PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED

AIRPLANE FLIGHT MANUAL

MOONEY
M20R

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

THIS DOCUMENT MUST BE CARRIED IN THE AIRCRAFT AT ALL TIMES

MOONEY AIRCRAFT CORPORATION
LOUIS SCHREINER FIELD
KERRVILLE, TEXAS 78026

SERIAL NUMBER_____

REGISTRATION NUMBER_____

FAA APPROVED _____

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FAA APPROVED in Normal Category based on CAR PART 3 and applicable portions of FAR PART 23; applicable to Mooney M20R S/N listed above only.

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CONGRATULATIONS

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

- NOTICE -

This manual is provided as an operating guide for the Mooney Model M20R. 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. It is the operators responsibility to ensure that this manual is current through the latest published revision.

This handbook will be kept current by Mooney Aircraft Corporation after the yellow information card in front of this handbook has been completed and mailed in.

Mooney Aircraft Corporation
Service Parts Department
Louis Schreiner Field,
Kerrville, TX., 78028.

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POH/AFM NUMBER 3600 (G)

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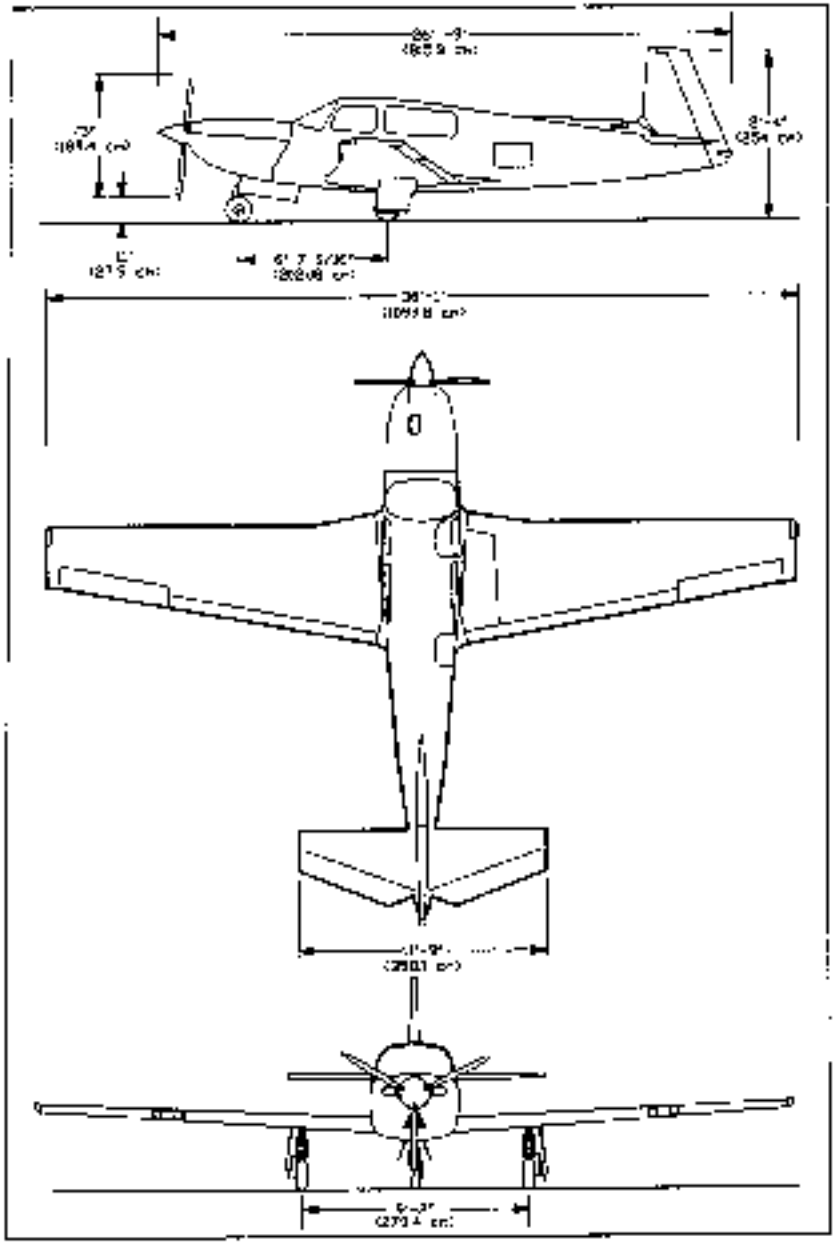

FIGURE 1 - 1 THREE VIEW - M20R

FUEL

Minimum Fuel Grade (Color)	100 LL (Blue) or 100 Octane (Green)
Total Capacity	92 U.S. Ga. (359.6 Liters)
Usable	89.0 U.S. Ga. (336.9 Liters)

OIL

Oil Specification	MHS-24( )
and as Approved by TCM. (Reference Engine Maintenance & Operators Manual)	
All Temperatures	15W50 or 20W50
Above 30°F (-1°C) Ambient Air (SL)	SAE 50
Below 90°F (10°C) Ambient Air (SL)	SAE 30, 10W30
Total Oil Capacity	6 Qts. (7.57 liters)
Oil Filter	Full Flow

Oil grades, specifications and changing recommendations are contained in SECTION VII

LANDING GEAR

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

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

Tire Size:	
Nose	5.00 x 5 (8 ply)
Main	6.00 x 6 (8 ply)
Tire Pressure	
Nose	49 PSI
Main	42 PSI

Minimum Turning Radius (No brakes applied)	
Right	43 ft. (12.0 m)
Left	48 ft. (14.4 m)

MAXIMUM CERTIFICATED WEIGHTS

Gross Weight	3368 Lbs. (1529 Kg)
Maximum Landing Weight	3200 Lbs. (1452 Kg)
Baggage Area	120 Lbs. (54.4 Kg)
Rear Storage Area	10 Lbs. (4.5 Kg)
Cargo (Rear Seats Folded Down)	340 Lbs. (154.2 Kg)

STANDARD AIRPLANE WEIGHTS

Basic Empty Weight	See Page 1-5
Useful Load	Varies with installed equipment.

See SECTION VI for specific airplane weight (pp. 6-5).

INTRODUCTION

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

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

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

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

DESCRIPTIVE DATA

ENGINE

Number of engines	1
Engine Manufacturer	Teledyne Continental Motors (TCM)
Model	IO-550-G(5)
Recommended TBO	2000 Hours
Type	Reciprocating, air cooled, fuel injected 6 Horizontally opposed
Displacement	550 Cu. In. (90.4 cc)
Bore	5.25 In. (13.3 cm)
Stroke	4.25 In. (10.8 cm)
Compression ratio	8.5 : 1

Fuel System

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

Accessories

Magnetos	Bendix - S8RN-20
Ignition Harness	Shielded Braided
Spark Plugs	AC 278 (or equivalent) (18 mm)
Oil Cooler	TCM Full Flow
Alternator	28 Volt DC, 100 AMPS
Starter	24 volt DC

Ratings:

Maximum Takeoff Sea Level BHP/RPM	280/2600

PROPELLER

Number	1
Manufacturer	McCauley
Model Number	3A32C41-8(G)-82NRC-9*
Number of Blades	3
Diameter (1/2 in. cutoff allowed)	73 in. (185.4 cm)
Type	Constant Speed
Governor (McCauley)	Hydraulically controlled by engine oil
Blade Angles @ 30.0 In. Sta	
Low	16.1 degrees + /- 0.2 degrees
High	40 degrees + /- 0.5 degrees

* Refer to TCDS for engine/propeller configuration requirement

CABIN AND ENTRY DIMENSIONS

Cabin Width (Maximum)	43.5 in. (110.5 cm)
Cabin Length (Maximum)	124 in. (315 cm)
Cabin Height (Maximum)	44.0 in. (112 cm)
Entry Width (Minimum)	29.0 in. (73.4 cm)
Entry Height (Minimum)	35.0 in. (88.9 cm)

BAGGAGE SPACE AND ENTRY DIMENSIONS

Compartment Width	24 in. (60.9 cm)
Compartment Length	43 in. (109.2 cm)
Compartment Height	35 in. (88.9 cm)
Compartment Volume	20.9 cu. ft. (592 cu. ft.)
Cargo Area (with rear seat folded down)	38.6 cu. ft. (1.09 cu. m)
Entry Height (Minimum)	20.5 in. (52.1 cm)
Entry Width	17.0 in. (43.2 cm)
Ground to Bottom of Sill	45.0 in. (114.3 cm)

SPECIFIC LOADINGS

Wing Loading - @ Maximum Gross Weight	19.26 lbs./sq. ft. (94 kg/Sq. m)
Power Loading - @ Maximum Gross Weight	12.82 lbs./HP (5.48 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. KIAS values published in this handbook assume zero instrument error.
KTAS	KNOTS TRUE AIRSPEED - The airspeed of an airplane relative to undisturbed air which is the KCAS corrected for altitude and temperature.
V_A	MANEUVERING SPEED - The maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{FE}	MAXIMUM FLAP EXTENDED SPEED - The highest speed permissible with wing flaps in a prescribed extended position.
V_{LE}	MAXIMUM LANDING GEAR EXTENDED SPEED - The maximum speed at which an aircraft can be safely flown with the landing gear extended.

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 steadyflight speed at which the airplane is controllable
V_{SO}	STALLING SPEED - The minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_X	BEST ANGLE-OF-CLIMB SPEED - The airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	BEST RATE-OF-CLIMB SPEED - The airspeed which delivers the greatest gain in altitude in the shortest possible time with gear and flaps up.

ENGINE POWER TERMINOLOGY

BHP	BRAKE HORSEPOWER - Power developed by the engine
CHT	CYLINDER HEAD TEMPERATURE - Operating temperature of engine cylinder(s) being monitored by sensor unit. Expressed in °F
EGT	EXHAUST GAS TEMPERATURE - The exhaust gas temperature measured at the exhaust pipe manifold. Expressed in °F.
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 expressed in inches of mercury (inHg)
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 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/air aperture, and therefore the air/fuel mixture. It is the primary method to shut the engine down.
CHT Gauge	Cylinder head temperature indicator used to determine that engine operating temperature is within manufacturer's specifications
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 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 the temperature, the higher the density altitude.
Indicated Altitude	The altitude actually read from an altimeter when, and only when barometric subscale (Kollsman window) 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 degrees Celsius (59°F); (3) The pressure at sea level is 29.92 inches Hg (1013.2 mb). (4) The temperature gradient from sea level to the altitude at which the temperature is -55.5°C (-69.7°F) is -0.0019812°C (-0.003564°F) per foot
OAT	OUTSIDE AIR TEMPERATURE - The free air static temperature, obtained either from in-flight temperature indications or ground meteorological sources. It is expressed in °C.
Pressure Altitude	The indicated altitude 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.
Basic Empty Weight	The actual weight of the airplane and includes all operating equipment and 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

WEIGHT AND BALANCE TERMINOLOGY (cont.)

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 chord (MAC).
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.
Maximum Landing Weight	The maximum authorized weight of the aircraft and its contents when a normal landing is to be made.
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 are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance from the reference datum.
Tare	The weight of chocks, blocks, stands, etc. used when weighing an airplane and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Usable Fuel	Fuel available for aircraft engine combustion.
Useful Load	The basic empty weight subtracted from the maximum weight of the aircraft. This load consists of the pilot, crew (if applicable), usable fuel, passengers and baggage.

MEASUREMENT CONVERSION TABLES

LENGTH

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

AREA

U. S. Customary Unit	Metric Equivalents
1 square inch	6.4516 sq. centimeters
1 square foot	929 sq. centimeters
1 square yard	0.836 sq. meter

VOLUME OR CAPACITY

U. S. Customary Unit	Metric Equivalents
1 cubic inch	16.39 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. liquid 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	64.77891 milligrams
1 dram	1.772 grams
1 ounce	28.350 grams
1 pound	453.6 grams

PRESSURE

U.S. Customary Unit	Metric Equivalents
1 PSIG	6.895 KPA
1 Inch Hg	3.386 KPA
1 Inch Hg	25.40 mm Hg

COMMON CONVERSIONS

1 pound/square foot	0.489 kg/meter square
1 pound /sq. inch	2.036 inch Hg
1 Pound/HP	0.4539 kg/HP

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INTRODUCTION

SECTION II includes the mandatory operating limitations, instrument markings, and basic placards necessary for the safe operation of the airplane, its engine, standard systems and standard equipment.

The limitations included in this section have been approved by the Federal Aviation Administration.

When applicable, limitations associated with optional systems or equipment such as autopilots are included in SECTION IX.

NOTE

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

Your Mooney is certificated under FAA Type Certificate No. 2A3 as a Mooney M20R

NOISE LIMITS

The certificated noise level for the Mooney M20R at 3368 lbs (1528 Kg.) maximum weight is 72.6dB(A). No determination has been made by the General Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

AIRSPEED LIMITATIONS

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

V / SPEED		KCAS/KIAS	REMARKS
V_{NE}	Never Exceed Speed	199/195	Do not exceed this speed in any operation
V_{NO}	Maximum Structural Cruising Speed	175/174	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed at:		
	lbs. /Kg.		
	2232/1012	104/103	Do not make full or abrupt control movement above this speed
	2430/1102	109/108	
	3300/1497	127/126	
	3368/1528	128/127	
V_{FE}	Maximum Flap Extended Speed	111/110	Do not exceed this speed with flaps in full down position.
V_{LE}	Maximum Landing Gear Extended Speed	166/165	Maximum speed at which the aircraft can be safely flown with the landing gear extended
V_{LO} (EXT)	Max. Speed for Gear Extension	141/140	Max. speed at which the landing gear can be safely extended.
V_{LO} (RET)	Max. Speed for Gear Retraction	107/106	Maximum speed at which the landing gear can be safely retracted.
	Maximum Pilot Window Open Speed	133/132	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 (Flap Operating Range)	59-110 KIAS	Lower limit is maximum weight V_{so} in landing configuration. Upper limit is maximum speed permissable with flaps extended.
Green Arc (Normal Operating Range)	66-174 KIAS	Lower limit is maximum weight V_s with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc (Caution Range)	174-195 KIAS	Operations must be conducted with caution and only in smooth air.
Radial Red Line	195 KIAS	Maximum speed for all operations.

FIGURE 2-2 AIRSPEED INDICATOR MARKINGS

POWER PLANT LIMITATIONS

Number of Engines 1

Engine Manufacturer . . . . . Teledyne Continental Motors (TCM)

Engine Model Number . . . . . IO-550-G(5) *

Engine Operating Limits for Takeoff and Continuous Operations

Maximum Continuous Power	280 BHP
Maximum Continuous RPM	2500 RPM
Transient RPM Limit	2600 RPM
Maximum Cylinder Head Temperature	460° F (237.7° C)
Maximum Oil Temperature	240° F (115° C)
Minimum Oil Temperature-Takeoff	75° F (24° C)
Recmnded Cruising Temperature	170°F-200°F (76°C-93°C)
Oil Pressure	
Normal Operating	30-60 PSI
Minimum (IDLE ONLY)	10 PSI

Oil Specification . . . . MHS-24( ), MHS-25( ) and TCM Approved oils

Fuel Grade (Color) . . . . . 100LL (Blue)** or 100 octane (Green) **

Number of Propellers 1

Propeller Manufacturer . . . . . McCauley
Propeller/Blade Model Number . . . . . 3A32C41B(GI-92NRC-0 *

Number of Blades 3

Propeller Diameter McCauley
Min . . . . . 72.5 in (184.2 cm)
Max . . . . . 73 in (185.4 cm)

McCauley - Propeller Blade Angles @ 30.0 in sta *
Low . . . . . 16.1 Degrees + /- 0.2 Degrees
High . . . . . 40.0 Degrees + /- 0.5 Degrees

Propeller Operating Limits (McCauley) . . . . . 2600 RPM

* Refer to TCDS for engine/propeller configuration required

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

POWER PLANT INSTRUMENT MARKINGS

INSTRUMENT	REDLINE MINIMUM LIMIT	GREEN ARC NORMAL OPERATING	YELLOW ARC	REDLINE MAXIMUM LIMIT
Tachometer	600 RPM No Redline	2200-2500 RPM	———	2500 RPM
Cylinder Head Temperature		250-420° F (121 - 215.5°C)	420 - 460°F (215.5-237.7°C)	460° F (237.7°C)
Oil Temperature	No Redline	170 -220° F (76.6 - 104°C)	100 - 170°F (37.7-76.6°C) 220° - 240° (104° - 115.5°C)	240° F (115.5°C)
Oil Pressure	10.0 PSI (IDLE ONLY)	30-60 PSI	10 - 30 PSI 60 - 100 PSI	100 PSI
Exhaust Gas Temperature		1400-1450°F (760-788°C) (BLUE ARC =	recommended climb	1650°F (899°C)

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

FIGURE 2 - 3 POWER PLANT INSTRUMENT MARKINGS

FUEL LIMITATIONS

WARNING!

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

NOTE!

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

NOTE!

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

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

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

CAUTION

To reduce possibility of ice formation within the aircraft or engine fuel system it is permissible to add ISO-PROPYL alcohol to the fuel supply in quantities NOT TO EXCEED 3% of total fuel volume per tank. DO NOT add other additives to fuel system due to potential deteriorating effects within the fuel system.

WEIGHT LIMITS

Maximum Weight - Takeoff	3368 lb. (1528 Kg.)
Maximum Weight - Landing	3200 lb. (1452 Kg)
Maximum Weight in Baggage Compartment	120 lb. (54.4 Kg.) @ Fus. Sta. 101.5 (257.7 cm)
Maximum Weight in Rear Storage Area	10 lb. (4.54 Kg.) @ Fus. Sta. 131.0 (332.5 cm)
Maximum Weight in Cargo Area (Rear seats folded down)	360 lbs. (154.2 KG) @ Fus. Sta. 70.7 (179.6 cm)

CENTER OF GRAVITY LIMITS (GEAR DOWN)

Most Forward	Fus. Sta. 41.0 IN. (104.1 cm) @ 2480 LB. (1102 Kg) 18.79% MAC
Intermediate Forward	Fus. Sta. 44.4 IN.(112.7 cm) @ 3300 lb. (1497 Kg) 21.7% MAC
Forward Gross	Fus. Sta. 46.0 IN. (116.8 cm) @ 3368 lb. (1528 Kg) 24.98% MAC
Aft Gross	Fus. Sta. 51.0 IN.(129.5 cm) @ 3368 lb. (1528 Kg) 33.18% MAC
MAC (at Wing Sta. 94.85) (241 cm)	61.00 in

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

MANEUVER LIMITS

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

| NOTE |

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

FLIGHT LOAD FACTOR LIMITS

Maximum Positive Load Factor	
Flaps Up	+3.8 g
Flaps Down (33 Degrees)	+2.0 g
Maximum Negative Load Factor	
Flaps Up	-1.5 g
Flaps Down	.0 g

FLIGHT CREW

Pilot	One
Maximum passenger seating configuration	Three

OPERATING LIMITATIONS

When this aft is not equipped with an approved oxygen system and flight operations above 12,000 ft. are desired, the airplane must be, (1) equipped with supplemental oxygen in accordance with FAR 23.1441, (2) operate in accordance with FAR 91.32 and (3) equipped with avionics in accordance with FAR 91 or FAR 135.

ALTERNATOR OPERATING LIMITATIONS IS 54 AMPS

KINDS OF OPERATION LIMITS

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

Optional equipment installations may not be required to be operational.

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

OPERATIONS IN KNOWN ICING CONDITIONS ARE PROHIBITED.

Autopilot Limitations - See SECTION IX.

KINDS OF OPERATION EQUIPMENT LIST

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

| NOTE |

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

SEE NEXT PAGE FOR LISTINGS.

KINDS OF OPERATION EQUIPMENT LIST

SYSTEM or COMPONENT	VFR DAY *	VFR NIGHT	IFR DAY	IFR NIGHT
AIRSPEED INDICATOR	[illegible]	1	[illegible]	1
ALTIMETER, SENSITIVE	1	1	1	1
MAGNETIC DIRECTION INDICATOR	1	1	1	1
MANIFOLD PRESSURE GAUGE	-	-	[illegible]	-
TACHOMETER	[illegible]	1	1	1
FUEL QUANTITY INDICATOR	2	2	2	2
FUEL PRESSURE INDICATOR	-	[illegible]	-	-
OIL PRESSURE INDICATOR	1	1	[illegible]	1
OIL TEMPERATURE INDICATOR	1	1	1	1
CYLINDER HEAD TEMPERATURE INDICATOR	1	[illegible]	1	1
EXHAUST GAS TEMPERATURE INDICATOR	[illegible]	[illegible]	[illegible]	[illegible]
AMMETER	[illegible]	[illegible]	1	1
ALTERNATOR	[illegible]	1	[illegible]	[illegible]
LANDING GEAR POSITION INDICATOR	2	2	2	2
SEAT BELT & SHOULDER HARNESS FOR EACH OCCUPANT **	1	1	[illegible]	[illegible]
OXYGEN MASK FOR EACH OCCUPANT ***	[illegible]	1	[illegible]	[illegible]
POSITION LIGHTS		3		3
STROBE LIGHTS (ANTICOLLISION)		3		[illegible]

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

KINDS OF OPERATION EQUIPMENT LIST (cont.)

SYSTEM & COMPONENT (cont.)

	VFR DAY *	VFR NIGHT	IFR DAY	IFR NIGHT
GYRO HORIZON			1	1
DIRECTIONAL GYRO			1	1
TURN COORDINATOR or TURN & BANK INDICATOR			1	1
LANDING LIGHT ****		1		1
INSTRUMENT LIGHTS (INTERNAL or GLARESHIELD)		1		1
CLOCK (WITH SWEEP SECOND HAND or DIGITAL)			1	1
COMMUNICATION SYSTEM			1	1
NAVIGATION SYSTEM (APPROPRIATE TO FACILITIES BEING USED)			1	1
BATTERY	2	2	2	2
VACUUM SYSTEM/ INDICATOR			1	*
FUEL BOOST PUMP	*	1	1	*
PILOT'S OPERATING HANDBOOK & AIRPLANE FLIGHT MANUAL	*	*	*	*
PITOT Heater ****			*	*
CAT GAUGE ****			1	*
VSI ****			1	*
ALTERNATE STATIC SOURCE ****			1	1
STAND-BY VACUUM SYSTEM ****			1	1

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

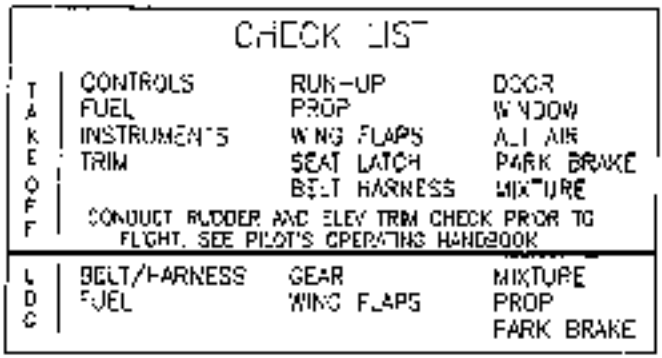
DECALS AND PLACARDS

CABIN INTERIOR

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

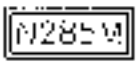
ON LEFT SIDE PANEL IN PILOT'S VISION

-4055

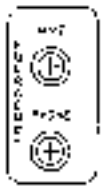


ON CONSOLE

A4027

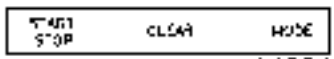


UPPER INSTRUMENT PANEL-PILOT SIDE



ON LOWER CONSOLE

UPPER LH INSTRUMENT PANEL



A4004

FLAP UP
A3015

CONSOLE ABOVE & BELOW SWITCH

FLAP DOWN
A4015

PILOT'S LH PANEL END OF ARM REST

(OPTIONAL FOR M20R)

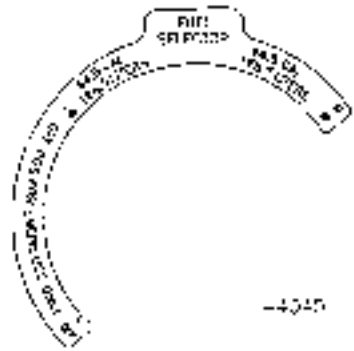
WARNING:
DO NOT EXCEED 170 LBS (77 kg) ON THIS SEAT BACK
SEE AIRCRAFT ORIGINAL CONSOLE DATA FOR BAGGAGE CENTER VENT ALLOWABLE
-4045

FWD END OF REAR SEAT BOTTOM STRUCTURE

FLOORBOARD BETWEEN SEATS

ON RADIO PANEL ADJACENT TO SLT SWITCH (OPTIONAL)

CAUTION
ABSENCE OF ALL LIGHTS DURING FIRST 3 SECONDS OF TEST INDICATES PROPER FUNCTION
A4015



MIKE PHONE

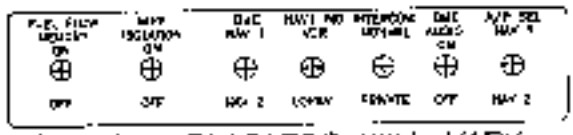
213

BELOW INSTRUMENT PANEL-EACH SIDE

ABOVE EACH FUEL QTY GAUGE ON SEZELISN 26-3170 TSAL 29-0196)

44.5 GAL USEABLE

INSTRUMENT/RADIO PANEL (VARIES W/ INSTALLED EQUIP.)



