengers, the best procedure is to reduce speed to the maneuvering speed, which is listed in the Limitations Section of the FAA Approved Airplane Flight Manual and Pilots Operating Handbook. This speed gives the best assurance of avoiding excessive stress loads, and at the same time providing margin against inadvertent stalls due to gusts.

Beware of overcontrolling in attempting to correct for changes in altitude; applying control pressure abruptly will build up G-forces rapidly and could cause damaging structural stress loads. You should watch particularly your angle of bank, making turns as wide and shallow as possible, and be equally cautious in applying forward or back pressure to keep the nose level. Maintain straight and level attitude in either up or down drafts. Use trim sparingly to avoid being grossly mistrimmed as the vertical air columns change velocity and direction.

MOUNTAIN FLYING

Avoid flight at low altitudes over mountainous terrain, particularly near the lee slopes. OBSERVE PUBLISHED MINIMUM ENROUTE ALTITUDES (MEA). If the wind velocity near the level of the ridge is in excess of 25 knots and approximately perpendicular to the ridge, mountain wave conditions are likely over and near the lee slopes. If the wind velocity at the level of the ridge exceeds 50 knots, a strong mountain wave is probable with strong up and down drafts and severe or extreme turbulence. The worst turbulence will be encountered in and below the rotor zone which is usually 8 to 10 miles downwind from the ridge. This zone is characterized by the presence of "roll clouds" if sufficient moisture is present; alto cumulus standing lenticular clouds are also visible signs that a mountain wave exists, but their presence is likewise dependent on moisture. Mountain wave turbulence can, of course, occur in dry air and the absence of such clouds should not be taken as any assurance that mountain wave turbulence will not be encountered. A mountain wave downdraft may exceed the climb capability of your airplane.

– AVOID MOUNTAIN WAVE DOWNDRAFTS. –

VFR - LOW CEILINGS

If you are not instrument rated, avoid "VFR On Top" and "Special VFR". Being caught above an undercast when an emergency descent is required (or at destination) is an extremely hazardous position for the VFR pilot. Accepting a clearance out of certain airport control zones with no minimum ceiling and one-mile visibility as permitted with "Special VFR" is not a recommended practice for VFR pilots.

Avoid areas of low ceilings and restricted visibility unless you are instrument proficient and have an instrument equipped airplane. Then proceed with caution and have planned alternates.

VFR - AT NIGHT

When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain a safe minimum altitude as 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
Wing 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. The larger and heavier the airplane the more pronounced wake turbulence will be. Wing tip vortices from large heavy airplanes are very severe at close range, degenerating with time, wind and space. These are rolling in nature from each wing tip. In test, vortex velocities of 133 knots have been recorded. Exhaust velocities from large airplanes at takeoff have been measured at 25 mph, 2100 feet behind medium large airplanes.

Encountering the rolling effect of wing tip vortices within two minutes or less after passage of large airplanes is hazardous to light airplanes. This roll effect can exceed the maximum counter roll obtainable in an airplane.

The turbulent areas may remain for as long as three minutes or more, depending on wind conditions, and may extend several miles behind the airplane. Plan to fly slightly above or to the upwind side of the other airplane's flight path.

Because of the wide variety of conditions that can be encountered, there is no set rule to follow to avoid wake turbulence in all situations. However, the Airman's Information Manual goes into considerable detail for a number of wake turbulence avoidance procedures. Use prudent judgment and allow ample clearance time and space following or crossing the wake turbulence of other airplanes in all takeoff, climb out, approach and landing operations. Be observant of wake turbulence from all aircraft, regardless of size.

The Airman's Information Manual contains a section on wake turbulence. FAA Advisory Circular AC 90-230 is also recommended reading.

TAKE-OFF AND LANDING CONDITIONS

When taking off on runways covered with water or freezing slush, the landing gear should remain extended for approximately ten seconds longer than normal, allowing the wheels to spin and dissipate the freezing moisture. The landing gear should then be cycled up, then down, wait approximately five seconds and then retract again. Caution must be exercised to insure that the entire operation is performed below Maximum Landing Gear Operating Airspeed.

Use caution when landing on runways that are covered by water or slush which cause hydroplaning (aquaplaning), a phenomenon that renders braking and steering ineffective because of the lack of sufficient surface friction. Snow and ice covered runways are also hazardous. The pilot should 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.

MEDICAL FACTS FOR PILOTS

GENERAL

Modern industry's record in providing reliable equipment is very good. When the pilot enters the airplane, he becomes an integral part of the man-machine system. He is just as essential to a successful flight as the control surfaces. To ignore the pilot in pre-flight planning would be as senseless as failing to inspect the integrity of the control surfaces or any other vital part of the machine. The pilot himself has the responsibility for determining his reliability prior to entering the airplane for flight.

While piloting an airplane, an individual should be free of conditions which are harmful to alertness, ability to make correct decisions, and rapid reaction time.

FATIGUE

Fatigue generally slows reaction times and causes foolish errors due to inattention. In addition to the most common cause of fatigue, insufficient rest and loss of sleep, the pressure of business, financial worries and family problems, can be 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, alchohol 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 10,000 feet. Night vision, however, can be impaired starting at altitudes lower than 10,000 feet. Heavy smokers may experience early symptoms of hypoxia at altitudes lower than 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 that you not fly as a crew member while under the influence of alcohol. Even small amounts of alcohol in the human system can adversely affect judgment and decision making abilities. FAR 91.11 states "(a) No person may act as a crew member - (1) within 8 hours after the consumption of any alcoholic beverage."

Tests indicate that as a general rule, 2 ounces (.06 LITERS) of alcohol at 15,000 feet produce the same adverse effects as 6 ounces (.18 LITERS) at sea level. In other words, the higher you get, "the higher you get".

DRUGS

Self-medication or taking medicine in any form when you are flying can be extremely hazardous. Even simple home or over-the-counter remedies and drugs such as aspirin, antihistamines, cold tablets, cough mixtures, laxatives, tranquilizers, and appetite suppressors, may seriously impair the judgment and coordination needed while flying. The safest rule is to TAKE NO MEDICINE before or while flying, except on the advice of your Aviation Medical Examiner.

SCUBA DIVING

Flying shortly after any prolonged scuba diving could be dangerous. Under the increased pressure of the water, excess nitrogen is absorbed into your system. If sufficient time has not elapsed prior to takeoff for your system to rid itself of this excess gas, you may experience the bends at altitudes even under 10,000 feet, where most light planes fly.

ADDITIONAL INFORMATION

In addition to the coverage of subjects in this section, the National Transportation Safety Board and the Federal Aviation Administration periodically issue general aviation pamphlets concerning aviation safety 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