(TYPICAL--PLACARDS WILL VARY WITH AIRCRAFT CONFIGURATION)

PUSH
TO SAFETY
BY PASS

GEAR UP
150 KIAS

GEAR DOWN
140 KIAS
GEAR EXTD
165 KIAS

A2001

UPPER
CTR
INSTR
PANEL

ABOVE
INSIDE
BAGGAGE
DOOR
HANDLE

AUXILIARY EXIT
DO NOT OPEN IN FLIGHT
TO OPEN
1. PULL OFF COVER
2. PULL CABLE RETRACTING LOCK PIN
3. ACTUATE HANDLE
TO CLOSE
1. STORE HANDLE
2. INSERT LOCK PIN
3. INSTALL COVER
4. CLOSE AND LATCH DOOR USING OUTSIDE HANDLE
5. LOCK DOOR

-4041

LWR INSTR PNL BELOW
CONTROL WHEEL SHAFT

FULL FOR ALT
STATIC SOURCE

A4001

ABOVE ENGINE INSTRUMENT
CLUSTER ON DEZEL (23-0170-23-0199)

DO NOT OPEN
ABOVE 195 KIAS

6049

BELOW
PILOT'S
STORM
WINDOW

ON MAGNETIC
COMPASS

-4015

AROUND EACH OXYGEN
OUTLET ON OVERHEAD
PANEL

OXYGEN

(OPTIONAL) OXY-SH

ABOVE
EACH
CONTROL
ON LWR
INSTR.
PANEL

THROTTLE
PUSH INCREASE

A4002

PROP
PUSH INCREASE

A4003

MIXTURE
PUSH RICH

A4005

CONSOLE ON CONTROL KNOB

A T A R
PULL ON

9-7033-11

WARNING: DO NOT EXCEED 120 LBS (54.4 Kg) IN THIS COMPARTMENT
SEE FOR STORAGE OF LIGHT DUTY APPROX ONLY
SEE AIRCRAFT LOADING SCHEDULE DATA
FOR BAGGAGE COMPARTMENT ALLOWABLE
–6021

BAGGAGE COMPARTMENT
ON HAT RACK SHELF

TOP OF BAGGAGE DOOR JAMB

WARNING: DO NOT EXCEED 120 LBS
(54.4 Kg) IN THIS COMPARTMENT
SEE AIRCRAFT LOADING SCHEDULE DATA
FOR BAGGAGE COMPARTMENT ALLOWABLE
–6020

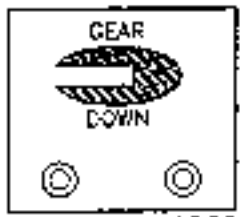
INSTRUMENT PANEL

SPEEDBRAKE EQUIPPED: FOR OPERATING INSTRUCTIONS AND LIMITATIONS SEE FAA APPROVED AFM SUPPLEMENT OR PILOTS OPERATING HANDBOOK.
(OPTIONAL) –4057

ON UPPER INSTRUMENT PANEL

NXXXXX

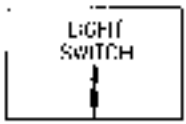
FLOORBOARD - BETWEEN SEATS



–4009

BETWEEN SEATS - ON EMERGENCY GEAR RELEASE EXTENSION HANDLE

PUSH TO RELEASE
–6012

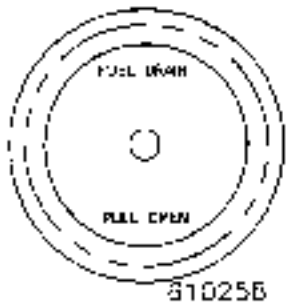


–6052

BAGGAGE DOOR FRAME

14 VOLTS
3 AMPS MAX
5 AINTERMITTENT

RT RADIO PNL ADJACENT TO AUX. <----PWR PLUG



S10258

FLOORBOARD - FWD OF CO-PILOT SEAT---->

FUSELAGE INTERIOR

The following placards must be installed inside the fuselage at the location specified

CAUTION

THIS DOOR SHALL BE REMOVED AND STOWED WHEN FIELD TEMPERATURES EXCEED 30°F (-1°C)

ON KIT SLIDING DOOR AT OIL COOLER, IF KIT INSTALLED

CAUTION
WINTERIZATION KIT INSTALLED

WHEN OPERATING AT TEMPERATURES ABOVE 30°F (-1°C) REMOVE OIL COOLER DOOR.

ON OIL FILLER DOOR IF KIT INSTALLED

MAINTAIN

LEVEL HERE

-6011

HYDRAULIC OIL RESERVOIR

28 VOLTS ONLY

-6080

BACKSIDE OF AUX. PWR. RECEPTACLE DOOR

USE AVIATORS OXYGEN ONLY

SEE PILOT'S OPERATING HANDBOOK FOR FILLING PRESSURES

(OPTIONAL) -41150

INSIDE OXYGEN FILLER DOOR

BOTH BATTERIES MUST BE INSTALLED FOR FLIGHT

-6060

ON BATTERY ACCESS PANELS LH & RH

INSIDE ENGINE OIL FILLER DOOR

ENGINE OIL
OIL INSTALLED IN THIS ENGINE IS

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

-6041

EXTERIOR

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

NO STEP
-6000

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

UNDERSIDE OF WING (2 PLCS) & AFT OF LH CONL FLAP (1PLC)

HOIST POINT
-6002

DO NOT PUSH
-6001

HORIZ. STAB. L/E
RUDDER T/E (BOTH SIDES)

UNDER TAILCONE AFT OF WING T/E

STATIC DRAIN
-6024

PITOT DRAIN
-6025

UNDER LEFT WING L/E NEAR FUSELAGE

UNDER WING NEAR SUMP DRAINS

FUEL DRAIN
-6028

GASCOLATOR DRAIN
-6030

UNDER FUSELAGE RT SIDE AFT OF NOSE WHEEL WELL

ON MAIN LDG GEAR DOOR

TIRE PRESSURE 42 PSI (2.95 kg/cm²)
-6012

TIRE PRESSURE 49 PSI (3.44 kg/cm²)
-6042

ON NOSE LANDING GEAR DOOR

TOWING LIMITS

-6035

ON NOSE LANDING GEAR LEG ASSY

ON NOSE LANDING GEAR SPINDLE ASSY.

WARNING
DO NOT EXCEED
TOWING LIMITS

-6036

LWR LH WING PANEL OUTBD OF HOIST PT

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

6054

FUEL 100(GREEN) OR 100LL(BLUE) MIN OCT
44 U.S. GAL USABLE
166.5 LITERS USABLE

-6004

ON BOTH FUEL FILLER CAPS

BLANK

TABLE OF CONTENTS

TABLE OF CONTENTS (con't)

INTRODUCTION

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

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

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

NOTE

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

AIRSPEEDS FOR EMERGENCY OPERATIONS

CONDITION	RECOMMENDED SPEED
ENGINE FAILURE AFTER TAKEOFF	
Wing Flaps UP	85 KIAS
Wing Flaps DOWN	80 KIAS
BEST GLIDE SPEED	
3368 lb/1528 kg	84.5 KIAS
3200 lb/1482 kg	83.0 KIAS
2900 lb/1315 kg	80.5 KIAS
2600 lb/1179 kg	77.0 KIAS
MANEUVERING SPEED	
3368 lb/1528 kg	127 KIAS
3300 lb/1497 kg	126 KIAS
2430 lb/1102 kg	108 KIAS
2232 lb/1012 kg	103 KIAS
PRECAUTIONARY LANDING WITH ENGINE POWER	
Flaps DOWN	75 KIAS
PRECAUTIONARY LANDING ABOVE 3200 LBS	
Flaps DOWN	80 KIAS
EMERGENCY DESCENT (GEAR UP)	
Smooth Air	156 KIAS
Turbulent Air	
3368 lb/1528 kg	127 KIAS
3300 lb/1497 kg	126 KIAS
2430 lb/1102 kg	108 KIAS
2232 lb/1012 kg	103 KIAS
EMERGENCY DESCENT (GEAR DOWN)	
Smooth Air	165 KIAS
Turbulent Air	
3368 lb/1528 kg	127 KIAS
3300 lb/1497 kg	126 KIAS
2430 lb/1102 kg	108 KIAS
2232 lb/1012 kg	103 KIAS

ANNUNCIATOR PANEL WARNING LIGHTS

WARNING LIGHT	FAULT & REMEDY
GEAR UNSAFE	RED light indicates landing gear is not in fully extended or retracted position. Refer to "FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY" procedure or "FAILURE OF LANDING GEAR TO RETRACT" procedure.
LEFT or RIGHT FUEL	RED light indicates 2 1/2 to 3 gals (9.5 to 11.4 liters) S/N 29-0001 thru 29-0169; [5 to 6 gals (23 to 30.3 liters) S/N 29-0170 thru 29-0199] of usable fuel remain in the respective tanks. Switch to fuller tank.
SPEED BRAKE	AMBER light indicates Speed Brakes are activated.
ALT AIR	AMBER light indicates alternate induction air door is open.
PROP DEICE	BLUE light indicates power applied to De-Ice boots.
PITOT HEAT	BLUE light indicates power is applied to heater. (Some Foreign A/C - AMBER light indicates power is NOT applied to heater.)
HI-O VAC (Flashing)	Suction is below 4.25 in. Hg (RED) Turn Stand-By Vacuum pump - ON
HI-LO VAC (Steady)	Suction is above 5.5 in. Hg (RED) Turn Stand-by Vacuum pump - ON

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 low. Refer to "ALTERNATOR OUTPUT LOW"
ALT VOLTS (Steady)	RED light indicates overvoltage sensing A/C light. C/B tripped. Refer to "ALTERNATOR OVER-VOLTAGE"
START ENGAGED	RED light indicates switch is fully engaged and starter is energized. Flight should be terminated as soon as practicable. Engine damage may result. This is normal indication during engine start.
STBY VAC	AMBER light indicates stand-by vacuum pump is ON.
REMOTE RNAV	NOT USED AT THIS TIME
BOOST PUMP	BLUE light indicates power to auxiliary fuel boost pump.

ENGINE

POWER LOSS - DURING TAKEOFF ROLL

Throttle	CLOSED
Brakes	AS REQUIRED TO STOP AIRCRAFT
Fuel Selector	OFF
Magneto/Starter Switch	OFF
Master Switch	OFF

POWER LOSS - AFTER LIFTOFF

Airspeed	82 KIAS (Flaps UP) 80 KIAS (Flaps TAKEOFF/DOWN)
Keep THE AIRCRAFT UNDER CONTROL	then:
Fuel Selector	SELECT OTHER TANK
Throttle	FULL FORWARD
Magneto switch	Verify ON BOTH
Mixture	FULL FORWARD
Propeller	FULL FORWARD
LOW Boost Pump Switch	ON to attempt re-start
If Engine Quits - then:	
HIGH BOOST Pump (guarded switch)	ON to attempt re-start

LAND AS SOON AS PRACTICABLE; CORRECT MALFUNCTION PRIOR TO NEXT FLIGHT
If engine does not re-start, proceed to **FORCED LANDING EMERGENCY**

WARNING:

Engine may run rough due to overrich mixture. Lean mixture until engine operates smoothly.

NOTE

If high power is required, mixture may require enrichening.

POWER LOSS - IN FLIGHT (RE-START PROCEDURES)

Airspeed	95 KIAS minimum
Fuel Selector	SELECT OTHER TANK (Verify fullest tank)
LOW Boost Pump Switch	ON - to attempt re-start
Throttle	FULL FORWARD
Propeller	FULL FORWARD
Mixture	AS REQUIRED to restore power
Magneto/Starter Switch	VERIFY on BOTH
LOW Boost Pump Switch	OFF if engine does not start immediately
HIGH BOOST Pump (guarded switch)	ON - to attempt re-start
Alternate Air Door	Manually Open

If engine does not start after initial attempts:

Mixture	IDLE CUT-OFF (detent) then advance slowly towards RICH until engine starts

If engine does not re-start after several attempts establish best glide speed (Refer to Maximum Glide Distance Chart) and proceed to **FORCED LANDING EMERGENCY**

After engine re-start:

Throttle	ADJUST as required
Propeller	ADJUST as required
Mixture	RE-TRIM as required for power setting
HIGH BOOST Pump Switch	OFF

NOTE

If engine fails when HIGH BOOST pump is turned OFF, suspect engine driven fuel pump failure. Proceed to ENGINE DRIVEN FUEL PUMP FAILURE.

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

- CAUTION -

Should engine excessively cool during engine out, care should be exercised during re-start to avoid excessive oil pressure. Allow engine to warm up.

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

POWER LOSS - PRIMARY ENGINE INDUCTION AIR SYSTEM BLOCKAGE

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

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

The following checklist should be used if a partial power loss due to primary induction air system blockage is experienced:

Alternate Air	Verify OPEN (annunciator light ON)
Manifold Pressure	1 - 2 inches less than normal, due to warm induction air

NOTE

The alternate air door should open automatically when primary induction system is restricted. If alternate air door has not opened (Annunciator light-OFF) it can be opened manually by pulling alternate air control.

Throttle	INCREASE as desired
Propeller	INCREASE as required to maintain desired cruise power setting (Ref. SECTION V)
Mixture	RELEAN to desired EGT
Flight	CONTINUE - request altitude with warmer air, if able.

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

Airspeed	BEST GLIDE SPEED
Alternate Air	Manually OPEN
LOW Boost Pump Switch	ON
Throttle	Full FORWARD
Propeller	FULL FORWARD
Mixture	AS REQUIRED to restore power
Magneto/Starter Switch	Verify on BOTH

After engine re-start

Throttle	ADJUST as required
Propeller	ADJUST as required
Mixture	RELEAN as required for power setting (Refer to power charts - SECTION V)
LOW Boost Pump Switch	OFF

If engine does not re-start after several attempts, maintain best glide speed & proceed to FORCED LANDING EMERGENCY.

ENGINE ROUGHNESS

Engine Instruments . . . . . CHECK
Fuel Selector . . . . . OTHER TANK
Mixture . . . . . READJUST for smooth operation
Magneto/Starter Switch . . . . . Select R or L or BOTH

If roughness disappears on single magneto, monitor power and continue on selected magneto.

WARNING

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

Throttle . . . . . REDUCE
. . . . . check for a throttle setting that may cause roughness to decrease.

If severe engine roughness cannot be eliminated LAND AS SOON AS PRACTICABLE

HIGH CYLINDER HEAD TEMPERATURE

Mixture . . . . . ENRICH As Required
Airspeed . . . . . INCREASE As Required
Power . . . . . REDUCE – if temperature cannot be maintained within limits

HIGH OIL TEMPERATURE

NOTE

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

Airspeed . . . . . INCREASE
Power . . . . . REDUCE

PREPARE FOR POSSIBLE ENGINE FAILURE IF TEMPERATURE CONTINUES HIGH

LOW OIL PRESSURE

Oil temperature and pressure gauges . . . . . Monitor
Pressure below 20 PSI . . . . . EXPECT ENGINE FAILURE, proceed to FORCED LANDING EMERGENCY

ENGINE DRIVEN FUEL PUMP FAILURE

WARNING

When operating engine at moderate power with "HIGH BOOST" ON and engine driven fuel pump has failed, engine may quit or run rough when manifold pressure is reduced, unless manually leaned.

An engine driven fuel pump failure is probable when engine will only operate with HIGH BOOST pump ON. Operation of engine with a failed engine driven fuel pump and auxiliary fuel pump HIGH BOOST ON will require smooth operation of engine controls and corresponding mixture change when throttle is repositioned or engine speed is changed. When relanding throttle or reducing engine speed, adjust mixture to prevent engine power loss from an overrich condition. Enrich mixture when opening throttle or increasing engine speed to prevent engine power loss from a lean condition. Always learn to obtain a smooth running engine.

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

HIGH BOOST Pump (guarded switch) . . . . . ON
Throttle . . . . . CRUISE Position or as required for engine operation
Mixture . . . . . ADJUST for smooth engine operation.
LAND AS SOON AS PRACTICABLE & CORRECT MALFUNCTION.

FUEL VAPOR SUPPRESSION (Fluctuating Fuel Flow)

Low Fuel Boost Pump Switch . . . . . ON to clear vapors
Engine operation . . . . . MONITOR
Low Fuel Boost Pump Switch . OFF - (if condition still exists, REPEAT PROCEDURE).

FIRES

ENGINE FIRE - DURING START ON GROUND

Magneto/Starter Switch . CONTINUE cranking or until fire is extinguished
If engine starts:
Power . . . . . 1500 RPM for several minutes
Engine . . . . . SHUTDOWN; inspect for damage
If engine does NOT start:
Magneto/Starter Switch . . . . . CONTINUE CRANKING
Mixture . . . . . IDLE CUTOFF
Low Fuel Boost Pump Switch . . . . . OFF
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

NOTE

If fire is not extinguished, attempt to increase airflow over engine by increasing glide speed. Proceed with FORCED LANDING EMERGENCY. DO NOT attempt an engine restart.
If necessary, use fire extinguisher to keep fire out of cabin area

ELECTRICAL FIRE - IN FLIGHT (Smoke in Cabin)

Master Switch . . . . . OFF

WARNING

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

Alternator Field Switch . . . . . OFF
Cabin Ventilation . . . . . OPEN
Heating Controls . . . . . CLOSED
Circuit Breakers . . . . . CHECK to identify faulty circuit if possible
LAND AS SOON AS POSSIBLE.

If electrical power is essential for 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.

EMERGENCY DESCENT PROCEDURE

In the event an emergency descent from high altitude is required, rates of descent of least 3 000 feet per minute can be obtained in two different configurations:
(1) With landing gear and flaps retracted, an airspeed of 199 KIAS will be required for maximum rate of descent.

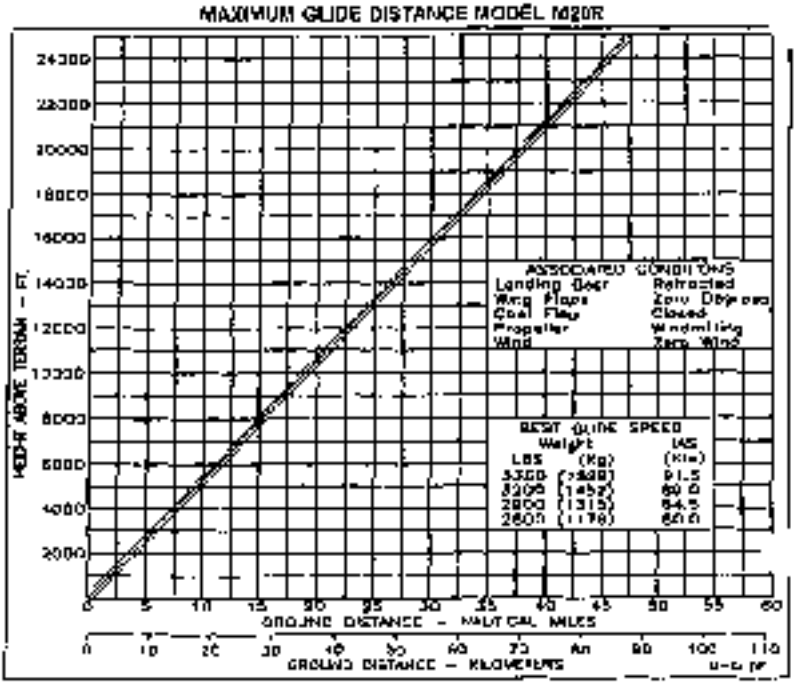
(2) With the landing gear extended and flaps retracted an airspeed of 165 KIAS will also give approximately the same rate of descent. At 165 KIAS and the gear extended, the angle of descent will be greater, thus resulting in less horizontal distance traveled than a descent at 199 KIAS. Additionally, descent at 165 KIAS will provide a smoother ride and less pilot work load.

THEREFORE: The following procedure is recommended for an emergency descent:

Power	RETARD INITIALLY
Airspeed	149 KIAS
Landing Gear	EXTEND
Airspeed	INCREASE TO 165 KIAS after landing gear is extended.
Wing Flaps	UP
Airspeed	MAINTAIN 165 KIAS during descent.
Speedbrakes (if installed)	EXTEND
Altitude	AS DESIRED
Power During Descent	AS REQUIRED to maintain CHT 250°F (121°C) minimum.

GLIDE

MAXIMUM GLIDE DISTANCE MODEL M20R



NOTE

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

FORCED LANDING EMERGENCY

GEAR RETRACTED OR EXTENDED

Emergency Locator Transmitter	ARMED
Seat Belts/Shoulder Harnesses	SECURE
Cabin Door	UNLATCHED
Fuel Selector	OFF
Mixture	IDLE CUTOFF
Magneto/Starter Switch	OFF
Wing Flaps	FULL DOWN
Landing Gear	DOWN-if conditions permit
Approach Speed	80 KIAS
Master Switch	OFF, prior to landing
Wings	LEVEL Attitude

OVERWEIGHT LANDING PROCEDURES

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

Approach Airspeed	83 KIAS

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

SYSTEMS EMERGENCIES

PROPELLER

PROPELLER OVERSPEED

Throttle	RETARD
Oil Pressure	CHECK
Propeller	DECREASE RPM, reset if any control available
Airspeed	REDUCE
Throttle	AS REQUIRED to maintain RPM below 2500 RPM

FUEL

LOW FUEL FLOW

Check mixture	ENRICH
Fuel Selector	SWITCH TANKS

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

ELECTRICAL

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

Alternator Field Circuit Breaker	RESET

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

1. Reduce electrical load, as required, to maintain essential systems
2. Continue flight and LAND, when PRACTICABLE, to correct malfunction

NOTE

The only source of electrical power is from the selected battery. Monitor battery voltage (min. 18V) and switch to other battery when necessary.

ALTERNATOR OUTPUT LOW
(Alternator warning light flashing)

REDUCE ELECTRICAL LOAD

If annunciator light still flashes:

Alternator Field Switch . . . . . OFF

1. Reduce electrical load, as required, to maintain essential systems
2. Continue flight and LAND, when PRACTICABLE, to correct malfunction

NOTE

The only source of electrical power is from the selected battery. Monitor battery voltage (min. 18V) and switch to other battery when necessary.

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

LANDING GEAR

FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY

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

NOTE

Slowly pull "T" handle 1 to 2 inches (2.6 to 5.1 cm) to locate clutch mechanism and allow it to engage drive shaft.

T-Handle . . . . . PULL (12 to 30 times) and RETURN until gear is down and locked
GEAR DOWN and ILLUMINATED. STOP when resistance is felt.
Visual Gear Down Indicator . . . . . CHECK ALIGNMENT by viewing from directly above indicator

CAUTION

Continuing to pull on T-Handle, after GEAR DOWN light ILLUMINATES, may bind actuator; electrical retraction MAY NOT be possible until binding is eliminated by ground maintenance. Return lever to normal position and secure with latch. Reset landing gear actuator circuit breaker.

WARNING

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

Do not fly craft until maintenance/inspection is done on landing gear system.

FAILURE OF LANDING GEAR TO RETRACT

AIRSPEED . . . . . Below 107 KIAS
GEAR Switch . . . . . UP Position
GEAR FAILS TO RETRACT — GEAR HORN - SOUNDING.
GEAR ANNUNCIATOR LIGHT & GEAR SAFETY BY-PASS LIGHT . . . ILLUMINATED

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

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

WHEN READY TO EXTEND LANDING GEAR

Airspeed . . . . . BELOW 140 KIAS
Gear Relay C/B . . . . . RESET
Landing Gear Switch . . . . . DOWN
Gear Down Light . . . . . ILLUMINATED

| NOTE |

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

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

GEAR EMERGENCY EXTENSION LEVER (on floor) . . . Verify LATCHED in proper position
GEAR ACTUATOR C/B . . . . . RESET
Gear should retract if C/B was tripped
FLIGHT . . . . . CONTINUE (if desired)

When ready to extend landing gear at next landing:
AIRSPEED . . . . . Below 140 KIAS
GEAR SWITCH . . . . . DOWN Position
If gear will not extend electrically at this time, refer to FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY (previous page).

VACUUM

When "HI/LO VAC" annunciator light illuminates (flashing or steady), vacuum operated instruments are considered to be unreliable. Push stand-by vacuum pump switch ON. The flashing Hi/LO VAC annunciator light should extinguish and the STBY VAC annunciator will illuminate. The vacuum operated gyro instruments will be operating on the stand-by vacuum system. The steady RED annunciator light may not extinguish when the stand-by vacuum switch is ON. Continue flight, monitor non-vacuum gauges. Have vacuum system inspected prior to next flight.

OXYGEN

In the event of oxygen loss above 12,500 ft. return to 12,500 ft as soon as feasible. Refer to SECTION X for the physiological characteristics of high altitude flight.

ALTERNATE STATIC SOURCE

The alternate static air source should be used whenever it is suspected that the normal static air sources are blocked. Selecting the alternate static source changes the source of static air for the airmeter, airspeed indicator and rate-of-climb from outside of the aircraft to the cabin interior. When alternate static source is in use, altitude indicated airspeed and altimeter readings according to the appropriate alternate static source airspeed and altimeter calibration tables in SECTION V. The alternate static air source valve is located on the instrument panel below pilot's control wheel shaft.

| NOTE |

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

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

UNLATCHED DOORS IN FLIGHT

CABIN DOOR

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

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

Airspeed	85 KIAS
Pilot's Storm Window	OPEN
Aircraft	RIGHT SIDESLIP (Right bank with left rudder)
Door	FULL SHUT & LATCH

BAGGAGE DOOR

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

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

ICING

WARNING

DO NOT OPERATE IN KNOWN ICING CONDITIONS.

The Model M20R is **NOT APPROVED** for flight into known icing conditions and operation in that environment is prohibited. However, if those conditions are inadvertently encountered or flight into heavy snow is unavoidable, the following procedures are recommended until further icing conditions can be avoided.

INADVERTENT ICING ENCOUNTER

Pitot Heat	ON
Propeller Deice	ON (if installed)
Alternate Static Source	ON (if required)
Cabin Heat & Defroster	ON
Engine Gauges	MONITOR for any engine power reduction

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

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

| 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.

| NOTE |

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

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

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

—— AVOID FURTHER ICING CONDITIONS ——

EMERGENCY EXIT OF AIRCRAFT

CABIN DOOR

PULL latch handle AFT.
OPEN door and exit aircraft.

BAGGAGE COMPARTMENT DOOR (Auxiliary Exit)

Release (Pull UP) rear seat back latches on spar
Fold rear seat backs forward. CLIMB OVER.
PULL off plastic cover from over inside latch
PULL latch pin
Pull red handle.
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 side of latch mechanism.
Place latch pin in shift hole to hold RED handle DOWN
Replace cover.
CHECK & operate outside handle in normal manner.

SPINS

WARNING

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

NOTE

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

INTENTIONAL SPINS ARE PROHIBITED.

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

Throttle	RETARD to IDLE
Ailerons	NEUTRAL
Rudder	Apply FULL RUDDER opposite direction of spin
Control Wheel	FORWARD of neutral in a brisk motion

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

HOLD ANTI-SPIN CONTROLS UNTIL ROTATION STOPS

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

OTHER EMERGENCIES

Refer to SECTION IX for Emergency Procedures of Optional Equipment.

TABLE OF CONTENTS

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INTRODUCTION

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

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

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

SPEEDS FOR NORMAL OPERATION

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

TAKEOFF:

Normal Climb Out	80-90 KIAS
Short Field Takeoff, Speed At 50 Ft.	75 KIAS

ENROUTE CLIMB, GEAR and FLAPS UP:

Best Rate of Climb	105 KIAS
Best Angle of Climb	85 KIAS

LANDING APPROACH (3200 lbs.):

Normal Approach, Flaps 10 degrees	80 KIAS
Normal Approach, Flaps 33 degrees	75 KIAS
Short Field Approach, Flaps 33 degrees	70 KIAS

BALKED LANDING (3200 lbs.):

Maximum Power, Flaps 10 degrees	85 KIAS

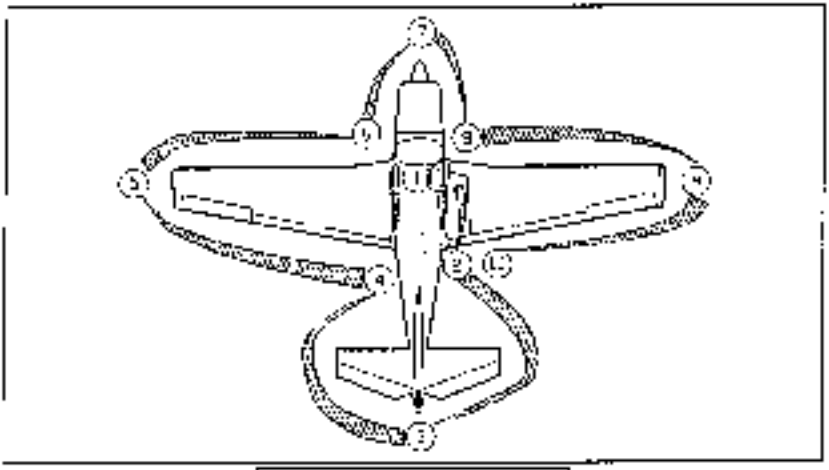
MAXIMUM RECOMMENDED TURBULENT AIR PENETRATION SPEED:

3368 lbs./1528 Kgs	127 KIAS
3200 lbs./1452 Kgs	123 KIAS
2800 lbs./1315 Kgs	117 KIAS
2600 lbs./1179 Kgs	111 KIAS
2400 lbs./1088 Kgs	106 KIAS

DEMONSTRATED CROSSWIND VELOCITY:

Takeoff or Landing . . . . . 19 Knots
(This is NOT A LIMITATION, only a demonstrated number)

(See CROSSWIND COMPONENT CHART, SECTION V)



PREFLIGHT INSPECTION

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

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

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

* If TKS system is installed, only pitot anunciator will illuminate AMBER when switch is ON and Pitot Heat has failed. Annunciator will not be illuminated when switch is ON and system is operating properly.

4. Left Fuselage/Tailcone

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

5. Left Wing

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

NOTE

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

Tiedown rope/chain	REMOVE
Wheel chock	REMOVE
Left Main Landing Gear, check door, tire & doors	INSPECT
Fuel Tank Sump Drain	DRAIN

Use sampler cup to VERIFY fuel is free of water, sediment & other contamination.
VERIFY proper fuel (BLUE/100LL)(GREEN/100 octane)

– CAUTION –

Some diesel may be BLUE. Verify by smell and feel that 100LL is being used.

VERIFY drain closed and does not leak

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

6. Left Cowl Area

Windshield	CLEAN
Cabin Air Inlet	UNOBSTRUCTED
Left Side Engine Cowl Fasteners	SECURED
Exhaust Pipes	INSPECT SECURED
Engine Oil Filter Door	OPEN & INSPECT AREA

NOTE

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

Engine Oil	CHECK QUANTITY 8 Qts.(7.57 L)
Engine Oil Filter Door	CLOSE & SECURE
Cooling Air Inlet	Verify UNOBSTRUCTED

7. Propeller/Spinner & Front Cowl Area

Propeller/Spinner	INSPECT for nicks, cracks, oil leaks/abnormal movement
Prop Deice Boots (if installed)	INSPECT condition
Induction Air Inlet/Filter	UNOBSTRUCTED
Nose gear, check oleo, tire & doors	INSPECT
Wheel chock	REMOVE

8. Right Crew Area
Right Side Engine Cowl Fasteners . . . . . SECURED
Cooling Air Inlet . . . . . Verify UNOBSTRUCTED
Windshield . . . . . CLEAN
Cabin Air Inlet . . . . . UNOBSTRUCTED

9. Right Wing

Fuel Tank Sump Drain . . . . . DRAIN
Use sample cup to VERIFY fuel is free of water, sediment & other contaminants.
VERIFY proper fuel (BLUE/100LL, GREEN/100 octane)
. . . . . SEE CAUTION on diesel fuel on previous page
VERIFY drain closes and does not leak.

Right main gear, shock disc, bolts & nuts . . . . . INSPECT
Wheel chuck . . . . . REMOVE
General Skin Condition . . . . . INSPECT Remove ice, snow and frost.
Fuel Tank . . . . . CHECK QUANTITY/SECURE CAP

| NOTE |

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

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

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

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

BEFORE STARTING CHECK

Preflight Inspection . . . . . COMPLETED
Seats, Seat Belts/Shoulder Harness (if occupant restraints) . . . . . ADJUST & SECURED
Magneto/Starter Switch . . . . . OFF
Master Switch . . . . . OFF
Alternator Field Switch . . . . . OFF
Radio Master Switch . . . . . OFF
Fuel Boost Pump Switches . . . . . OFF
Directional Gyro (slave) (if installed) . . . . . SLAVED (if installed)
Circuit Breakers . . . . . CHECK - ALL IN
SELF Switch . . . . . ARMED
Rocker Switches . . . . . OFF
Alternate Static Source . . . . . Push OFF
Throttle . . . . . CLOSED
Propeller . . . . . FULL FORWARD (HIGH RPM)
Mixture . . . . . IDLE CUT-OFF
Parking Brakes . . . . . SET
Wing Flap Switch . . . . . FLAPS UP
Defrost . . . . . PUSH OFF
Cabin Heat . . . . . PUSH OFF
Cabin Vent . . . . . AS DESIRED
Fuel Selector . . . . . FULLEST TANK
All Rocker Switches . . . . . OFF
Landing Gear Switch . . . . . DOWN POSITION

RED Emergency Gear Extension Handle	DOWN AND LATCHED
Internal Lights	OFF
Passenger Briefing	COMPLETED
	(Emergency and general information briefing)

Refer to SECTION 9 for Optional Equipment Procedures and Checklists

Obtain local information prior to engine start.

ENGINE START

~ CAUTION ~

When either battery voltage is low, inspection should be conducted to determine condition of battery and/or reason for battery being low. Replacement or servicing of batteries is essential and charging for at least one hour should be done before engine is started. Batteries must be serviceable and IT IS RECOMMENDED THAT BATTERIES BE FULLY CHARGED TO OPERATE AIRCRAFT. Electrical components may also be damaged if aircraft is operated when batteries are low.

| NOTE |

When starting engine using the approved external power source, no special starting procedure is necessary. Use normal starting procedures below. DO NOT START ENGINE IF BOTH BATTERIES ARE INCAPABLE OF STARTING ENGINE. Recharge dead batteries for at least one hour (at 3-4 amps) before starting engine. Only No. 1 battery (left side of tailcone) is connected to the Auxiliary Power plug.

Before Starting Checklist	COMPLETED
Throttle	FULL OPEN
Propeller	FULL FWD (High RPM)
Mixture	Full Forward (RICH)
Master Switch	ON
Alternator Field Switch	ON
Annunciator Lights	PRESS TO TEST (all lights should illuminate)
Low Fuel Boost Pump Switch	ON during engine starting sequence

~ CAUTION ~

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

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

| NOTE |

COLD ENGINE START - Low fuel boost pump ON during "Start" sequence. Turn low fuel boost pump OFF when engine obtains smooth operation.

| NOTE |

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

| NOTE |

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

Throttle . . . . . IDLE 600 - 700 RPM
* Engine Oil Pressure . . . . . CHECK in GREEN ARC
. . . . . If minimum oil pressure (10 PSI) is not indicated within 30 seconds accomplish engine shutdown procedures.
Low Fuel Boost Pump Switch . . . . . OFF
* Ammeter . . . . . CHECK
Turn LDG LT ON & observe negative movement of needle
* Interior/Exterior Lights . . . . . AS DESIRED
* Engine Instruments . . . . . CHECKED
* Fuel Flow Indicator . . . . . TEST/RESET (if desired)
* Throttle . . . . . 600/1000 RPM
* Mixture . . . . . ADJUST FOR SMOOTH OPERATION

– CAUTION –

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

FLOODED ENGINE START

Throttle . . . . . 1/2 OPEN
Mixture . . . . . IDLE CUTOFF
Low Fuel Boost Pump Switch . . . . . ON - 8 - 10 SECONDS THEN OFF
Magneto/Starter Switch . . . . . TURN & PUSH to START
release to BOTH when engine starts
Mixture . . . . . Slowly advance toward RICH until engine starts
Throttle . . . . . IDLE 600 - 700 RPM
SEE ENGINE START PROCEDURES ABOVE * FOR REMAINING SEQUENCES.

WARM ENGINE START

Throttle . . . . . 1/2 to 1 inch OPEN
Mixture . . . . . Full Forward (RICH)
Low Fuel Boost Pump Switch . . . . . ON - (TO CLEAR FUEL VAPORS)
Low Fuel Boost Pump Switch . . . . . OFF
Magneto/Starter Switch . . . . . WITHIN 1-2 SECONDS, TURN & PUSH to START
release to BOTH when engine starts
Throttle . . . . . IDLE 600 - 700 RPM
SEE ENGINE START PROCEDURES ABOVE * FOR REMAINING SEQUENCES

HOT ENGINE START

Throttle . . . . . FULL OPEN
Mixture . . . . . IDLE CUT-OFF
Boost Pump . . . . . HIGH for 5 sec. or LOW for 15 sec.
Boost Pump . . . . . OFF
Throttle . . . . . IDLE POSITION
Mixture . . . . . Full Forward (RICH)
Magneto/Starter Switch . . . . . TURN & PUSH to START
release to BOTH when engine starts
Throttle . . . . . IDLE 600 - 700 RPM
SEE ENGINE START PROCEDURES ABOVE * FOR REMAINING SEQUENCES.

BEFORE TAXI

Engine Start Checklist . . . . . COMPLETED
Radio Master Switch . . . . . ON
Elevator Trim Switch . . . . . ON
Internal/External Lights . . . . . As Desired
Directional Gyro . . . . . SET or Slave switch ON
Stand-by Vacuum Pump Operational Check
Stand-by vacuum operational indicator red button - VISIBLE
STBY VAC Switch . . . . . ON

BEFORE TAXI (con't)

Stand-by vacuum operational indicator red button - NOT VISIBLE
STBY VAC Switch . . . . . OFF
Instruments . . . . . Normal Operation
Radios . . . . . CHECKED and SET
Altimeter . . . . . SET
Fuel Selector . . . . . SWITCH TANKS verify engine runs on other tank
Cabin Heat . . . . . AS DESIRED
Defroster . . . . . AS DESIRED
Cabin Vent . . . . . AS DESIRED
Optional Equipment Checks . . . . . Reference SECTION IX

TAXI

Before Taxi Checklist . . . . . COMPLETED
Rudder Trim . . . . . AS DESIRED

– CAUTION –

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

Parking Brake . . . . . 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
Propeller . . . . . Full Forward (HIGH RPM)

– CAUTION –

To prevent battery depletion on prolonged taxi or holding position before takeoff, increase RPM until "AMMETER" indicates positive charge.

BEFORE TAKEOFF

Taxi Checklist . . . . . COMPLETED
Parking Brake . . . . . SET
Fuel Selector . . . . . FULLEST TANK
Throttle . . . . . 1000 RPM
Propeller . . . . . HIGH RPM
Mixture . . . . . FULL FORWARD
Alternate Air . . . . . Verify CLOSED
Alternator Field Switch . . . . . Verify ON
Throttle . . . . . 2000 RPM
Magneto Switch . . . . . CHECK - BOTH to L, BOTH to R, BOTH
Verify engine operates smoothly on each magneto separately
(150 RPM MAX drop on each magneto, 50 RPM MAX difference)

NOTE

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

Propeller . . . . . CYCLE/Return to high RPM
Ammeter . . . . . CHECK Positive Charge Indication
Throttle . . . . . RETARD to 1000 RPM
Low Fuel Boost Pump Switch . . . . . ON-Verify annunciator light will illuminate BLUE
Low Fuel Boost Pump Switch . . . . . OFF

Elevator Trim	TAKEOFF SETTING
Rudder Trim	TAKEOFF SETTING
Wing Flaps	CHECK operation,
SET AT TAKEOFF position (10 Degrees)	
Flight Controls	CHECK free and correct movement
Cabin Door	CHECK SECURED
Seats, Seat Belts and Shoulder Harness	SECURED
Avionics and Auto Pilot	CHECK - (Refer to SECTION IX)
Annunciator Lights	CHECK
Internal/External Lights	AS DESIRED
Strobe Lights/Rotating Beacon	ON
Pitot Window	CLOSED
Emergency Gear Extension (RED) Handle	DOWN & LATCHED
Oil Temperature	75°F(24°C) minimum
CHT	250°F(121°C) minimum
Parking Brake	RELEASE

TAKEOFF

Proper engine operation should be checked early in the takeoff roll. Any significant indication of rough or sluggish engine response is reason to discontinue 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 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)

Power	FULL THROTTLE (2500 RPM)
Annunciator	CHECK
Engine Instruments	CHECK for proper indications
Lift Off/Climb Speed	As specified in SECTION 5 (Takeoff Distance)
Landing Gear	RETRACT IN CLIMB after clearing obstacles.
Wing Flaps	UP

| NOTE |

If maximum performance takeoffs are desired obtain full power before brake release. Use lift off and climb speed as specified in SECTION 5.

CLIMB

| NOTE |

If applicable, use noise abatement procedures as required.

| NOTE |

See SECTION 5 for rate of climb graph.

CLIMB (CRUISE)

Power	2500 RPM
Manifold Pressure	24 Inches
Mixture	FULL RICH or BLUE ARC on EGT
Rudder Trim	As Desired
Airspeed	120 KIAS

CLIMB (BEST RATE)(Vy)

Power	FULL THROTTLE (2500 RPM)
Mixture	FULL RICH or BLUE ARC on EGT
Rudder Trim	As Desired
Airspeed	105 KIAS

Power	FULL THROTTLE/2500 RPM
Mixture	FULL RICH
Rudder Trim	As Desired
Airspeed	85 KIAS

Leaning may be required during CLIMB depending on atmospheric conditions.

CRUISE

NOTE

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

Airspeed	ACCELERATE to cruise airspeed
Throttle	SELECTED SETTING (Ref. CRUISE PERFORMANCE CHARTS in SECTION 5)

NOTE

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

Propeller	Set RPM to selected setting
Mixture	LEAN TO 50°F rich of PEAK EGT

NOTE

Cruise operation at BEST POWER will result in a substantial increase in fuel flow, greatly decreasing range and endurance; reference charts published in SECTION 5.

Engine Instruments	CHECK

NOTE

Careful leaning of mixture control will result in best fuel efficiency. This requires operating at proper EGT. Failure to do so will result in excessive fuel burn. After leveling off at cruise altitude, set RPM for desired power setting per Cruise Power Chart in Section V. Slowly lean mixture until EGT reaches peak value. Enrichen to 50°F rich of peak EGT for best power (50°F lean of peak is best economy); careful adjustments are necessary for accurate setting. Changes in altitude or power MAY REQUIRE readjustment of EGT.

Engine temperatures	STABILIZE at cruise condition.
Rudder Trim	As Desired

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

FUEL TANK SELECTION

Low Fuel Boost Pump Switch	ON
Fuel Selector	OPPOSITE TANK
Low Fuel Boost Pump Switch	OFF

OXYGEN SYSTEM

(OPTIONAL EQUIPMENT)

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

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

For safety reasons NO SMOKING should be allowed in the airplane while oxygen is being used.

When ready to use the oxygen system proceed as follows:

Mask and Hose . . . . . SELECT - either MIC or BTD
Adjust mask to face and adjust metallic nose strap for snug mask fit.
Delivery Hose . . . . . PLUG INTO OUTLET assigned to that seat

| NOTE |

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

Oxygen Supply Control Knob . . . . . ON
Face Mask Hose Flow Indicator . . . . . CHECK
. . . . . Oxygen is flowing if the indicator is being forced towards the mask.
Delivery Hose . . . . . UNPLUG from outlet when discontinuing use of oxygen
. . . . . This automatically stops flow of oxygen from that outlet
Oxygen Supply Control Knob . . . . . OFF - when oxygen is no longer required.

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

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

Refer to duration chart (Fig. 7-43) for safe operational quantities.

DESCENT

| NOTE |

Avoid extended descents at low manifold pressure settings, as engine can cool excessively and may not accelerate satisfactorily when power is re-applied.

NORMAL DESCENT - GEAR UP

Seats, Seat Belts/Shoulder Harness . . . . . ADJUST AND SECURE
Wing Flaps . . . . . UP
Landing Gear . . . . . UP
Throttle . . . . . CHT in Green
Propeller . . . . . 2400 RPM
Mixture . . . . . Peak EGT (Monitor as descent progresses)
Cylinder Head Temperature (CHT) . . . . . MONITOR 250° F (121° C) minimum
Airspeed . . . . . AS DESIRED (199 KIAS max)
Rudder Trim . . . . . AS DESIRED

NOTE

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

– CAUTION –

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

NORMAL DESCENT - GEAR DOWN

Seats, Seat Belts/Shoulder Harness	ADJUST AND SECURE
Wing Flaps	UP
Airspeed	DECELERATE to 140 KIAS
Landing Gear	DOWN
Throttle	Keep CHT in Green Arc
Propeller	2400 RPM
Mixture	Rich as desired (Monitor as descent progresses)
Cylinder Head Temperature (CHT)	Monitor (250° F (121° C) min)
Airspeed	100 KIAS or LESS

NOTE

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

APPROACH FOR LANDING

– CAUTION –

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

Seats, Seat Belts/Shoulder Harness	ADJUST AND SECURE
Internal/External lights	AS DESIRED
Landing Gear	EXTEND below 140 KIAS
	(Check Gear Down light ON Check visual indicator)
Mixture	FULL RICH (on final)
Propeller	HIGH RPM (on final)
Fuel Boost Pump Switches	OFF
Fuel Selector	FULLEST TANK
Wing Flaps	T/O POSITION (FULL DOWN below 110 KIAS)

-- CAUTION --

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

Elevator Trim	AS DESIRED
Rudder 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 recommended to counteract nose up pitching moment as power is increased and/or flaps are retracted.

Power	FULL FORWARD/2600 RPM
Mixture	Verify FULL RICH
Fuel Boost Pump Switches	OFF
Wing Flaps	TAKEOFF POSITION (10°) (After POSITIVE climb established)
Trim	NOSE DOWN to reduce forces
Airspeed	88 KIAS
Landing Gear	RETRACT
Wing Flaps	RETRACT
Airspeed	105 KIAS

LANDING

LANDING (NORMAL)

Approach for Landing Checklist	COMPLETED
Approach Airspeed	As specified in SECTION V (Landing Distance)
Touchdown	MAIN WHEELS FIRST (aligned w/ runway)
Landing Roll	LOWER nose wheel gently
Brakes	MINIMUM required

NOTE

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

NOTE

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

NOTE

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

"CAUTION"

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

TAXI AFTER LANDING

Throttle	AS REQUIRED
Fuel Boost Pump Switches	OFF
Wing Flaps	RETRACT
Elevator Trim	TAKEOFF SETTING
Avionics/Radios	AS REQUIRED
Interior/Exterior Lights	as DESIRED

SHUTDOWN

Parking Brake	SET
Throttle	IDLE RPM
Radio Master Switch	OFF
Interior/Exterior Lights	OFF
Pitot Heat	OFF
Magneto/Starter Switch	GROUNDING CHECK
Mixture	IDLE CUT-OFF
Alternator Field Switch	OFF
Master Switch	OFF
Magneto/Starter Switch	OFF

SECURING AIRCRAFT

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

TIE DOWN AIRCRAFT at wing and tail points.

TABLE OF CONTENTS

TABLE OF CONTENTS (con't)

INTRODUCTION

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

VARIABLES

It is not possible to make allowances in the charts for varying levels of pilot technique, proficiency or environmental conditions. Mechanical or aerodynamic changes are not authorized because they can affect the performance or flight characteristics of the airplane. The effect of such things as soft runways, sloped runways, winds aloft or airplane configuration changes must be evaluated by the pilot. However, the performance on the charts can be duplicated by following the stated procedures in a properly maintained, standard MOONEY M20R.

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

To obtain effect of altitude and OAT on aircraft performance:

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

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

"CAUTION"

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

OPERATIONAL PROCEDURES FOR MAXIMUM FUEL EFFICIENCY

For maximum fuel efficiency on the M20R, proper mixture leaning during cruise flight must be accomplished. The TCM IO-550-G(B) engine in the M20R has been designed to attain maximum fuel efficiency at desired cruise power. Best power mixture (at 2400 RPM) has been determined to be 50°F (10°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 procedures is recommended for setting cruise power and leaning to best economy at 75% power or less.

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

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

PERFORMANCE CONSIDERATIONS

RANGE and ENDURANCE ASSUMPTIONS

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

OPTIONAL PROPELLER DE-ICE BOOTS

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

LANDING GEAR DOORS

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

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

An approximate adjustment to range data shown in this manual can be made based on flight time planned with landing gear doors removed from aircraft. For example, using the above cruise speed decrease for a 5 hour flight will result in a decrease in range of approximately 25 N.M.:

5 HR x 5 KTS = ... 25 N.M. reduction in range

MISSION PROFILE CHARTS

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

The charts are based on the following:

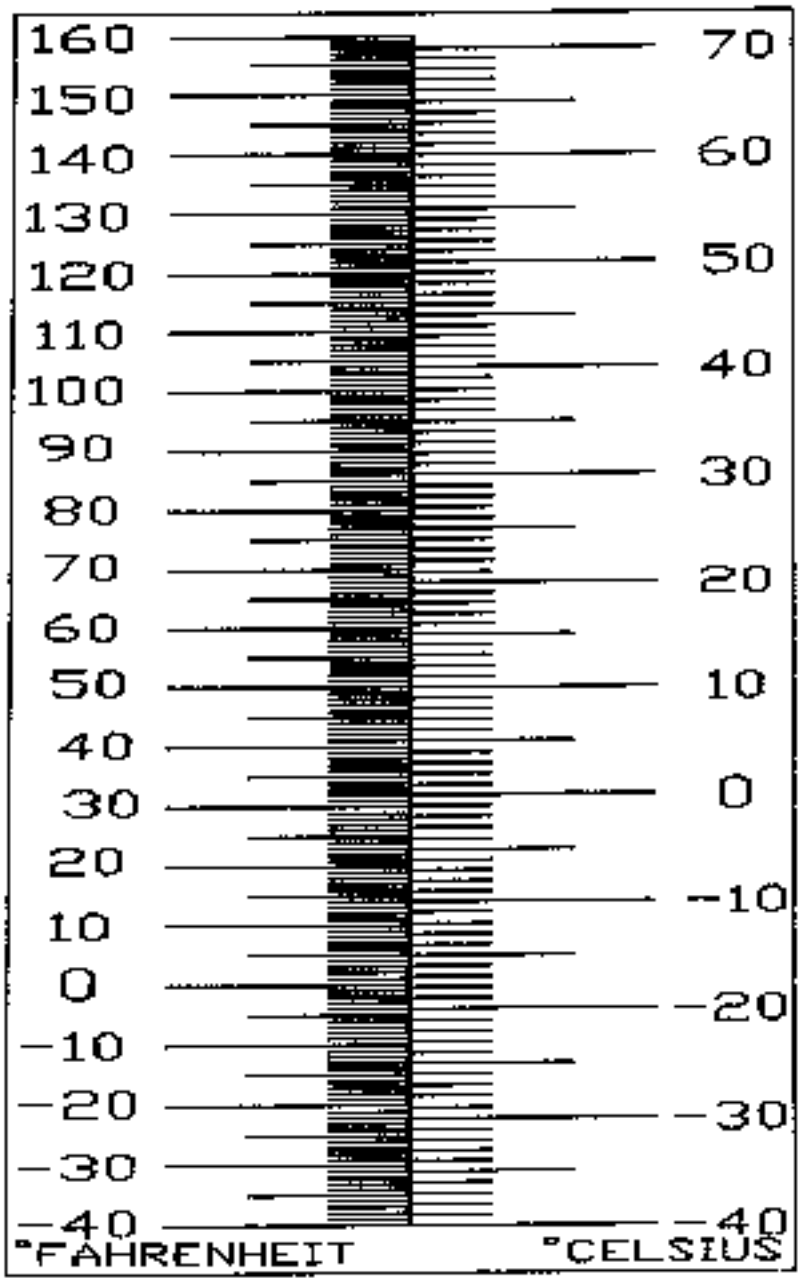
Fuel used to warm up, taxi and takeoff
Time and fuel to climb at maximum power
Time and fuel to cruise at the specified power setting
Cruise with gear and flaps UP.
Time and fuel to descend at 750 FPM at 150 KIAS
Zero wind
Gross weight

– CAUTION –

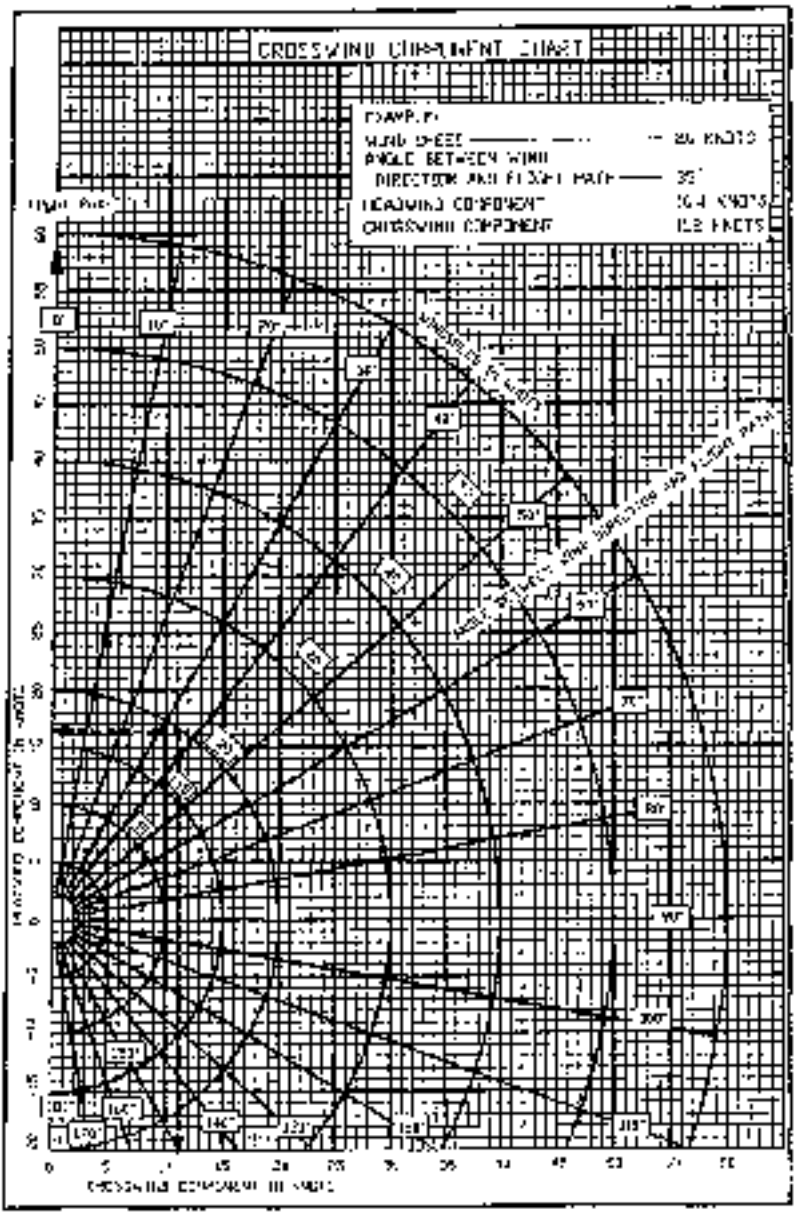
Zero wind conditions seldom occur. In addition, varying atmospheric conditions, aircraft weight, mechanical condition of the aircraft and piloting techniques all affect the actual flight time and fuel used during a flight.

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

TEMPERATURE CONVERSION

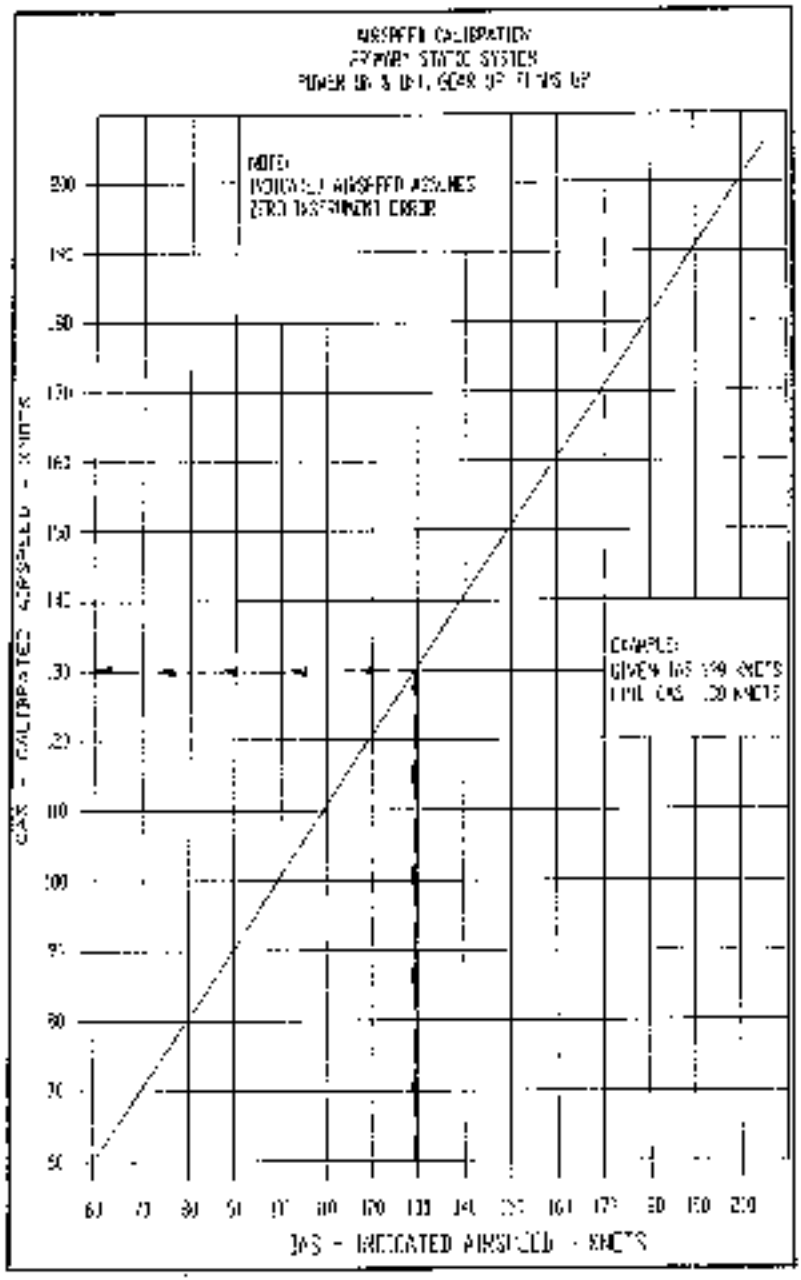


CROSSWIND COMPONENT CHART

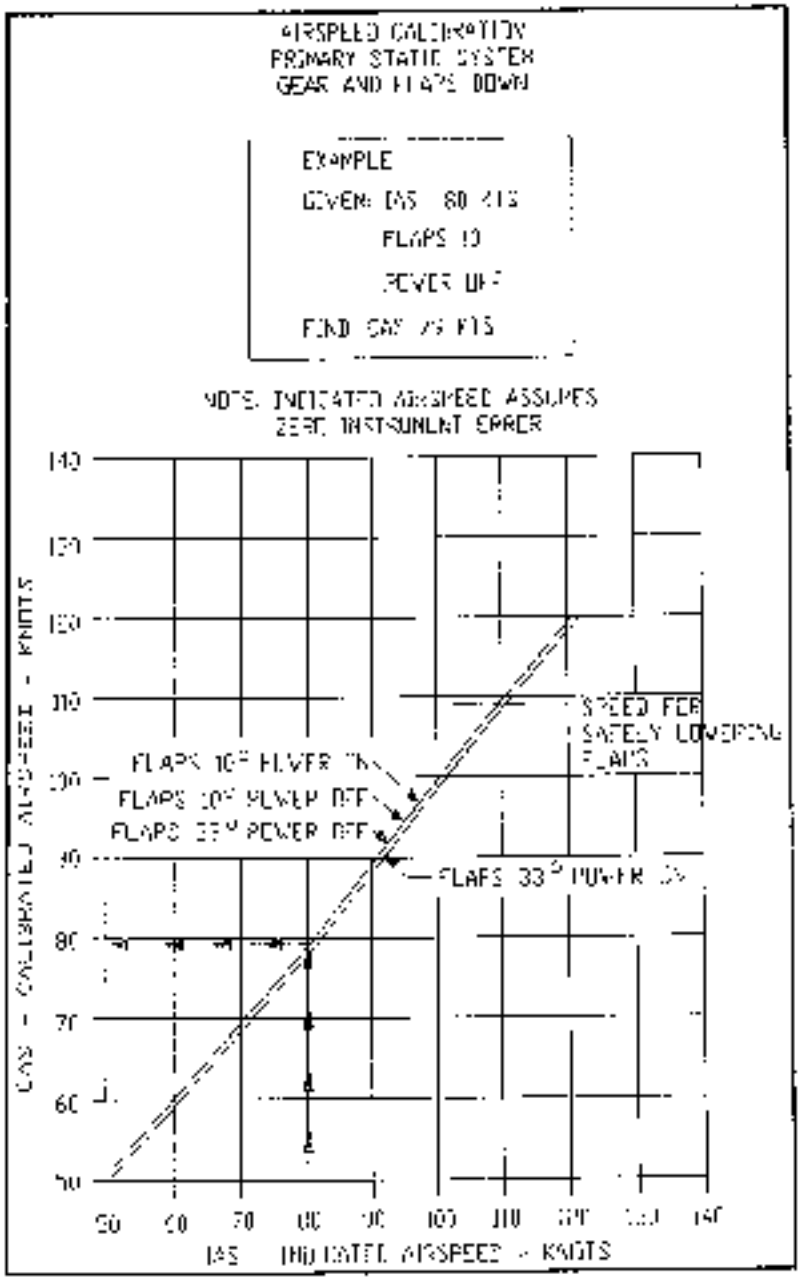


DEMONSTRATED CROSS WIND IS 13 KNOTS
(THIS IS NOT A LIMITATION)

AIRSPEED CALIBRATION - PRIMARY STATIC SYSTEM (GEAR UP)



AIRSPEED CALIBRATION - PRIMARY STATIC SYSTEM (GEAR DN)



AIRSPEED CALIBRATION - ALTERNATE STATIC SYSTEM

KIAS	GEAR & FLAPS UP KIAS	GEAR & FLAPS DN (10°) KIAS	GEAR & FLAPS DN (40°) KIAS
50	3.0	0.0	-1.0
60	1.6	-1.2	-2.0
70	0.0	-2.2	-3.2
80	-1.8	-3.2	-4.5
90	-2.0	-4.0	-6.0
100	-3.0	-4.2	-7.4
110	-3.0	-5.4	-5.6
120	-3.0	-	-
130	-3.6	-	-
140	-4.8	-	-
150	-5.1	-	-
160	-5.6		-
170	-6.1	-	-
180	-6.5	-	-
190	-7.2	-	-
200	-7.0	-	-

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

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

ALTIMETER CORRECTION - PRIMARY STATIC SYSTEM

SEA LEVEL | 12,500 FT | 25,000 FT.

KIAS	Gear & Flaps UP	Gear Dn/10° Flaps	Gear Dn/30° Flaps	Gear & Flaps UP	Gear Dn/10° Flaps	Gear Dn/33° Flaps	Gear & Flaps UP	Gear Dn/10° Flaps	Gear Dn/33° Flaps
50	2	4	9	4	7	4	-5	10	-5
60	-3	3	-6	-4	-1	-7	-7	7	-10
70	-9	2	-9	-5	-3	-13	8	4	23
80	-4	-6	-14	-6	-15	-20	-9	-17	-30
90	-9	-11	-19	-12	-17	-25	-16	-23	-43
100	-6	-11	-22	-9	-16	-33	-13	-24	-50
110	2	5	-23	2	7	23	4	-11	-51
120	9	-		12		--	20	—	--
130	21	—	—	31	--	—	47	—	—
140	23	—	—	33	—	--	51	—	--
150	15	—	-	22	—	—	35	--	--
160	12	--	---	17	---	—	26		
170	9	-		13	-	--	20	--	—
180	8	—	—	12	—	--	18		--
190	10			14			22	—	—
200	12	—	—	16	--	---	27	—	—

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

EXAMPLE
KIAS = 110 . . . . . ALTIMETER CORRECTION: -7 ft
FLAPS = 10° . . . . . (Subtract from Indicated Altitude)
INDICATED PRESSURE ALTITUDE: 12,500 ft PRESSURE ALTITUDE: = 12,493 ft.

ALTIMETER CORRECTION - ALTERNATE STATIC SYSTEM

	SEA LEVEL			12,500 FT.			25,000 FT.		
KIAS	GEAR UP FLAPS UP	GEAR & FLAPS DN 10°	GEAR & FLAPS DN 33°	GEAR UP FLAPS UP	GEAR & FLAPS DN 10°	GEAR & FLAPS DN 33°	GEAR UP FLAPS UP	GEAR & FLAPS DN 10°	GEAR & FLAPS DN 33°
50	13	0	-4	20	0	-7	30	-9	-10
60	6	-6	-11	12	-9	-16	18	-14	-24
70	0	-14	-20	0	-20	-29	0	-31	-45
80	-13	-23	-32	-19	-34	-47	-29	-51	-72
90	-23	-32	-46	-33	-47	-71	-50	-79	-106
100	-27	-42	-58	-39	-62	-87	-68	-94	-146
110	-30	-53	-97	-43	-70	-127	-66	-119	-194
120	-32	-	-	-49	-	-	-72	-	-
130	-53	-	-	-77	-	-	-113	-	-
140	-57	-	-	-84	-	-	-127	-	-
150	-69	-	-	-102	-	-	-155	-	-
160	-82	-	-	-120	-	-	-182	-	-
170	-95	-	-	139			21*		
180	-107	-	-	-150	-	-	-248	-	-
190	-120	-	-	195	-	-	-282	-	-
200	-149	-	-	-215	-	-	-327	-	-

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

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

STALL SPEED VS. ANGLE OF BANK

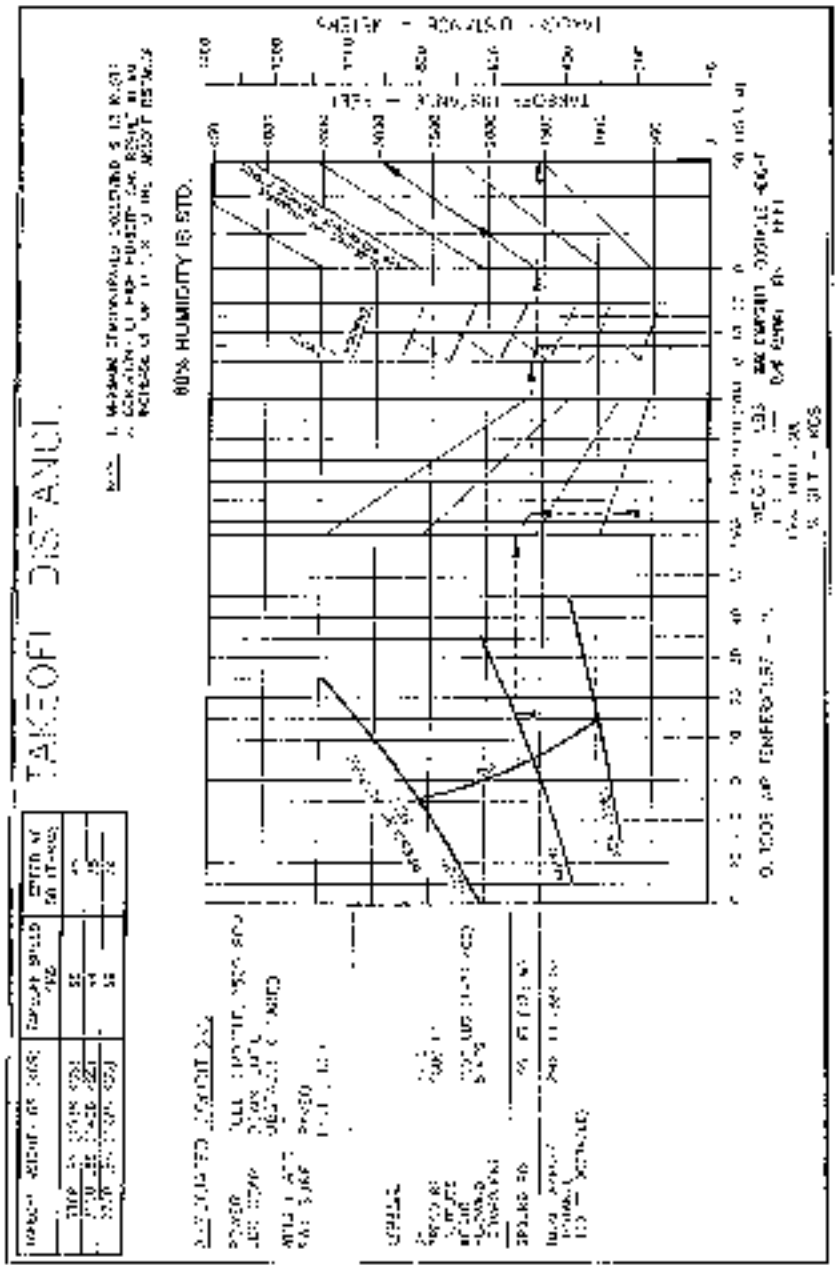
ASSOCIATED CONDITIONS:
FORWARD C.G.
POWER IDLE

NOTE: UP TO 300 FEET ALTITUDE LOSS MAY OCCUR DURING STALLS AT MAXIMUM WEIGHT

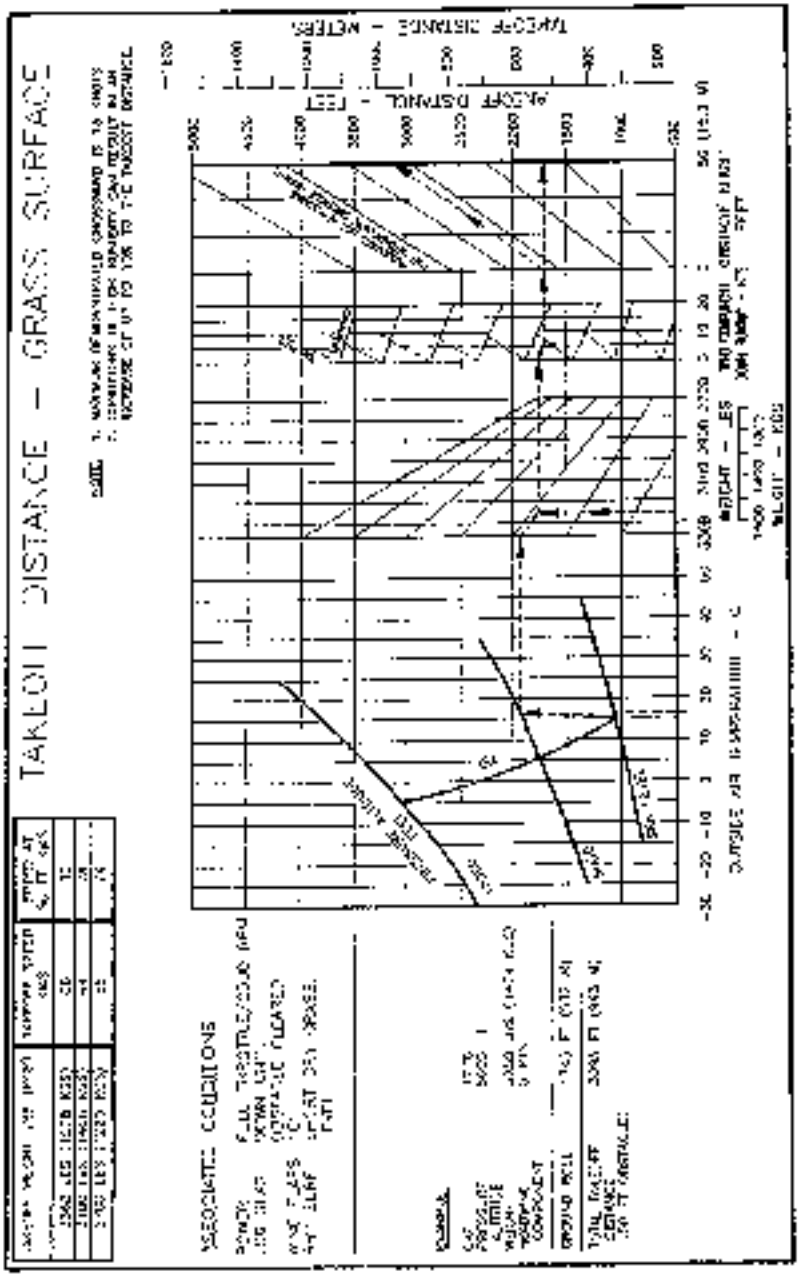
EXAMPLE:
WEIGHT — 3000 LBS (1361 KG)
LANDING GEAR — DOWN
FLAPS — [illegible]
ANGLE OF BANK — 45°
STALL SPEED — 72.5 KCAS (73.0 KIAS)

GROSS WEIGHT	GEAR AND FLAP POSITION	ANGLE OF BANK 0° KCAS	0° KIAS	30° KCAS	30° KIAS	45° KCAS	45° KIAS	60° KCAS	60° KIAS
3368 LBS (1528 KG)	GEAR UP, FLAPS 0°	66.0	66 54.8	71.0	71.5	78.5	79.0	93.5	94.0
	GEAR DOWN, FLAPS 10°	64.5	64.6 54.8	69.5	69.5	76.0	77.5	91.0	92.0
	GEAR DOWN, FLAPS 33°	59.0	59.0	63.5	64.5	70.0	70.0	84.0	84.5
3000 LBS (1361 KG)	GEAR UP, FLAPS 0°	55.5	64.5 55.0	67.0	67.5	74.5	75.0	88.5	89.0
	GEAR DOWN, FLAPS 10°	54.0	57 54.0	65.5	65.5	72.5	73.0	86.5	87.5
	GEAR DOWN, FLAPS 33°	55.5	55.5	59.5	59.5	66.0	66.0	78.5	79.5
2700 LBS (1225 KG)	GEAR UP, FLAPS 0°	59.0	59.5	63.5	64.0	70.0	70.5	83.5	84.0
	GEAR DOWN, FLAPS 10°	58.0	58.0	62.5	62.5	69.0	69.0	82.0	83.0
	GEAR DOWN, FLAPS 33°	53.0	53.0	57.0	57.0	63.0	63.0	75.0	76.0

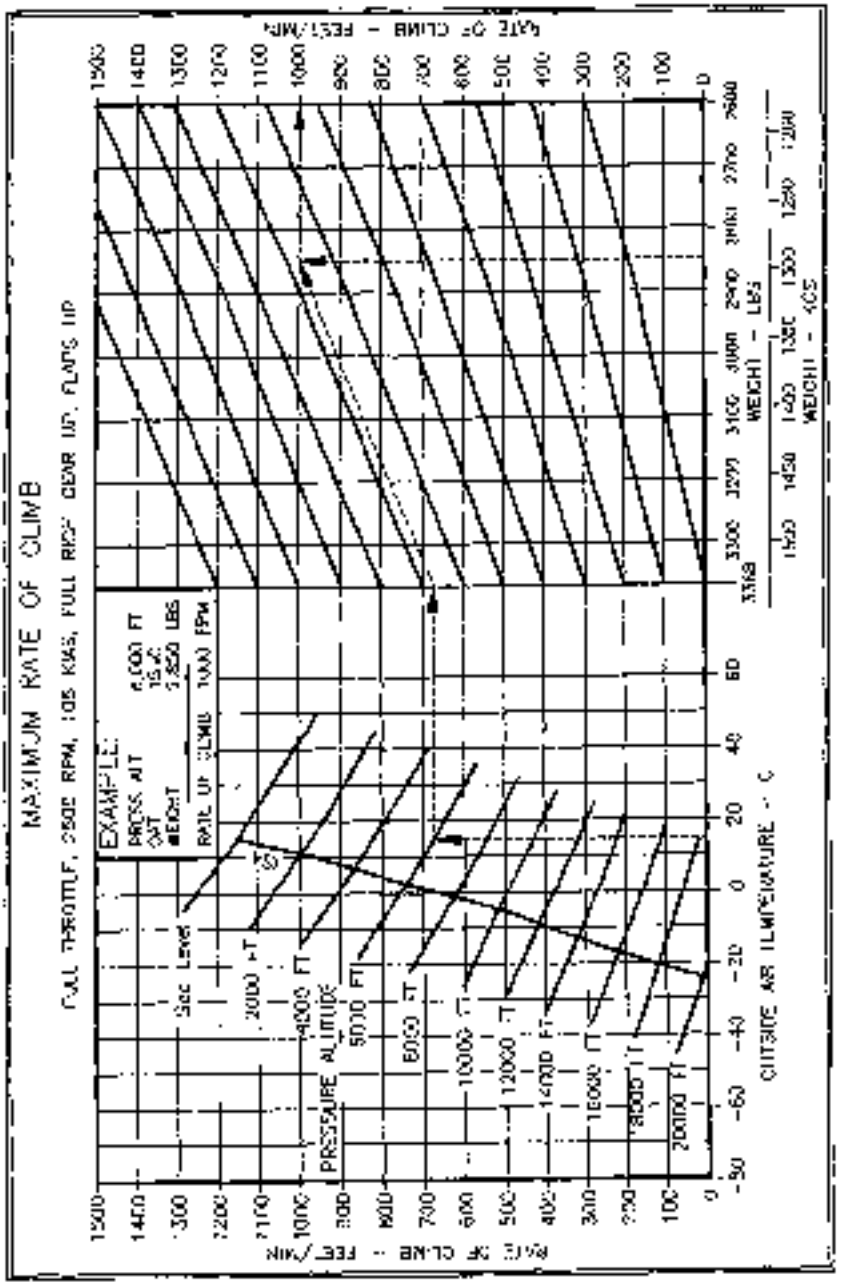
TAKEOFF DISTANCE - HARD SURFACE

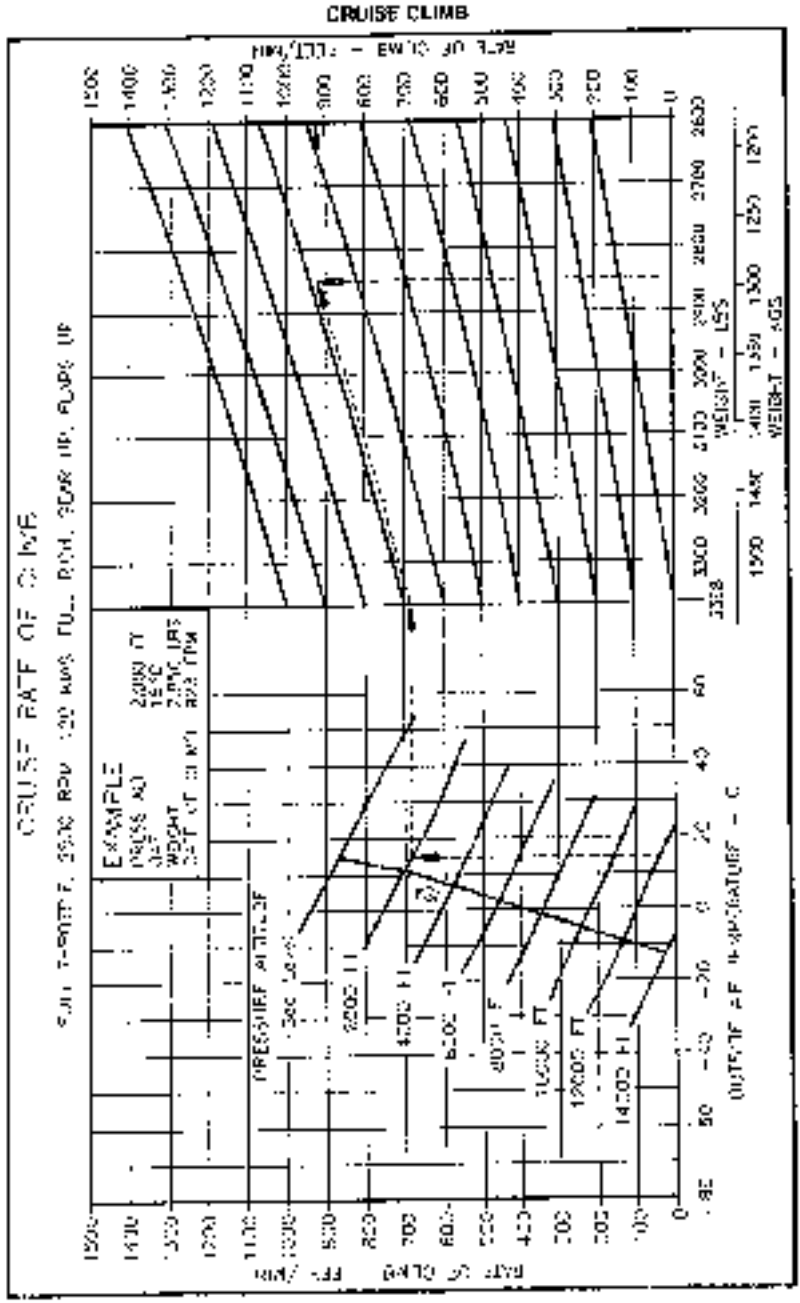


TAKEOFF DISTANCE - GRASS SURFACE

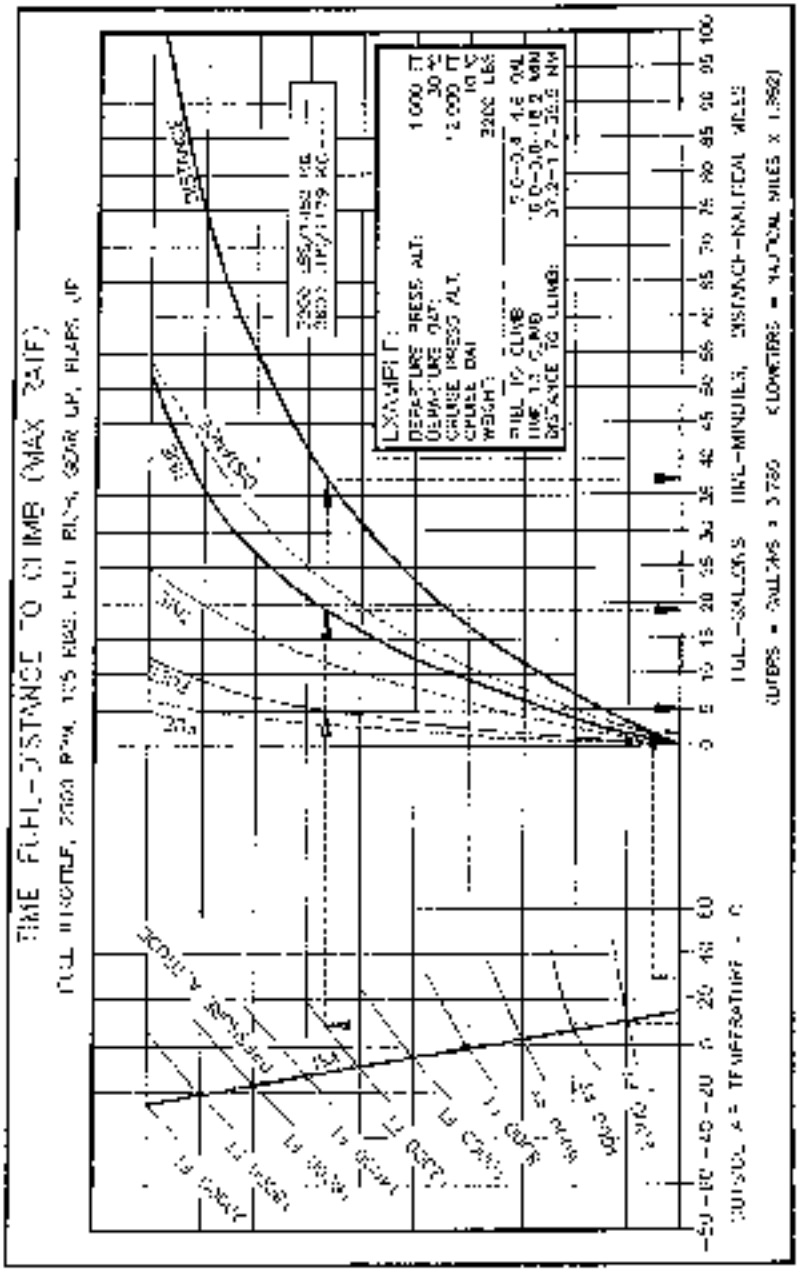


MAXIMUM RATE of CLIMB

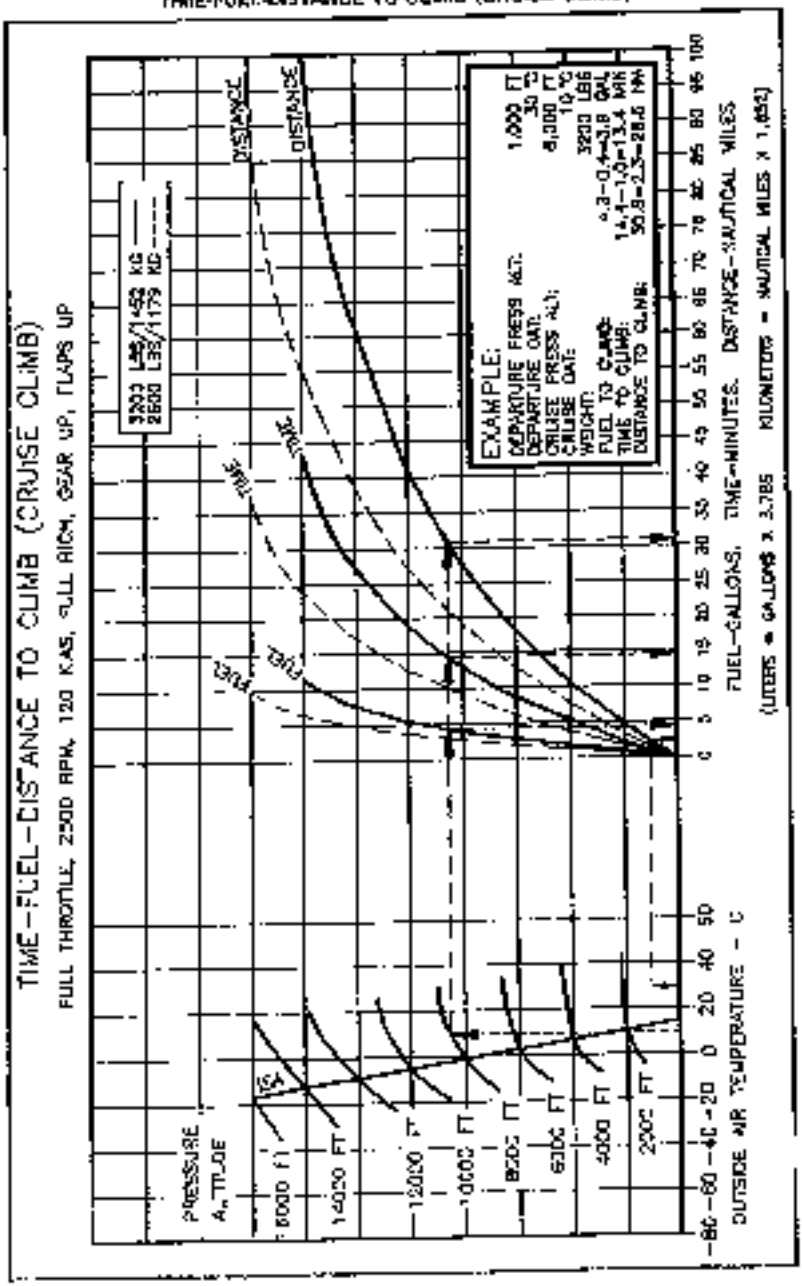



CRUISE CLIMB
CRUISE RATE OF CLIMB
EXAMPLE
PRESSURE ALTITUDE
OUTSIDE AIR TEMPERATURE - C
RATE OF CLIMB - FPM
WEIGHT - LBS

TIME-FUEL-DISTANCE TO CLIMB (MAX CLIMB)



TIME-FUEL-DISTANCE TO CLIMB (CRUISE CLIMB)



M20R CRUISE POWER SETTINGS AND FUEL FLOWS

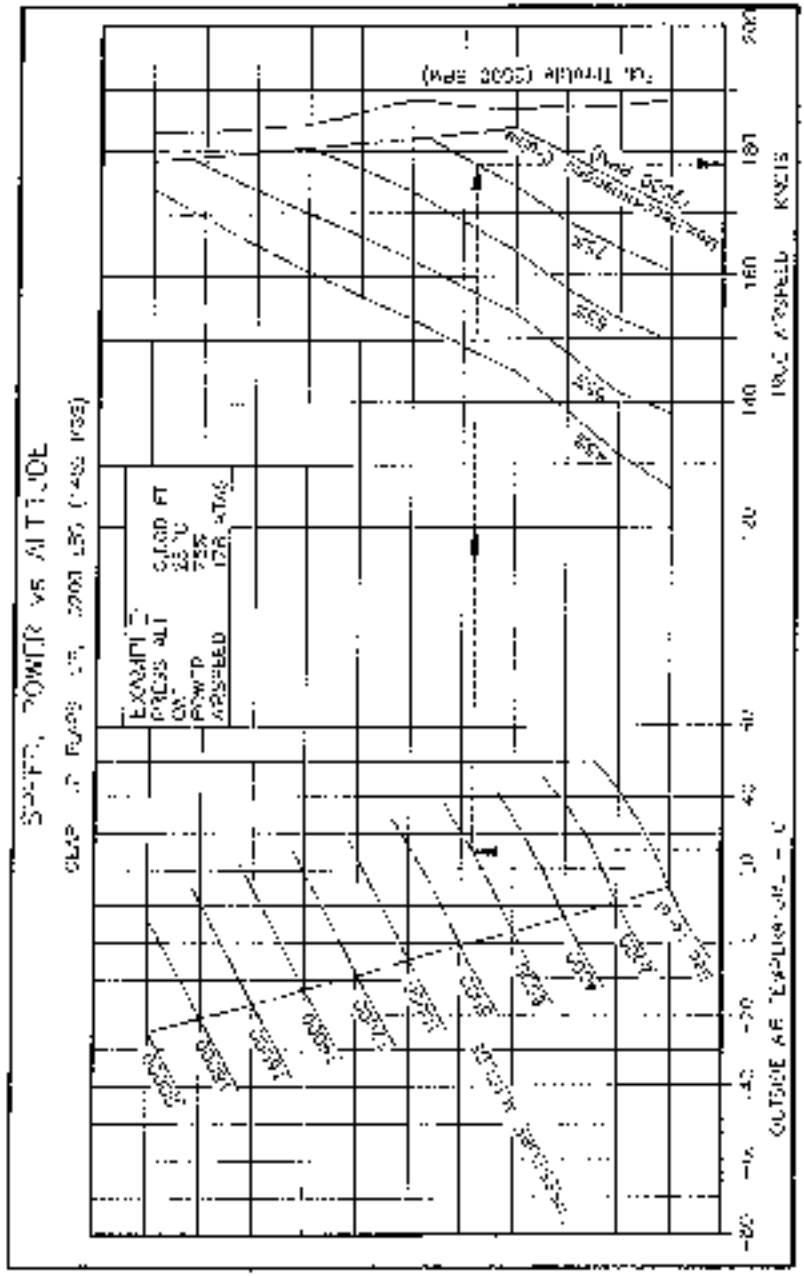
EXAMPLE: Cruise Alt. 8000 ft, OAT 4°C (SEE NOTE), Power Setting Desired 75%
RPM/MP 2400/22.9, Fuel Flow 15.6 (Best Power)

1. BEST POWER is 50°F Rich of Peak. 2. ECONOMY CRUISE is 50°F Lean of Peak.

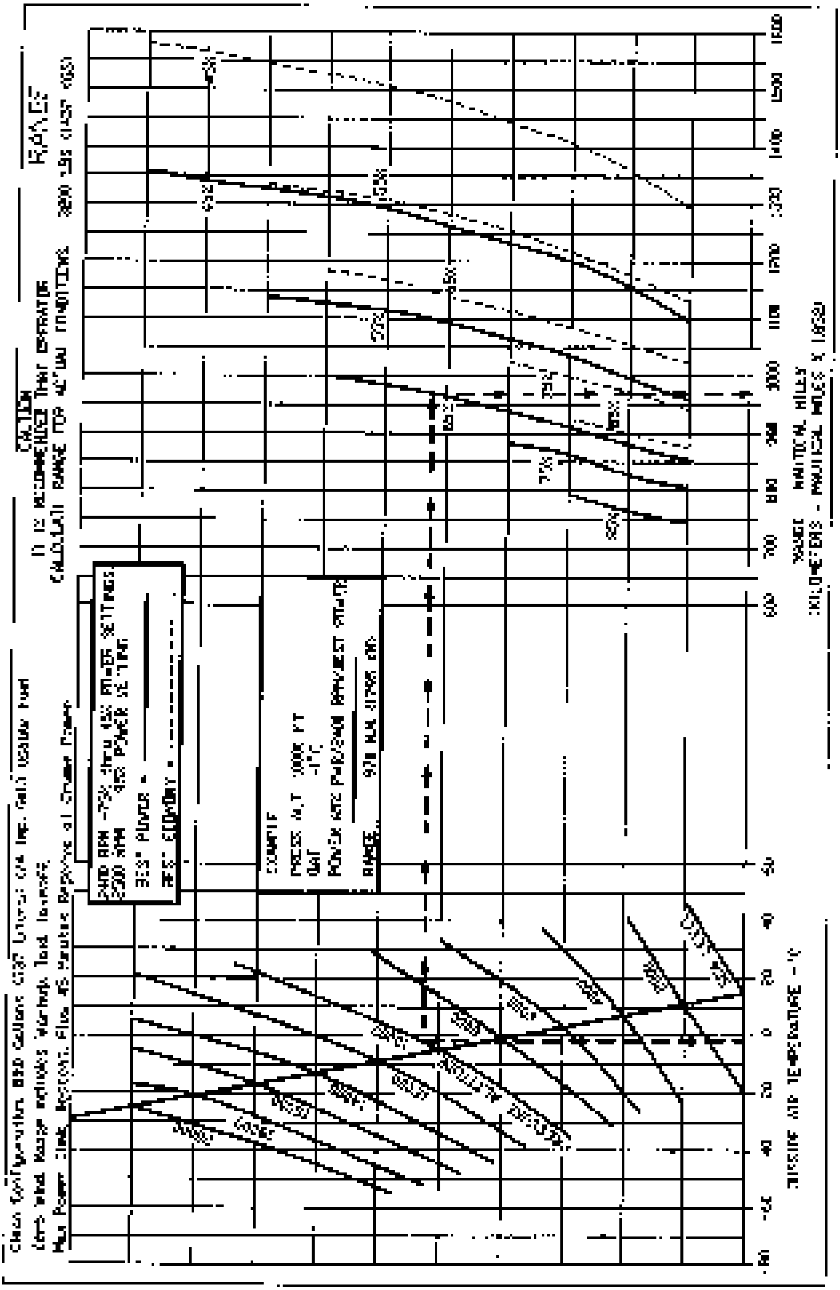
			Max. Recommended	75% Power 210 HP			65% Power 192 HP			55% Power 154 HP			45% Power 126 HP		
		RPM	2400	2500	2300	2400	2500	2300	2400	2500	2300	2400	2500	2300	2400	2300
Pressure Altitude (Feet)	Fuel Flow	Best ECON	15.2	15.3	13.5	13.6	13.7	11.8	11.9	12.0	10.0	10.1	10.2	8.2	8.3	8.4
		Best POWER	17.5	17.6	15.5	15.6	15.7	13.9	14.0	14.1	11.7	11.8	11.9	9.6	9.7	9.8
Std. Day	Std. Temp.		MANIFOLD PRESSURE – INCHES OF MERCURY													
S. L.	15°C	59°F	27.0	26.2	25.3	24.3	23.0	22.4	21.4	20.3	19.5	18.6	17.7	16.8	15.8	15.0
2,000	11°C	52°F	27.0	25.7	24.8	23.8	22.6	22.0	21.1	20.0	19.1	18.2	17.3	16.2	15.4	14.6
4,000	7°C	45°F		25.2	24.2	23.2	22.3	21.7	20.8	19.7	18.7	17.7	16.8	15.7	14.9	14.3
6,000	3°C	38°F		24.7	23.6	22.8	22.0	21.2	20.3	19.2	18.2	17.2	16.3	15.3	14.6	14.0
8,000	-1°C	31°F				22.5	21.7	20.7	19.8	18.7	17.7	16.8	16.0	14.9	14.2	13.7
10,000	-5°C	23°F						20.2	19.3	18.2	17.2	16.4	15.8	14.6	13.9	13.4
12,000	-9°C	16°F						19.5	18.7	17.9	16.7	16.0	15.6	14.3	13.6	13.1
14,000	-13°C	9°F							18.1	17.7	16.3	15.8	15.4	14.0	13.3	12.9
16,000	-17°C	2°F									16.1	15.6	15.2	13.7	13.0	12.7
18,300	-21°C	-5°F											15.0	13.5	12.8	12.5
20,000	-25°C	-12°F												13.3	12.6	12.3

NOTE: Add .4" MP for each 10°C (18°F) OAT above standard day temperature. Subtract .4" MP for each 10°C (18°F) below standard day temperature. If OAT above standard precludes obtaining the desired MP, use the next higher RPM/MP with appropriate temperature correction to MP.

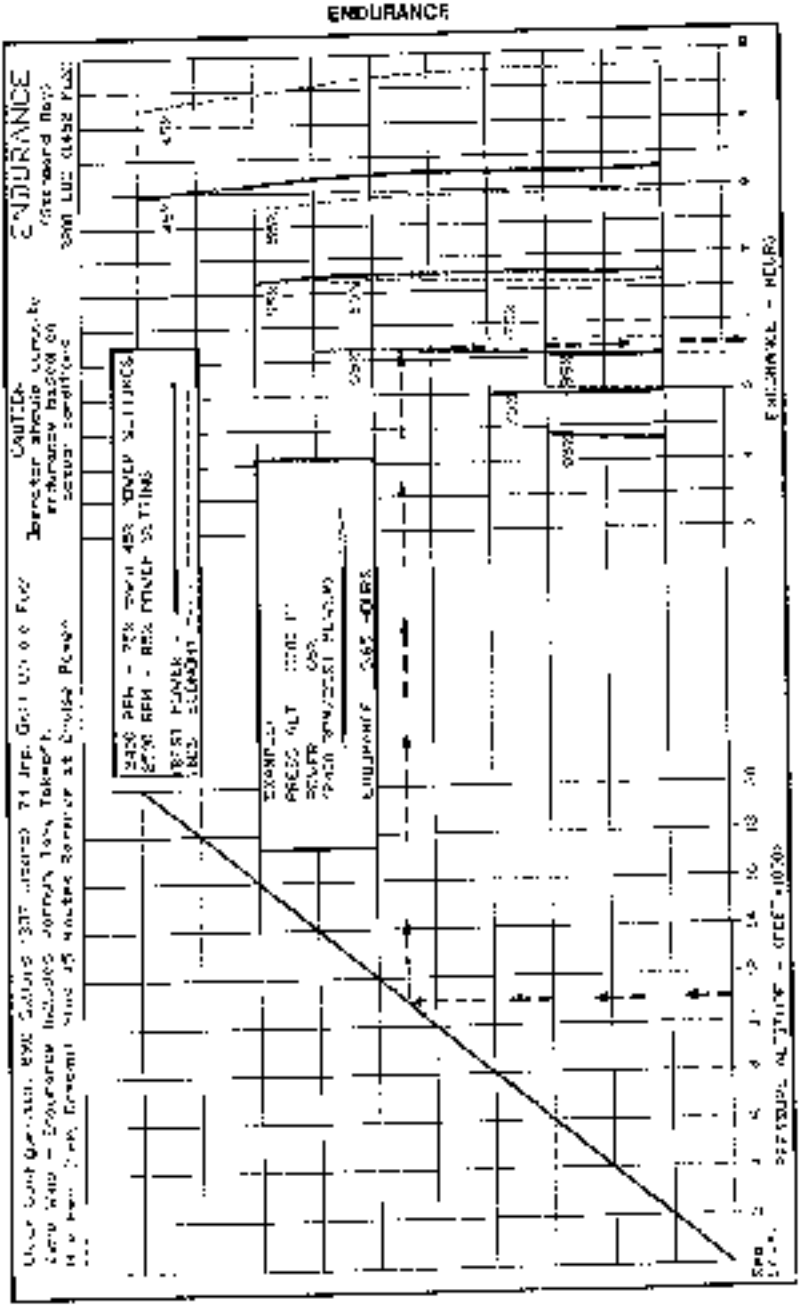
SPEED POWER VS ALTITUDE



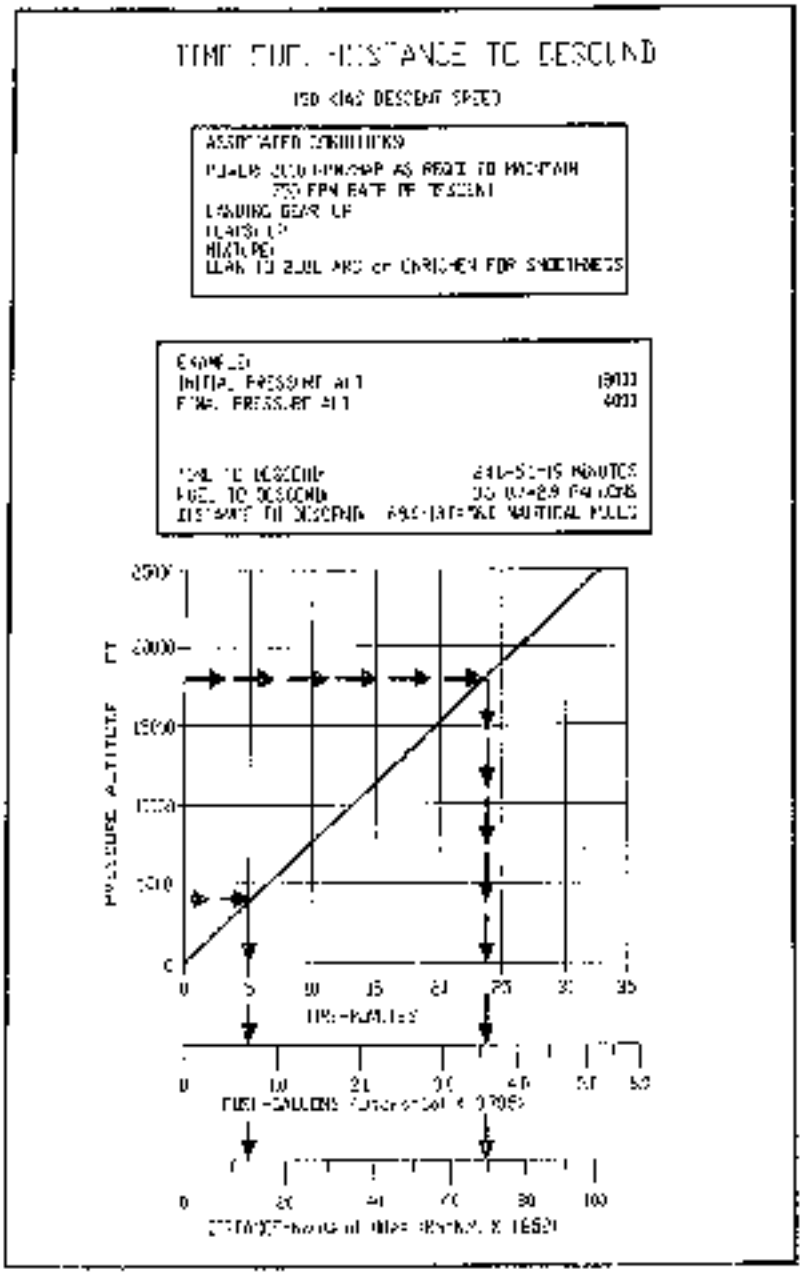
RANGE



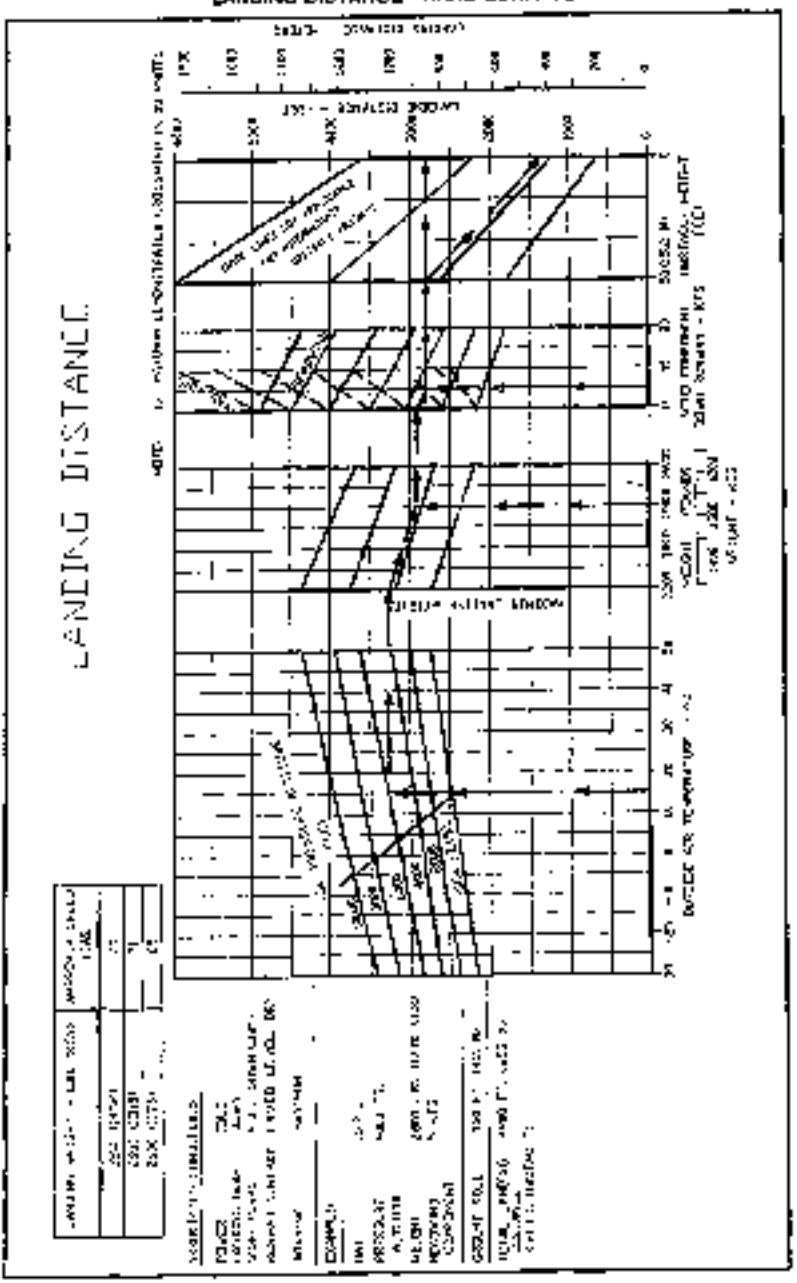
ENDURANCE



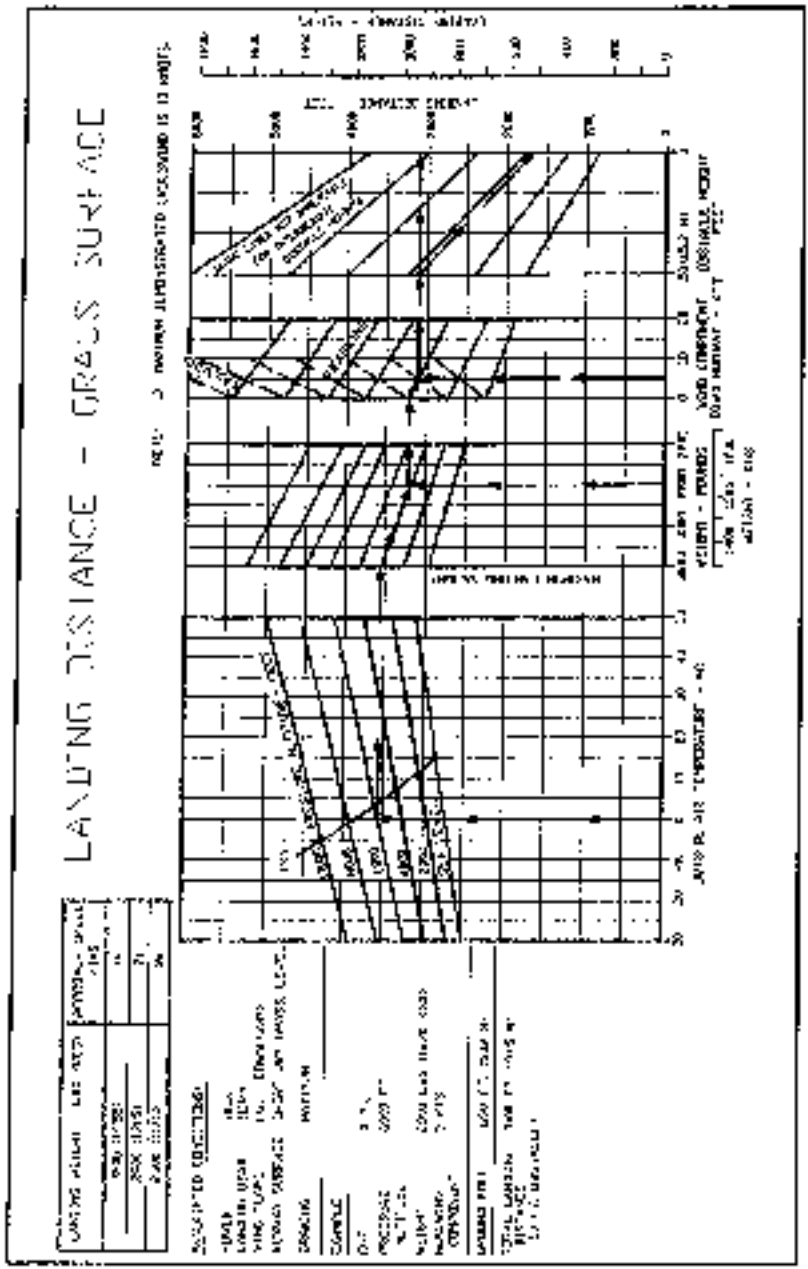
TIME-FUEL-DISTANCE TO DESCEND

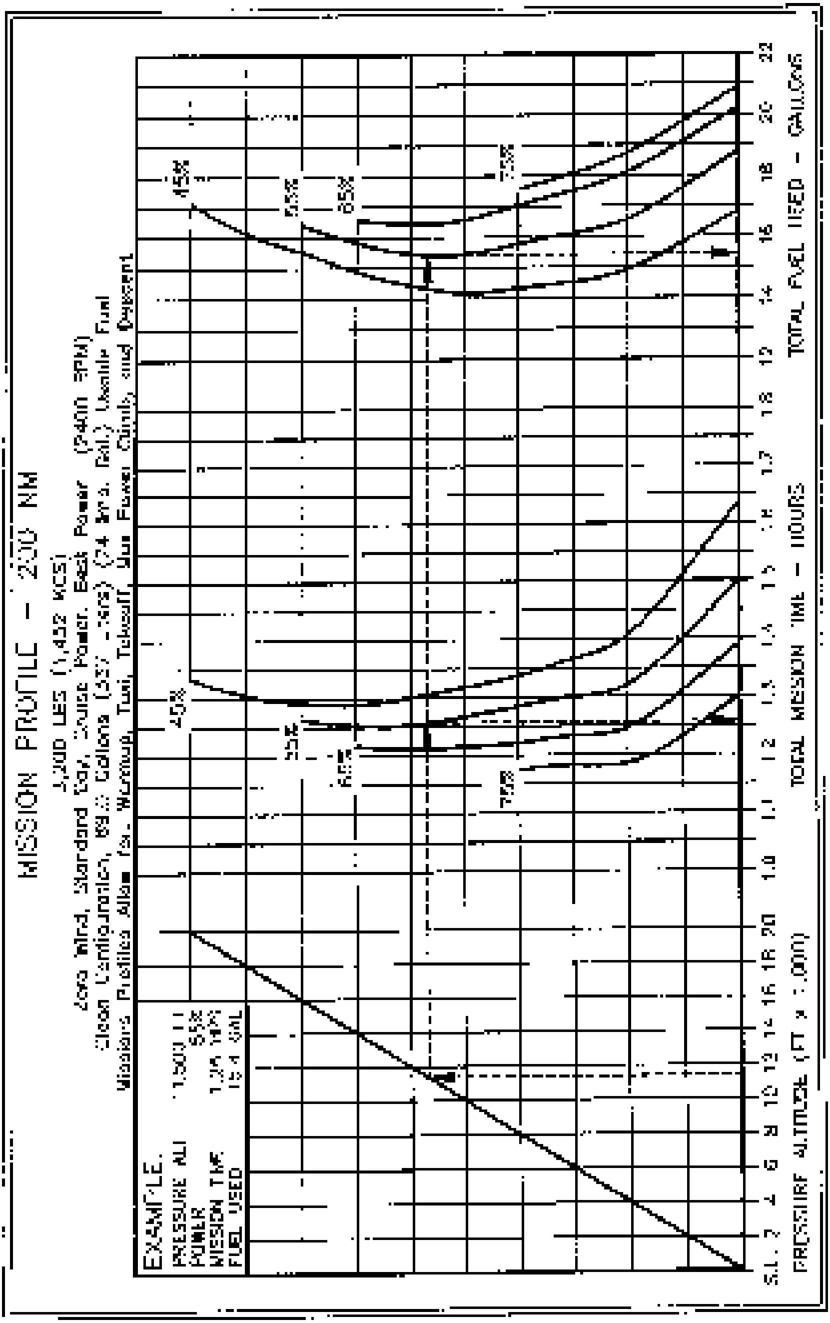


LANDING DISTANCE - HARD SURFACE

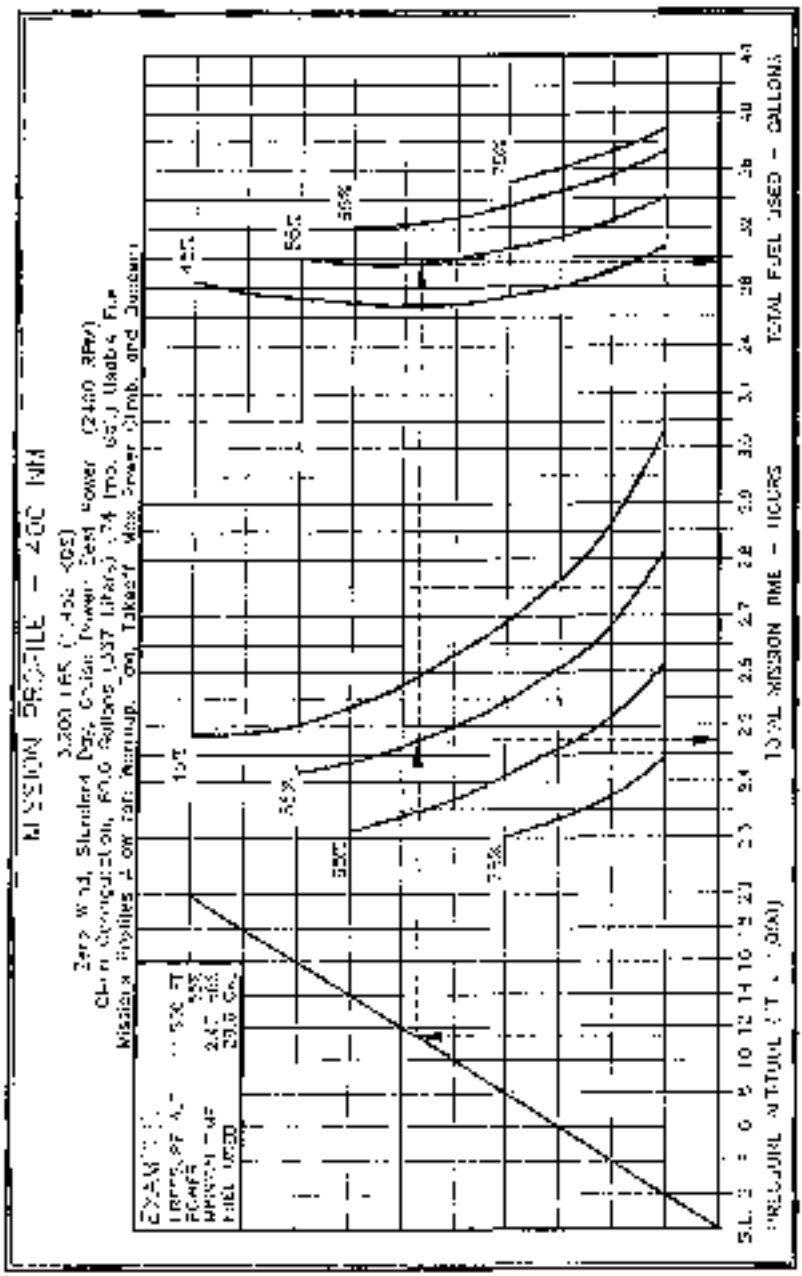


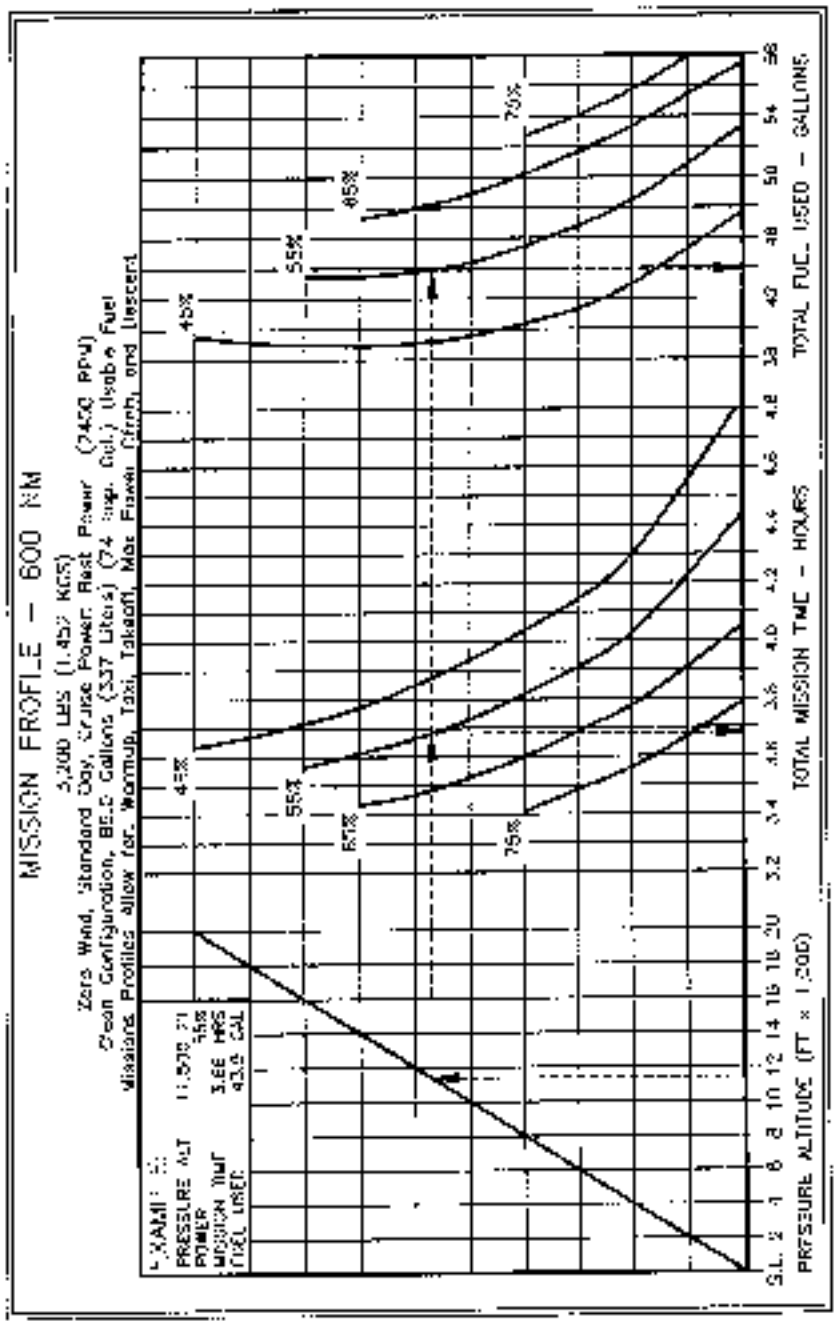
LANDING DISTANCE - GRASS SURFACE




MISSION PROFILE - 200 NM
3,200 LBS (1,452 KGS)
Zero Wind, Standard Day, Cruise Power, Best Power (2400 RPM)
Clean Configuration, 89.0 Gallons (337 Liters) (74 Imp. Gal.) Usable Fuel
Missions Profiles Allow for: Warmup, Taxi, Takeoff, Max Power Climb, and Descent
EXAMPLE:
PRESSURE ALT 11,500 FT
POWER 55%
MISSION TIME 1.25 HRS
FUEL USED 15.4 GAL
45%
55%
65%
75%
S.L. 2 4 6 8 10 12 14 16 18 20
PRESSURE ALTITUDE (FT x 1,000)
1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8
TOTAL MISSION TIME - HOURS
12 14 16 18 20 22
TOTAL FUEL USED - GALLONS

MISSION PROFILE - 400




MISSION PROFILE – 600 NM
3,200 LBS (1,452 KGS)
Zero Wind, Standard Day, Cruise Power, Best Power (2450 RPM)
Clean Configuration, 85.8 Gallons (337 Liters) (74 Imp. Gal.) Usable Fuel
Missions Profiles Allow for Warmup, Taxi, Takeoff, Max Power Climb, and Descent
EXAMPLE:
PRESSURE ALT 11,500 FT
POWER 75%
MISSION TIME 3.66 HRS
FUEL USED 43.6 GAL
45%
55%
65%
75%
SL 2 4 6 8 10 12 14 16 18 20
3.2 3.4 3.6 3.8 4.0 4.2 4.4 4.6 4.8 5.0 5.2 5.4 5.6
PRESSURE ALTITUDE (FT x 1,000)
TOTAL MISSION TIME – HOURS
TOTAL FUEL USED – GALLONS

MISSION PROFILE - 800

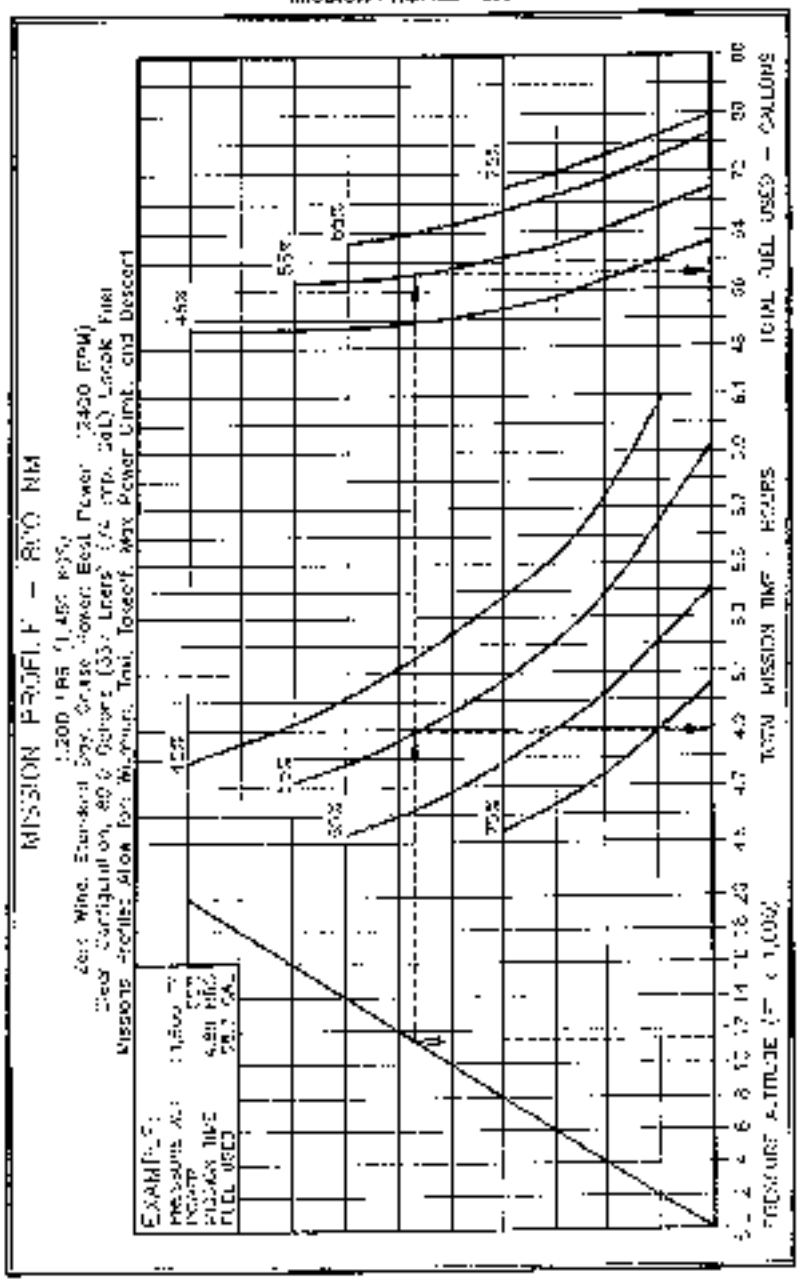


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TABLE OF CONTENTS

NOTE

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

MOONEY - M20R

AIRCRAFT SERIAL NO. _____

AIRCRAFT REGISTRATION NO. _____

_____ _____ _____

Mooney Aircraft Corporation - Approval Signature & Date

INTRODUCTION

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

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

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

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

The maximum certificated gross weight for the TCM powered M20R is 3368 lbs. (1528 Kg) for Takeoff and 3200 pounds (1452 Kgs) for Landing. Maximum useful load is determined by subtracting the corrected aircraft empty weight from its maximum gross weight. The aircraft must be operated strictly within the limits of the Center-of-Gravity Moment Envelope shown on page 6-8.

AIRPLANE WEIGHING PROCEDURE

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

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

1. Check for installation of all equipment as listed in the Weight & Balance Record Equipment List.
2. Top off both wing tanks with full fuel. Subtract usable fuel, 88.0 U.S. gals. (332 liters) @ 6.02 lbs/gal (40LL) (.68 Kg/l) = 519 lbs. (236 Kgs.) from total weight as weighed.

– – –*– – –

OPTIONAL METHOD - Ground aircraft and defuel tanks as follows:

a. Disconnect fuel line at fuel system union located forward of the firewall on the lower left hand side.
b. Connect a flexible line to output fitting that will reach fuel receptacle.
c. Turn fuel selector valve to tank to be drained. Remove filler cap from fuel filler neck.
d. Turn on fuel boost pump until tank is empty.
   REPEAT STEPS C AND D. TO DRAIN OTHER TANK
e. Replace 3.0 gallons (11.4 liters) fuel into each tank (unusable fuel). (Use 5.4 lbs/gal. (.99 Kg/liter) for 100LL fuel).
f. Replace filler caps.

– – –*– – –

EQUIPMENT LIST

MO.
DAY
YEAR

M-FO-[illegible]

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

EQUIPMENT LIST

R C2-B1

MO.		
DAY		
YEAR		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT Lbs.	ARM (Cm)	ARM In.	MARK IF INST'D
	A. POWERPLANT & ACCESSORIES						
1B	ENGINE TCM IO550-G (*) INCLUDES STARTER, ALTNR, VAC PUMP, EXH. INDUCT. SYST., ALT. AIR, ENG. PT., FULL OIL, PROP GOV	600200	(249.3)	549.5	(-59.16)	-23.29	X
2B	PROPELLER - CONSTANT SPEED MCCAULEY - HUB - 3A32C415 BLADES (*) - G82NDB-5 W/ SPINNER	600036	(34.7)	76.6	(-102.9)	-40.5	
3B							
	* Refer to Section I & II for engine/propeller configuration.						

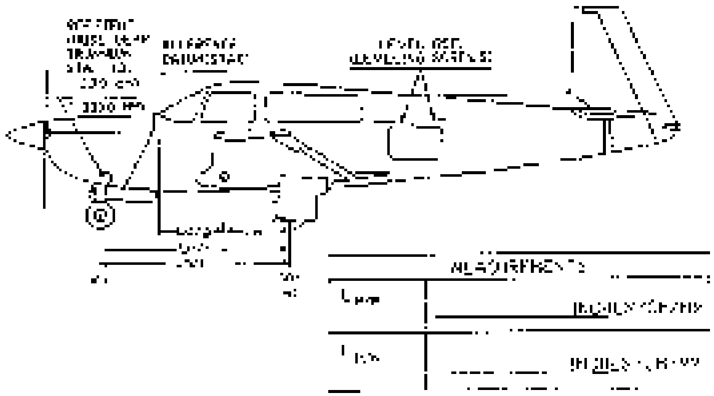
EQUIPMENT - S
M-20-82
ITEM NO.
ITEM DESCRIPTION
REF. DRAWING
WEIGHT
ARM
MO
DAY
YEAR
MARK IF INSTALLED

WEIGHING (cont'd)

3. Fill oil tank to capacity (8 qts).
4. Position front seats in full forward position.
5. Position flaps in full up position.
6. Position a 200-pound (90.7 Kg) capacity scale under each of the main wheels.
7. Level aircraft as previously described making certain nose wheel is centered.
8. Weigh the aircraft and deduct any tare from each reading.
9. Find reference point by dropping a plumb bob from center of nose gear trunion (retracting pivot axis) to the floor. Mark the point of intersection.
10. Locate center line of nose wheel axle and main wheel axles in the same manner.
11. Measure the horizontal distance from the reference point to main wheel axle center line. Measure horizontal distance from center line of nose wheel axle to center line of main wheel axles.
12. Record weights and measurements, and compute basic weight and CG as follows on next page.

NOTE
Wing Jack Points are located at Fus. Sta. 66.650 in. (143.94 cm). Nose Jack Point is located at Fus. Sta. -5.51 in. (-14.0 cm). Refer to SECTION VIII, Jacking, for procedures.

M20R - WEIGHT & BALANCE CHART



SCALE POSITION AND SYMBOL	SCALE READING	TARE	NET WEIGHT
NOSE WHEEL (Wn)			
RIGHT MAIN WHEEL (WR)			
LEFT MAIN WHEEL (WL)			
BASIC EMPTY WEIGHT (W)			
AS WEIGHED (W)			

[illegible]

[illegible]

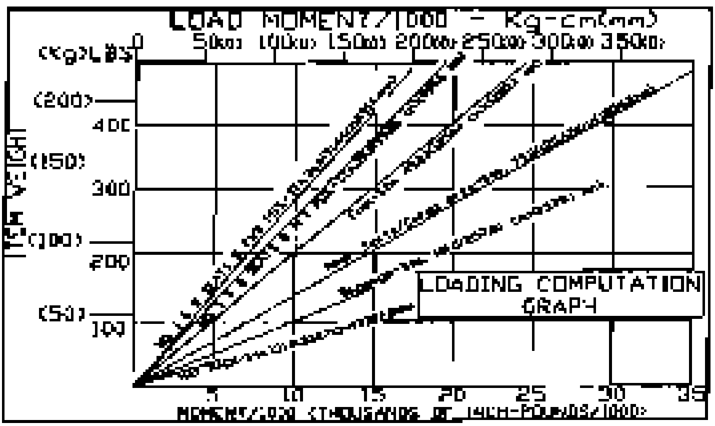
[illegible]

[illegible]

PROBLEM FORM

STEP	ITEM	SAMPLE PROBLEM Weight lbs	SAMPLE PROBLEM Moment /1000	YOUR PROBLEM Weight lbs	YOUR PROBLEM Moment /1000
1	A/C Basic Empty Weight [illegible]	2309	[illegible] 106.46	2317	100.49
2	Pilot Seat [illegible]	170	[illegible]		
	Co-Pilot Seat [illegible]	170	[illegible]		
3	Left Rear Seat [illegible] or Cargo Area	[illegible]	[illegible] 13.41		
	Right Rear Seat [illegible] or Cargo Area	170	[illegible]		
4	Fuel [illegible]	[illegible]	[illegible]		
5	Baggage [illegible]	100	[illegible]		
	Hat Rack [illegible]				
6	Loaded A/C Weight [illegible] A/C [illegible]	3368	[illegible]		
7	Required Fuel Burn [illegible]	108	[illegible]		
8	[illegible] LANDING WEIGHT of A/C	3260	[illegible]		
9	Refer to Center of Gravity Moment Envelope [illegible] CAUTION [illegible]				
	[illegible] graph				

CAUTION
Pilot is responsible for cargo loaded in rear seat area, with seat backs folded down, Cargo Center of Gravity location varies with total weight loaded. Compute CG value when cargo is loaded.



PILOT'S LOADING GUIDE

LOADING CALCULATION PROCEDURE

Proper loading of the aircraft is essential for maximum flight performance and safety. This section will assist you in determining whether the aircraft loading schedule is within the approved weight and center-of-gravity limits.

To figure an actual loading problem for your aircraft, proceed as follows:

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

|NOTE|

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

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

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

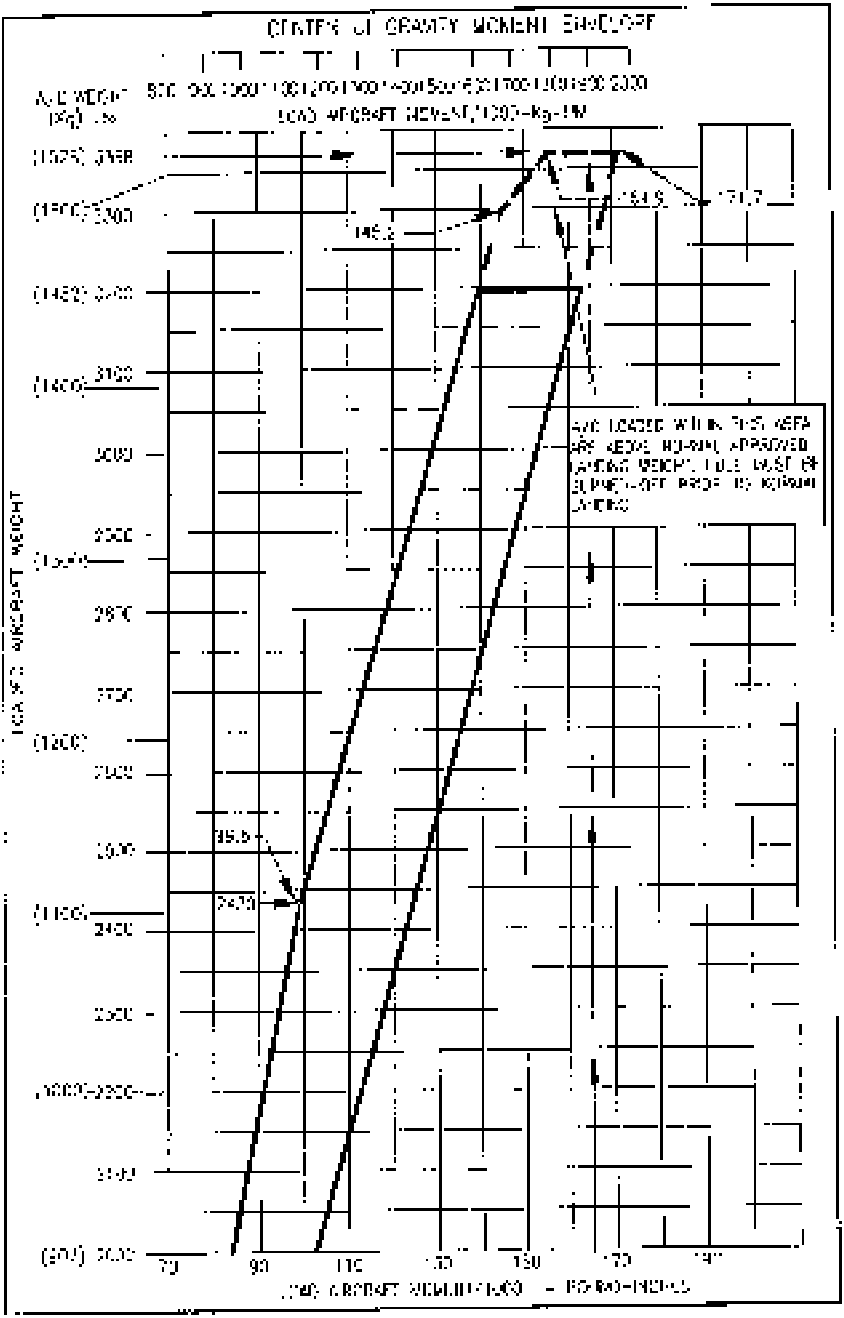
Step 4. Again proceed as in Step 2 to account for the amount of fuel carried and enter the weight and moment/1000 values in the proper columns.

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.

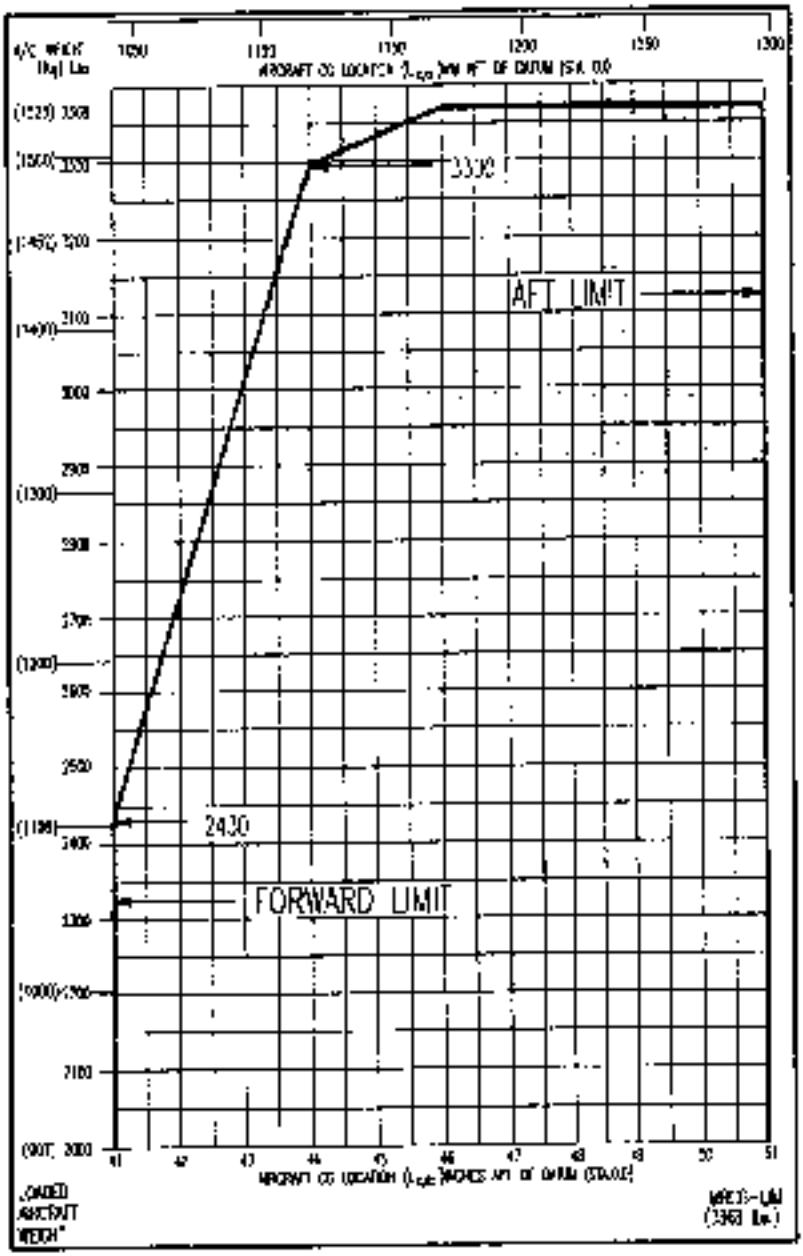
Step 6. Total the weight columns. This total must be 3368 Pounds (1528 Kgs) or less. Total the Moment/1000 column.

DO NOT FORGET TO SUBTRACT NEGATIVE NUMBERS.

Step 7. Refer to the Center-of-Gravity Moment Envelope (page 6-6). 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 take-off.


(1528) 3368
145.2
164.9
171.7
95.5
2470
(1100)
70
90
110
130
150
170

M20R - CENTER OF GRAVITY LIMITS ENVELOPE



FIXED BALLAST

The M20R has provisions for a fixed ballast located in the tailcone at Fuselage Station 209.5. Some aircraft with EFIS, TKS & other systems, may require all or a portion of the fixed ballast to be removed in order to stay within the weight and balance center of gravity envelope

EQUIPMENT LIST

The following equipment list is a listing of items approved at the time of publication of this manual for the Mooney M20R.

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

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

NOTE

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

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

A/C reg	A/C Type	A/C S/N:	WO
OY-ELW	M20R	29-0045	A1010

Date	Item:	C/	AC TT	AC TC
02-04-2012			728	0

DAO

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EASA Part 145 Approval DK 145.0025

[illegible]

	WEIGHT	ARM	MOMENT
Choose between LBS. and KG.	*LBS.*	*INCH*	*LBS./INCH*

Previous Aircraft Empty weight at date 9. maj 1995

	WEIGHT	ARM	MOMENT
DATA:	2317,00	43,30	100465,00

DESCRIPTION	TYPE	SERIAL No	WEIGHT LBS		ARM INCH	MOMENT LBS./INCH
REMOVED ITEMS:			*REMEMBER minus in front of weight*			
Com/Nav	KX155	55179	-5,70	X	14,40	-82,08
GPS	KLN90B	20516	-6,30	X	14,40	90,72
Transponder	KT76A	133926	-3,10	X	14,40	-44,64
GPS Ant	810435-501	0306	-1,10	X	16,50	18,15
GPS Ant	KA92	01727	-0,60	X	117,96	-70,78
TXP Ant	CI105	N/A	-0,40	X	41,50	-16,60
Encoder	A13000	2018196	0,50	X	4,00	-2,00
				X		
				X		
				X		
				X		
				X		
INSTALLED ITEMS:						
Com/Nav/GPS	GTN750	1ZA010052	7,80	X	14,40	112,32
Transponder	GTX33	89121086	3,60	X	128,00	460,80
GPS Ant	GA35	90693	0,60	X	117,96	70,78
TXP Ant	CI 105-16	25947	0,40	X	170,00	68,00
Encoder	SA0150	10335	0,30	X	18,00	5,40
				X		
				X		
				X		
				X		
				X		
				X		
				X		
NEW AIRCRAFT EMPTY			2312,00	X	43,52	100357,33

NEW AIRCRAFT EMPTY WEIGHT 2312,00 LBS.

NEW AIRCRAFT CENTER OF GRAVITY 43,42 INCH

PS: ARM: Plus only to decimals

Support Staff signature & stamp: [signature] DAO 27 Date: 15/4-12

EQUIPMENT LIST

MO ____ DAY ____ YEAR ____

EQ-01

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED
	C. ELECTRICAL SYSTEM						
1C	BATTERIES 24 VOLTS (2)	670021	(10.4)	23.00	(370.6)	145.9	x
2C	REGULATOR, VOLTAGE (2)	800311	(.27)	.6 EA	(41.8A)	16.25	x
3C	[illegible] CATCH	520557	(.58)	1.1	(105.3)	41.45	x
4C	CIGAR LIGHTER	800171	(.03)	.07	(19.05)	7.5	x
5C	FUEL PUMP ELECTRIC	610227	(.55)	1.1	(38.1)	15.0	x
6C	STALL WARNING INDICATOR	800311	(.45)	1.0	(127.0)	50.0	x
7C	GEAR WARNING INDICATOR	800311	(.45)	1.0	(29.50)	39.5	x
8C	WING TIP STROBE LIGHT INST.	800311	(2.27)	5.0	(124.62)	50.0	x
9C	TAIL STROBE LIGHT INST.	800311	(.68)	1.5	(578.7)	227.92	x
10C	LANDING/TAXI LIGHTS (2 SETS)	210417	(2.7)	5.92	(105.6)	41.6	x
11C	ACTUATOR - FLAPS	550110	(2.3)	5.1	(267.0)	105.1	x
12C	ACTUATOR, LANDING GEAR	560343	(5.08)	11.2	(99.06)	39.0	x

EQUIPMENT LIST

M20 02

MO | DAY | YEAR

ITEM NO	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED
	G. ELECTRICAL SYSTEM (CONT.)						
130	ELT (DORNE & MARGOLIN) ELT-8	010057	(1.79)	3.95	(312.4)	123.0	
140							
150	E.L.T. (ARTEX) ELT110-4	510050	(2.26)	4.98	(436.8)	172.0	
160	ELT (NARCO) ELT-10	810020	(2.49)	5.5	(407.7)	160.5	
170	E.L.T. (AMERI-KING)	810435	(1.41)	3.1	(429.0)	168.9	
180							
190							
200							
210							

EQUIPMENT LIST

M20R

MO. ____ DAY ____ YEAR ____

ITEM NO.	ITEM DESCRIPTION	REF DRAWING	WEIGHT (KG)	WEIGHT (POUNDS)	ARM (MM)	ARM (INCHES)	MARK IF INSTALLED
	C. WHEELS, TIRES & BRAKES						
10	MAIN WHEEL & BRAKE ASSY (2)	520049	(4.38)	9.62	(1635.5)	64.4	X
	WHEEL ASSEMBLY (2)	520029	(4.99)	11.0	(1625.0)	63.98	X
	BRAKE ASSEMBLY (2)	520025	(.36)	.8	(1633.4)	64.30	
20	TIRES, MAIN (2) (6 PLY RATING) 6.00 X 6 TYPE III W/ TUBES	520024	(4.99)	11.0	(1623.0)	63.90	X
30	NOSE WHEEL ASSEMBLY	540000	(1.80)	4.0	[illegible]	-20.3	X
40	TIRE, NOSE (6 PLY RATING) 5.00 X 5 TYPE III W/ TUBE	540000	(2.18)	4.8	(-310)	-12.2	X
50	MASTER CYLINDER, BRAKE (2)	630111	(.36)	.8	(1108)	[illegible]	X
60	VALVE, PARKING BRAKE	600109	(.23)	.5	(1276.8)	[illegible]	X
70	[illegible] BRAKE ASSEMBLY (2)	520059	(1.40)	3.08	(1584.5)	62.38	X
80							
90							

EQUIPMENT LIST

MO.
DAY
YEAR

M-[illegible]

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (KG)	WEIGHT (POUNDS)	ARM (CM)	ARM (INCHES)	MARK IF INSTALLED
	E INSTRUMENTS						
1E	GYRO HORIZON	880339	[illegible]	2.9[illegible]	(44.30)	17.46	
2E	DIRECTIONAL GYRO		[illegible]	[illegible]	(42.7[illegible])	16.8	
3E	CLOCK, PANEL MOUNTED		[illegible]	.25	(49.78)	19.6	
4E	OAT GAUGE		.125	.27	(49.95)	19.5	X
5E	INDICATOR, VERTICAL SPEED		[illegible]	.5	(44.49)	17.57	X
6E	INDICATOR, TURN & SLIP/TURN COORD.		[illegible]	1.84	(41.91)	16.5	X
7E	ALTIMETER		[illegible]	1.1	(36.6)	14.4	
8E	INDICATOR, AIRSPEED		[illegible]	.70	(41.75)	16.6	X
9E	TACHOMETER		[illegible]	0	(46.99)	18.5	X
10E	FUEL FLOW		[illegible]	1.35	[illegible]	18.48	X
11E							
12E	ENGINE GAUGES (DUAL INDICATORS)	020[illegible]	[illegible]	.8[illegible]	(46.99)	18.5	X

EQUIPMENT LIST

MO. DAY YEAR

M ED-E2

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED
	E. INSTRUMENTS (CON'T)						
13E	ANNUNCIATOR PANEL	820336	(.58)	1.3	(44.45)	17.5	X
14E	MAGNETIC COMPASS	100123	(2.3)	.5	(60.6)	23.87	X
15E	MANIFOLD PRESSURE	020336	(.45)	1.0	(46.94)	18.48	X
16E	ALTERNATE STATIC AIR SOURCE	820336	(.14)	.31	(44.69)	17.5	X
17E							
18E							
19E							
20E							

EQUIPMENT LIST

MO. DAY YEAR

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT KG	WEIGHT POUNDS	ARM M	ARM INCHES	MARK IF INSTALLED
	[illegible] SYSTEMS						
[illegible]	VACUUM SYSTEM INSTALLATION [illegible]	[illegible]	2.58	5.68	[illegible]	-1.0	
[illegible]	VACUUM PUMP	880015	[illegible]	5.4	[illegible]	5.0	
[illegible]	STANDBY VACUUM POWER SYSTEM	[illegible]	[illegible]	5.4	[illegible]	-2.5	
[illegible]	[illegible] VACUUM PUMP [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10.4	
[illegible]	OXYGEN SYSTEM [illegible]	[illegible]	[illegible]	44.55	[illegible]	127.0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible] RATE CONTROL [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	5.??	[illegible]	43.2	

EQUIPMENT LIST

MO [illegible]
DAY ____
YEAR ____

CHECK [illegible]

ITEM NO.	ITEM DESCRIPTION	REF DRAWING	WEIGHT LBS.	WEIGHT (CHANGE)	ARM IN.	ARM (CHANGE)	MARK IF INSTALLED
	D. CABIN ACCOMMODATIONS						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	19.48	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	42.0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							

EQUIPMENT LIST

MO. ______
DAY ______
YEAR ______

MR-[illegible]

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED
	H. AVIONICS & AUTOPILOTS						
1H	NAT AA80 INTERCOM	[illegible]	([illegible])	7	(140.2[illegible])	[illegible]	
2H	KING KLN 90A GPS	[illegible]	(3.1[illegible])	6.9	(59.44)	23.4	
3H	KING KCS 55A	810152	(5.[illegible])	12.04	(166.8[illegible])	65.45	
4H	KING KMA 24	810150	(.77)	1.7	(40.6[illegible])	16.0	
5H	TERRA ENCODER	810150	(.2[illegible])	.50	(20.[illegible])	[illegible]	
6H	KING KLN 90B GPS	810[illegible]	(3.13)	6.9	(59.44)	23.4	
7H	DAVID CLARK ISOCOM	[illegible]	.23	.5	(43.18)	17.0	
8H	KING KN 15[illegible]	[illegible]	([illegible])	[illegible]	(36.65)	14.43	
9H	KING KN 163	810151	([illegible])	5.7	(35.5[illegible])	14.0	
10H	KING KI 209	810150	(.73)	1.6	(38.[illegible])	15.0	
11H	KING KR 87 ADF SYS	810151	([illegible])	5.4	(112.4[illegible])	44.25	
12H	KING KR 87	810150	(2.40)	5.2	(148.3)	58.4	

EQUIPMENT LIST

MO		
DAY		
YEAR		

MR ED NO

ITEM NO	ITEM DESCRIPTION	REF DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED
	[illegible] AVIONICS & AUTOPILOTS						
13-	KING KN 62A	910150	(1.20)	2.6	(38.1)	15.0	
14-	KING KT 76A	910150	(1.4)	3.1	(37.1)	14.6	
15-	KING KFC 150	910130	(11.4)	25.5	(2154.0)	85.3	
16-	KING KRA 10A/KI 227	910150	(2.67)	5.9	(136.1)	53.6	
17-	KING KLN 88	[illegible]	(1.43)	3.1	(86.7)	34.13	
18-	[illegible]	810420	(2.0)	4.4	(220.0)	86.6	
19-	[illegible]	950244	(1.20)	2.6	(-7.6)	-3.0	
20-	GARMIN 155 GPS	810410	(1.0)	2.2	(36.5)	14.39	
21-	PS ENGINEERING INTERCOM	810202	(.55)	1.2	(81.3)	32.0	
22-	INTERIOR SOURCE ROUTER	[illegible]	(2.3)	5	(48.3)	19.0	
23-							
24-							

EQUIPMENT LIST

WT. ____
DATE ____
BY: ____ AP ____

[illegible]

ITEM NO.	ITEM DESCRIPTION	MCI DRAWING NO.	WEIGHT (KG)	WEIGHT (POUNDS)	ARM (MM)	ARM (INCHES)	MARK IF INSTALLED
	[illegible] (CONT'D)						
2?A	[illegible]	8[illegible]	[illegible]	3.9	[illegible]	156.?	
?A	K?-??? [illegible]	310150	[illegible]	2.9	[illegible]	18.?	
[illegible]	AA8? INTERCOM	[illegible]	[illegible]	.7	(43.2?)	17.?	
?A	AA83 INTER-VOX (MUSIC)	810202	0.32	.7	(43.2?)	17.0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	96.5	
3?A	WX-1000/1000+ SERIES III	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
?A	KAP 150 [illegible] (KFC-150)	[illegible]	[illegible]	20.1	(?0?.?)	32.6	
?A	[illegible]	820031	[illegible]	[illegible]	(?0.?)	[illegible]	
?A	[illegible]	[illegible]	[illegible]	?.9	(228.?)	[illegible]	
?A	[illegible] RADAR ALT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
?A	FUEL FLOW/TOTALIZER	820035	[illegible]	[illegible]	(?46.?)	[illegible]	
?A	[illegible] (CARD)	8[illegible]	[illegible]	[illegible]	(?58.?)	[illegible]	

EQUIPMENT LIST

ITEM NO.	ITEM DESCRIPTION	REF DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED
	AVIONICS & AUTOPILOTS (cont.)				
[illegible]	KING KX-155A w/ GLIDE SLOPE	3000?A	1.6	36.?	14.54
[illegible]	KING K[illegible]	3??150	3.5	36.0	14.54
3--	[illegible] 204	3??150	1.7	38.?	45.0
4?-	[illegible]	??0150	2.1	[illegible]	5.0
[illegible]	ECO? HEADSET [illegible]	3?0150	[illegible]	[illegible]	[illegible]
4??	PMA [illegible]	[illegible]	2.2	[illegible]	25.6
[illegible]					
[illegible]					
[illegible]					
[illegible]					
[illegible]					

[illegible]

M-20-11

EQUIPMENT LIST

MO. / DAY / YEAR

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (Kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED
	0. AUXILIARY EQUIPMENT (FLY AWAY)						
11	TOW BAR FOLDING (STOWED)	010036	(.03)	2.5	(2731)	107.5	X
23	JACK POINTS (2) (STOWED)		(.07)	.1	(332.7)	131.0	X
35	EYE BOLT, WING TIE DOWN (2) (STOWED)		(.09)	.1	(332.7)	131.0	X
47	FUEL SAMPLER CUP (STOWED)		(.04)	.05	(332.7)	131.0	X
53	BAGGAGE TIE DOWNS (2) (STOWED)		(.04)	.1	(332.7)	131.0	X
61	CARGO RESTRAINT BELTS (2) (STOWED)		(.07)	.1	(332.7)	131.0	X
71	PITOT COVER (STOWED)		(.03)	.1	(332.7)	131.0	X
81	POH/AFM No. - MOONEY		(.04)	.1	(332.7)	131.0	X
95	ENGINE OPERATOR'S MANUAL-LYCOMING		(.05)	.1	(332.7)	131.0	X
105	ENGINE LOG BOOK		(.07)	.1	(332.7)	131.0	X
111	AIRFRAME LOG BOOK	010036	(.08)	.1	(332.7)	131.0	X
121							

EQUIPMENT LIST

MO.
DAY
YEAR

M-EQ-J1

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (kg)	WEIGHT (POUNDS)	ARM (cm)	ARM (INCHES)	MARK IF INSTALLED
	J. OPTIONAL EQUIPMENT						
1J	ARM REST INSTL. PILOT'S SEAT	140295	(.90)	2.1	(87.6)	34.5	X
2J	LUMBAR SUPPORT INSTL. (2)	140300	(.59)	2.18	(88.9)	35.0	
3J	ACCESS PANEL, FUEL GAUGE (2)	210099	NEGLIGIBLE DIFFERENCE				X
4J	RECOGNITION LIGHT INSTL (2)	210413	(.60)	1.32	(134.6)	53.0	
5J	RUDDER PEDAL EXTENSION INSTL. w/ 2	720115	(.059)	.13	(38.1)	15.0	
6J	AUX. POWER RECPT. INSTL.	800166	(1.48)	3.27	(338.7)	133.0	
7J	AUX. POWER CABLE ADAPTER	800042	(3.43)	7.57		***	
8J	DUAL BRAKE INSTL	950102	(1.38)	3.05	(38.1)	15.0	
9J	STATIC DISCHARGE INST.	950253	NEGLIGIBLE DIFFERENCE				
10J	STOP ASSY & INSTL	950256	(1.25)	2.75	(274.3)	108.0	
11J	FIRE EXTINGUISHER INSTL	1503P0	(1.20)	2.65	(153.7)	60.5	
12J							

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

EQUIPMENT LIST

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED
	OPTIONAL EQUIPMENT (CONT.)				
[illegible]	ANTI-COLLISION LIGHT, FLASHING [illegible]	950279	[illegible] .05	[illegible] 18.50	
[illegible]	[illegible] COLLISION BEACON/ROTATING SPEC.	950282	[illegible] 1.5	[illegible] 18.0	
[illegible]	TANKS, HEATED	950208	1.21	[illegible] -24.75	
[illegible]	HEADREST, INSTL. REAR	940113-[illegible]	[illegible] 0.47	[illegible] 90.0	
[illegible]	HEADREST, INSTL. FRONT	940113-[illegible]	[illegible] .57	[illegible] 45.0	
[illegible]	SKYMAP	810[illegible]	[illegible] 10.[illegible]	[illegible] 62.[illegible]	
[illegible]	STORMSCOPE [illegible]	[illegible]	[illegible] 8.[illegible]	[illegible] 5.5	
[illegible]	(2) PASSENGER SEAT, [illegible] SEAT	[illegible]	NO CHANGE	NO CHANGE	
[illegible]	TKS AIRFRAME [illegible]	950007	[illegible] 1.5	[illegible] 27.6	(NOT INSTALLED)
[illegible]	TKS PROPELLER [illegible]	[illegible]	[illegible] 20.6	[illegible] 36.[illegible]	(NOT INSTALLED)
[illegible]	[illegible]	[illegible]	[illegible] 52.2	[illegible] 33.7	
[illegible]	[illegible]	[illegible]	[illegible] 0.[illegible]	[illegible] 1.[illegible]	

EQUIPMENT LIST

MO.	DAY	YEAR

MF 10-03

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (LBS) POUNDS	ARM (IN) INCHES	MARK IF INSTALLED
	OPTIONAL EQUIPMENT (Cont'd)				
[illegible]					
[illegible]					
[illegible]					
[illegible]					
[illegible]					
[illegible]					
[illegible]					
[illegible]					
[illegible]					

EQUIPMENT LIST

M20R-US

MO.
DAY
YEAR

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT kgs (POUNDS)	ARM cm (INCHES)	MARK IF INSTALLED
	OPTIONAL EQUIPMENT ACCOUNTS				

TABLE OF CONTENTS

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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 that you, the pilot, familiarize yourself with all controls and systems while sitting in the pilot's seat and rehearsing the systems operations and flight procedures portions of this manual.

AIRFRAME

The M20R is an all metal, low wing, high performance airplane. The fuselage has a welded, tubular-steel cabin frame covered with non-structural aluminum skins. Access to the cabin is provided by a door located on the right side of the fuselage. A door is provided aft of the rear seat for access to the baggage compartment. The aft fuselage, tailcone, is of semi-monocoque construction.

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

The M20R has a tapered, full-cant laver, laminar-flow type wing. The airfoil varies from a NACA 63_2-215 at the wing root to a NACA 64_1-412 at the wing tip, modified by an inboard leading edge cuff.

An aerodynamically designed cover is attached to the wing tip and contains the wing navigation, anti-collision and optional recognition lights. Wrap-around stretched formed skins cover the wing; flush riveting is used on the forward, top and bottom two thirds of the wing chord to provide benefit of laminar flow aerodynamics.

The empennage consists of the vertical and horizontal stabilizer assembly and the rudder and elevator surfaces. The entire empennage pivots around attaching points on the aft fuselage to provide pitch attitude trim.

The tricycle landing gear allows maximum vision and ground maneuvering. Hydraulic disc brakes and a steerable nose wheel aid in directional control during taxiing and ground operations. The landing gear is electrically retracted and extended. A warning horn, a gear position indicator on the floorboard and a green "GEAR DOWN" light help prevent inadvertent gear-up landings. A manual emergency gear extension system is provided in the event of 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 rudder and nose wheel steering mechanisms. Push-pull tubes, rather than conventional cable/pulley systems, actuate 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 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 tailcone attachment points. A variable down-spring located in the tailcone and a boteweight located forward of the control column help create desirable stability characteristics.

Aileron System

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

Elevator System

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

Rudder System

The rudder attaches to the aft vertical fin spar at four hinge points. Push-pull rods and bellcranks link rudder to the rudder pedals.

Stabilizer Trim System

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

Rudder Trim System

The M20R is equipped with an electric rudder trim system which allows the pilot to trim out much of the rudder force required for takeoff, climb, cruise and descent. The system is a "bungee" type spring assembly, attached to the rudder control system and driven by an electric motor. The trim system is operated by a split toggle switch located above the throttle on the pilot's panel. The split switch is a safety measure that greatly reduces the possibility of a runaway trim situation. The electric trim indicator (LED) is located adjacent to the toggle switch. A potentiometer controls the rudder trim position indicator. Takeoff position is within the first 3 lighted segments on the right end of the indicator. Rudder force varies from negligible (with trim at the far right) to mild (with trim set to the third segment from the right). Cruise setting will result in the trim indicator being slightly left of neutral. A high speed descent will result in an even more left of neutral position.

Wing Flaps

The wing flaps are electrically operated and interconnected through a torque tube and bellcranks. Total flap area is 17.98 square feet.
Normal travel is 0 to 33°. Limit switches prevent travel beyond these limits. Wing flap position is controlled by a pre-select switch located on the lower center console. Also located on the center console is a flap position indicator showing which pre-select position has been selected: full up, takeoff (10°) or full down positions. A potentiometer controls the flap position indicator (LED). 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 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 steer the aircraft in approach speeds.

INSTRUMENT PANEL

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

FLIGHT PANEL & INSTRUMENTS

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

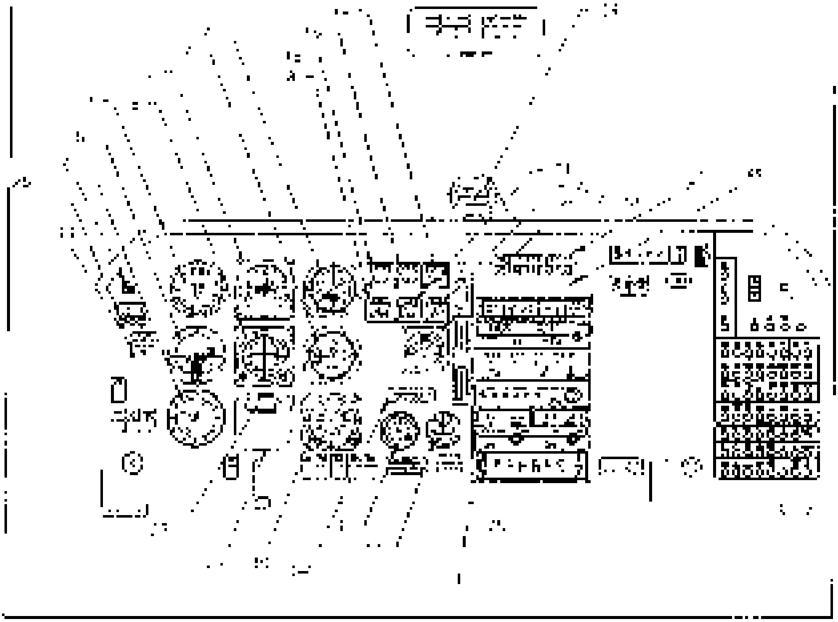


FIGURE 7 - 1 FLIGHT PANEL (29-0001 THRU 29-0165)

1. CLOCK - (S/N 29-0001 thru 29-0169) (Refer to Figure 7-1)
The electric, digital, panel mounted clock, may be used and set by the following procedures. Three buttons are located below digital face of 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 CLEAR button for 4 - 5 seconds to enter clock set mode. 12 H or 24 H will flash.

- Push START/STOP button to select either 12 or 24 hour mode.
- Push CLEAR to select hours (hours flashing/minutes steady) or minutes (hours steady/minutes flashing) for setting.
- Push START/STOP to increase either hours or minutes until desired time is set.
- Push MODE to return to normal time.

1. CLOCK (S/N 29-0170 thru 29-0199) (Refer to Figure 7-1A)
The electric, digital, panel mounted DAVTRON Model 800 clock, may be used and set by the following procedures.

The SEL button selects what is to be displayed on the four digit window and the CTL button controls what is being displayed. Pressing select sequentially selects GMT, Local Time, Elapsed Time and back to GMT. The control button starts and resets Elapsed Time when momentarily pushed. Normal operation of the M800 cannot accidentally reset time.

SETTING GMT
Select GMT for display in the four digit window with the SEL button. Simultaneously press both the select and control buttons to enter the set mode. The tens of hours digit will start flashing. The control button has full control of the flashing digit and each button push increments the digit. Once the tens of hours is set, the select button selects the next digit to be set. After the last digit has been selected and set with the control button, a final push of the select button exits the mode. The lighted annunciator will resume its normal flashing, indicating the GMT clock is running.

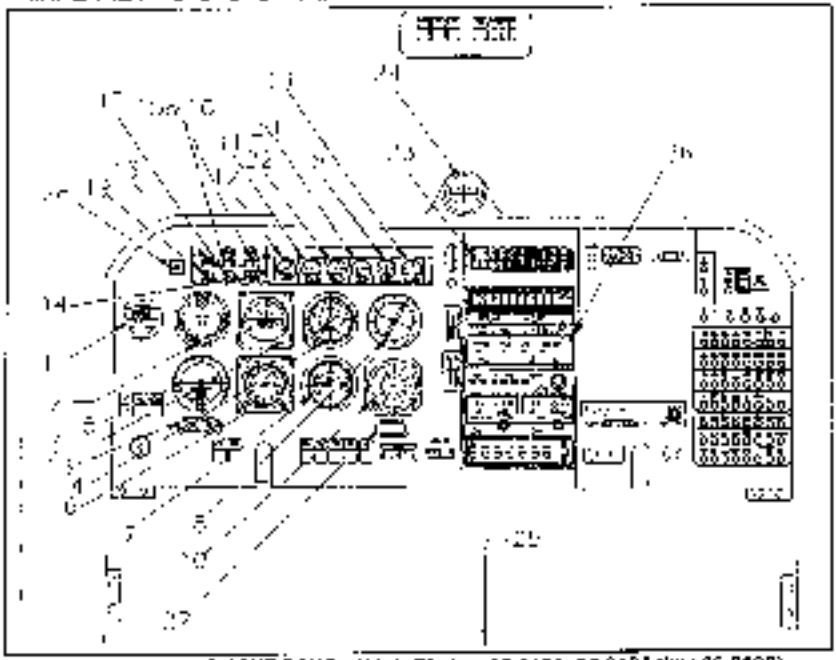


FIGURE 7 - 1A FLIGHT PANEL (29-0170 thru 29-0182, 29-0184 thru 29-0198)

SETTING LOCAL TIME
Select Local Time, (LT) using the SEL button. Simultaneously push the SEL and CTL buttons to enter set mode. The tens of hours digit will start flashing. The set operation is the same as GMT, except that minutes are already synchronized with the GMT clock and cannot be set in Local Time.

TEST MODE
Hold SEL button down for three seconds and the display will indicate 8888 and activate all four annunciators.

ELAPSED TIME COUNT UP
Select ET for display. Press CTL button. ET count will start. Elapsed Time counts up to 59 minutes, 59 seconds, and then switches to hours and minutes. It continues counting up to 99 hours and 59 minutes. Press CTL button again to reset to zero.

ELAPSED TIME COUNT DOWN
Select ET display and enter set mode by pressing both buttons. The countdown time can now be set. Pressing the pre-selected GMT time setting. When the time is entered and the last digit is no longer flashing, the clock is ready to start the countdown. Momentarily pressing the CTL button starts the countdown. When the count reaches zero, the display flashes and the external alarm is activated. Pressing either SEL or CTL will deactivate the alarm. Elapsed minutes counted UP.

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

3 ARTIFICIAL HORIZON
Varies with installed equipment.

4 ALTIMETER
The altimeter operates by absolute pressure and outwards barometric pressure to indicate reading in feet above mean sea level. The altimeter has a fixed dial with three pointers to indicate hundreds, thousands and ten-thousands of feet. Barometric pressure is set by

through the static ports. A knob adjusts a movable dial, a small window on the face of the main dial, to indicate local barometric pressure and to correct the altimeter reading for prevailing conditions.

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

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

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

8. AUTOMATIC DIRECTION FINDER (INDICATOR) (ADF)

9. NAVIGATION INSTRUMENT NO. 2

10. **(OPTIONAL)** Stormscope, Second Altimeter, etc.

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

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

13. FUEL FLOW
Fuel flow gauge - an electric instrument operating from information provided by a fuel flow transducer. This gauge indicates fuel flow being used by the engine. The FT-101A system will display the quantity of fuel used when the "USED" button is pushed.

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

15 & 16. FUEL QUANTITY INDICATORS
Fuel quantity indicators are used in conjunction with float-operated variable-resistance transmitters in each fuel tank. Tank-full position of transmitter floats produces maximum resistance through the transmitters, permitting minimum current flow through fuel quantity indicator and maximum pointer deflection. Instruments are calibrated in gallons of fuel volume.

17. VACUUM INDICATOR - Indicates operating vacuum pump pressure. Location varies on panel.

18. OIL PRESSURE
Electrical instrument - uses a transducer as a reference. Calibrated in pounds per square inch (PSI).

19. OAT (Outside Air Temperature)
Outside air temperature gauge provides pilot with free stream outside air temperature in °C. Location may vary on panel.

20. EXHAUST GAS TEMPERATURE (EGT)
A thermocouple probe, located at junction of #1, 3 & 5 exhaust pipes, transmits temperature variations to the indicator which serves as a visual aid during leaning. EGT varies with fuel air ratio, power and RPM. Engine operation within BLUE ARC, during climbs, provides sufficient fuel to keep engine power within proper temperature range. Location varies on panel.

21. OIL TEMPERATURE
Oil temperature gauge - an electric instrument connected to an electrical resistance bulb engine. Temperature changes of engine oil changes electrical resistance, thereby allowing more or less current to flow through indicating gauge. Instrument is calibrated in ° F

22. CYLINDER HEAD TEMPERATURE
Cylinder head temperature indication is controlled by an electrical resistance type temperature probe installed in cylinder number 2. The indicator receives power from aircraft electrical system. Instrument is calibrated in ° F.
A 6 position switch, with probes installed in all cylinders, is optional.

23. ANNUNCIATOR PANEL
See description elsewhere in this SECTION

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

25. HOUR METER
Hour meter - located on baggage compartment bulkhead and indicates elapsed time while engine is running. Location may vary depending on installed systems.

26. RADIO INSTRUMENTS
Refer to SPECTRUM IX for the description of the radio/navigation configuration installed in the aircraft

27. ALTITUDE PRE-SELECT - OPTIONAL

28. MASTER WARNING LIGHT - When any RED warning light on the panel shows that a system or component is malfunctioning, the MASTER WARN light illuminates in approximately 15-20 seconds after any annunciator light begins to show a malfunction. Pilot should identify the source system warning light on the annunciator, then PUSH the MASTER WARN light (it contains a PUSH switch under the light). MASTER WARN light will extinguish for approximately 5 minutes or until the next system malfunction warning light on the annunciator illuminates. Repair inoperable system prior to next flight

SWITCHES & CONTROLS

1. MAGNETO/STARTER SWITCH
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 key and receptacle, engages starter. Releasing key when engine starts allows switch to return, by spring action, to BOTH position.

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

3. ALTERNATOR FIELD SWITCH
This switch cuts alternator field power from main buss to alternator

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

5. OPTIONAL - Rotating/Flashing Beacon, etc

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

7. NAVIGATION LIGHT (NAV LITE) SWITCH/CIRCUIT BREAKER
Navigation light combination switch/circuit breaker turns wing tip and tail navigation lights ON. Should a short occur, the combination switch/circuit breaker will automatically trip to the OFF

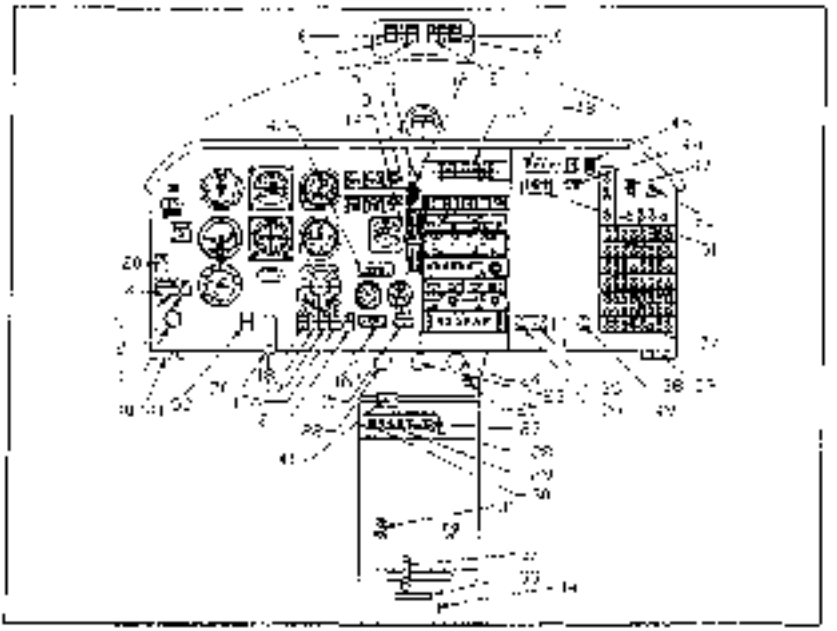


FIGURE 7 - 2 SWITCHES/CONTROLS (S/N 29-0001 thru 29-0159)

position. The glareshield and panel lights are also turned on when this switch is ON. Control dimming of either glareshield or panel lights with rotating switches on lower console.

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

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

11. GEAR SAFETY BY PASS SWITCH (Gear Retraction Override)
Gear safety override switch is a manual means of electrically by-passing the Airspeed Safety Switch. In the event the landing gear switch is placed in gear up position, a properly operating Airspeed Safety Switch prevents gear from being retracted before takeoff speed of approximately 90 +/- 5 KTS is reached. To retract landing gear at a lower airspeed, the GR SAFETY BY PASS switch may be held depressed until landing gear is completely retracted.

~ CAUTION ~

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

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

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

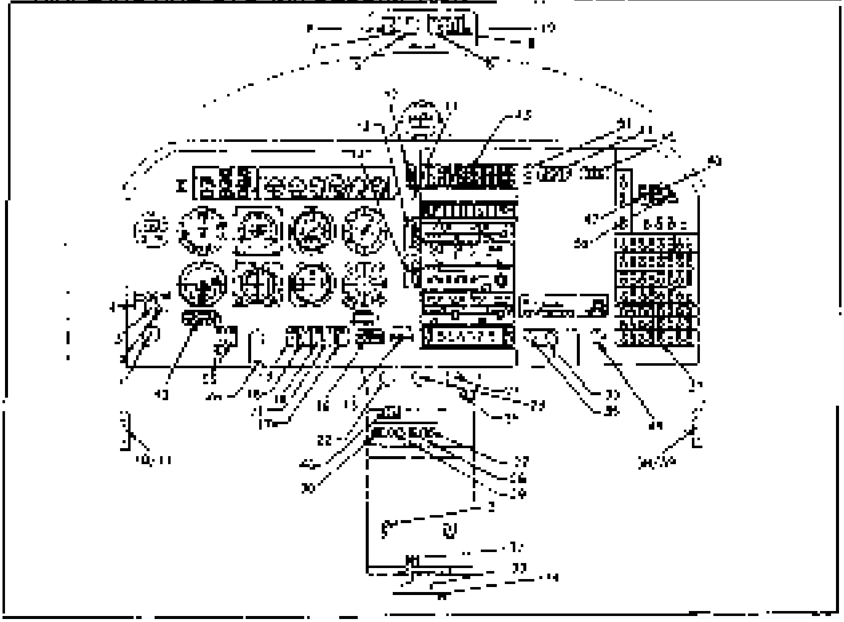


FIGURE 7 - 2A SWITCHES/CONTROLS (S/N 29-0170 thru 29-0182, 29-0184 thru 29-0199)

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

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

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

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

17. " HIGH BOOST " FUEL BOOST PUMP SWITCH
An electric fuel boost pump, capable of operating engine at reduced power in case of engine driven fuel pump failure, is provided. The guarded switch (lift guard) can be pushed ON to operate engine (at reduced power) if required.

— CAUTION —

Pushing HIGH BOOST pump switch ON when engine driven pump is operating properly will cause engine to quit due to excessive rich fuel mixture.

17A. BOOST PUMP SWITCH (LOW BOOST)
The Low Fuel Boost pump switch connects the fuel boost pump through a voltage regulator to provide engine priming capability prior to engine start and to provide a means of purging fuel

vapor from fuel system during extreme temperature conditions, either environmental conditions or from engine heat soak situations.

18. STAND-BY VACUUM (STBY VAC) SWITCH.
When STBY VAC annunciator light illuminates (steady or flashing), the vacuum operated gyro instruments are considered to be unreliable. STBY VAC switch should be turned ON. Refer to Airborne Service Letter No. 93, located in Section X.

19. PITOT HEAT SWITCH/CIRCUIT BREAKER
Pitot heat combination switch/circuit breaker turns heating elements within pitot tube on. Should a stall occur, the combination switch/circuit breaker will automatically trip to OFF position. "PITOT HEAT" annunciator light will illuminate "BLUE" when switch is ON and current is flowing through pitot heater. On some export aircraft, annunciator will illuminate "AMBER" when switch is OFF and will not be illuminated when ON and drawing current.

20. PROPELLER DE-ICE (PROP DE-ICE) SWITCH (if installed).
See SECTION IX for operating procedures. (29-0001 thru 29-0169)
NOT USED ON FIGURE 2A

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

22. THROTTLE CONTROL
Push throttle control forward to increase engine power. Pull throttle aft to decrease engine power. Full throttle automatically activates the boost pump. Vernier control is optional.

23. PROPELLER CONTROL
Push propeller control forward to increase engine RPM, pull control aft to decrease engine RPM. Control is a vernier type and fine adjustments of RPM can be obtained by turning knob clockwise to increase RPM and counter clockwise to decrease RPM. Knob should not be turned IN any closer than .030" to .060" to panel surface.

24. MIXTURE CONTROL
Mixture control allows pilot to adjust the fuel-air ratio (mixture) of the engine. Push control forward to enrichen mixture. Pull control full aft to close idle cutoff, shutting down engine. Control is a vernier type and fine adjustments of mixture can be obtained by turning knob clockwise to enrichen mixture and counterclockwise to lean. Knob should not be turned IN any closer than .030" to .060" to panel surface.

25. WING FLAP SWITCH
Flap switch, on 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 (10°). 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.

-CAUTION-

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

26. ALTERNATE STATIC SOURCE VALVE
Pull alternate static source valve full aft to change source of static air for the altimeter, airspeed and vertical speed indicator from outside of aircraft to cabin interior. Airspeed and altimeter readings are affected slightly when alternate static source is used (See Charts in SECTION V).

27. PARKING BRAKE CONTROL
Depress brake pedals and pull parking brake control to set parking brake. Push parking brake control in to release parking brake.

28. CABIN VENT CONTROL (Fresh Air)
Pull cabin vent control aft to open valve in mixing box connected to cabin air inlet NACA vent located on the right side of the airplane. Optimum use of cabin vent control is described in the Cabin Environment Section.

29. CABIN HEAT CONTROL
Pull cabin heat control to turn cabin heat on. To lower cabin temperature, cabin heat control is pushed forward toward the OFF position. Optimum use of cabin heat control is described in the Cabin Environment Section.

30. **DEFROST CONTROL**
Pull defrost control to decrease air flow to lower cabin area and increase air flow to windshield ducts in the front of glareshield area. Optimum use of the defrost control is described in the Cabin Environment Section.

31. **MIKE JACK** (Hand Held Microphone) (EMERGENCY MIC. AND PHONE JACK)
Plug hand held microphone jack into this plug and place microphone in holder located on front of lower console.

32. **TRIM CONTROL WHEEL**
Rotating trim control wheel forward lowers nose during flight, rearward rotation raises nose of aircraft during flight. If optional electric trim system is installed, pushing both sides of split trim switch located on left hand portion of pilots control wheel, will electrically trim aircraft.

33. **FUEL SELECTOR VALVE**
Fuel selector valve, located on floorboard, is a three position valve which allows pilot to select either left or right fuel tank. Turning valve OFF shuts off ALL fuel to engine. At full throttle engine will stop from fuel starvation in 2 to 3 seconds.

34. **GEAR DOWN POSITION INDICATOR** (Floorboard)
The gear-down position indicator, near back of fuel selector valve pan, aft of center console, has twin marks that align when landing gear is down and illuminates when GREEN GEAR DOWN light is ON. A red-white striped decal shows when landing gear is NOT in the down position.

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

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

37. **CIRCUIT BREAKER PANEL**
See data is elsewhere in this Section.

38 & 39 **CO-PILOT'S HEADSET JACKS.**
40 & 41 **PILOT'S HEADSET JACKS.**

42. **FUEL FLOW TOTALIZER INDICATOR & FUEL MEMORY SWITCH.**
"Fuel Totalizer" memory is connected to the aircraft battery through a "FUEL MEM" dry switch. Indicates fuel flow being used at given power setting, fuel used, fuel remaining and/or time remaining since last five hiding, if memory switch has been left ON and system has not been RESET. Optional systems depict different data. (Some optional "Fuel Totalizer" systems do not contain a memory switch.)

43. **ANNUNCIATOR PANEL**
See description elsewhere in this section.

44. **OPTIONAL DIRECTIONAL GYROSCOPIC INDICATOR REMOTE SLAVE and/or COMPENSATION SWITCH**

45. **EMERGENCY LOCATOR TRANSMITTER (ELT) SWITCH (ATK/ON)**
Place in ARM position for normal operation. Refer to ELT Description elsewhere in this section for proper and lawful usage.

46. **ALTERNATE AIR (ALT AIR)**
Automatically opens when induction air system becomes blocked for any reason. May be opened manually by pulling knob aft. AMBER annunciator light will illuminate when alternate air door is open.

47. **BATTERY SELECT SWITCH - BAT 1/BAT 2**
This switch allows pilot to select either battery as primary for any flight. Battery #1 is normally used for operations. The battery not being used is recharged through a trickle charge system. It is recommended to switch batteries occasionally.

48. **FUEL FLOW MEMORY SWITCH (OPTIONAL FOR S/N 20-0001 thru 20-0159)**
Normally left in "ON" position at all times so that "Fuel Used" information is retained from one flight to the next until reset. Memory switch may be turned OFF to prevent battery drain if aircraft is to be stored for extended periods of time. (Some OPTIONAL "Fuel Flow" systems do not contain a memory switch.)

48. EMERGENCY BUS SWITCH (25-0170 thru 29-0199)
(Optional when Stand-by Alternator is installed)
When Low Voltage annunciator light illuminates, steady or flashing, pull 70A BAT circuit breaker and PUSH EMERG BUS switch ON to bring Stand-by Alternator on line.

49. CIGAR LIGHTER (CAUTION 60 watt)

50. STAND-BY VACUUM OPERATIONAL INDICATOR
RED button is visible when STBY VAC switch is OFF. RED button is pulled back (not visible) when stand-by vacuum pump is operating. This is dictator is for preflight check only.

51. OPTIONAL - INTER-COM CONTROL PANEL

52. OPTIONAL EQUIPMENT SWITCH(ES)

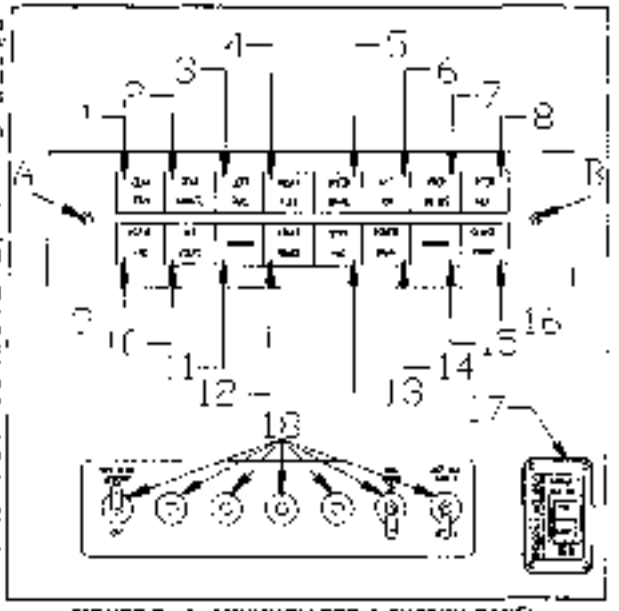
MAP LIGHT SWITCH;RHEOSTAT, MIC SWITCH, ELECTRIC TRIM SWITCH (if installed) & OPTIONAL AUTO-PILOT SWITCHES are located in the pilot's control wheel.

ANNUNCIATOR & SWITCH PANEL

ANNUNCIATOR

A. PRESS-TO-TEST SWITCH
Press PED press-to-test switch (2-5 sec) with Master Switch ON to illuminate light bulbs (some annunciator legends may not be active, see descriptions below). Defective bulbs must be replaced prior to flight. Includes MASTER WARN light on S/N 29-0170 thru 29-0199.

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



1. GEAR SAFETY INDICATOR (GEAR DOWN)
2. GEAR SAFETY INDICATOR (GEAR UNSAFE)
A GEAR DOWN light (GREEN), a GEAR UNSAFE light (RED), and a warning horn provide visual and audible gear position signals. The green (GEAR DOWN) light shows continuously when gear is fully extended with navigation lights ON. The GEAR DOWN light is dimmed for night operation. All gear lights are OUT when landing gear is fully retracted. Additional verification is accomplished by checking light-board indicator windows.

FIGURE 7 - 3 ANNUNCIATOR & SWITCH PANEL
S/N 29-0001 THRU 29-0169

3. LEFT FUEL
4. RIGHT FUEL
Left and right fuel annunciator light (RED) comes on when there is 5-1/2 to 3 gallons (20.8 to 11.4 liters) for S/N 29-0001 thru 29-0169, 6 to 3 gallons (23 to 20.8 liters) for S/N 29-0170 thru 29-0199, of usable fuel remaining in the respective tank.

5. SPEED BRAKE
Illuminates AMBER when speed brakes are extended.

6. ALT AIR
Illuminates AMBER when the alternate air door is opened, either manually or automatically. In this situation, induction air for the engine is drawn from inside cowling rather than through the RAM/CA induction air intake. The normal induction air system MUST be checked, for proper operation, prior to next flight.

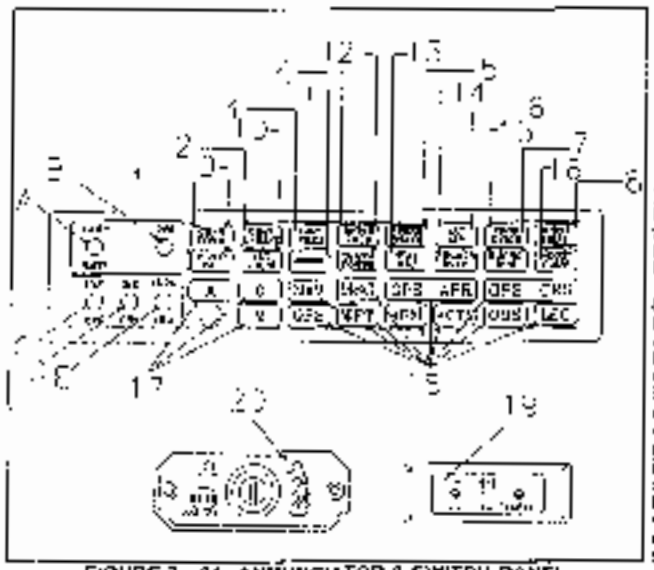


FIGURE 7 - 3A ANNUNCIATOR & SWITCH PANEL
S/N 28-0170 THRU 28-0199

NOTE
Indication of alternate air (warm air) will result in loss of power.

7. PROP DE-ICE
Illuminates BLUE when Propeller De-Ice has been selected ON.

8. PITOT HEAT
Illuminates BLUE when pilot has selected PITOT HEAT rocker switch ON. Some equipped aircraft will illuminate AMBER when switch is OFF or if other than a normal electrical failure in pitot heat system and WILL NOT BE illuminated when the switch is ON.

9. HI/LO VAC
A RED light indicates a malfunction or improper adjustment of vacuum system. Vacuum is available for operation of attitude gyro and directional gyro. Detailed vacuum range is 4.25 - 5.25 in. Hg. (4.5 - 5.5 inches of mercury (Hg)). The HI/LO VAC light will SUNK WHEN VACUUM IS BELOW 4.25 in. Hg. and illuminates STEADY WHEN VACUUM IS ABOVE 5.5in. Hg. In either case, gyros should not be considered reliable during the warning time. Refer to Airborne Service Letter No. 81 located in Section X.

10. ALT VOLTS
A RED light indicates improper voltage supply. A FLASHING RED light indicates alternator voltage fluctuations be over/under regulated or no voltage from alternator. A STEADY RED light indicates over-voltage or tripped voltage relay.

11. SPARE

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

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

14. REMOTE RNAV (Optional)
Illuminates when OMNI 2 is selected and optional RNAV system is not functioning.

15. SPARE (S/N 28-0001 THRU 28-0169)
15. EMERGENCY BUS (S/N 28-0170 THRU 28-0199) (OPTIONAL)
Illuminates when the EMERG BUS switch is switched ON to only Standby Alternator or Bat-

16. **BOOST PUMP**
Illuminates BLUE when the Electric Fuel Boost Pump is selected ON. Light comes on high intensity when HI BOOST switch is ON and low intensity when LOW BOOST switch is ON.

SWITCH PANELS & ANNUNCIATOR PANELS WILL VARY WITH AIRCRAFT

C, D, E **NAVIGATION MODE SELECTION SWITCHES** (Figure 7-3A)

17. **ELT SWITCH** (29-0001 THRU 29-0169)
17. **MARKER BEACONS** (29-0170 thru 29-0199)
Illuminates applicable colors as aircraft passes over marker beacons on approach.

18. **OPTIONAL SWITCHES** (29-0001 thru 29-0169)
18. **NAVIGATION SELECTION LIGHTS** (29-0170 thru 29-0199)
Illuminates as the pilot selects the navigation system desired. Varies with installed equipment.

19. **ELT SWITCH** (29-0170 thru 29-0199)

20. **OPTIONAL SWITCHES** (29-0170 thru 29-0199)

GROUND CONTROL

NOSE GEAR STEERING

Nose gear steering system consists of a steering horn on nose gear leg linked to the rudder pedals 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 40 ft. (12.0 m) right & 48 ft. (14.4 m) left, without use of brakes. A MANUAL tow bar is provided to ground handle aircraft. Care must be used to not swivel nose wheel beyond 13° right or 11° left from center. Adjustable steering stops are incorporated on nose gear leg assembly.

— CAUTION —
Exceeding steering swivel angle limits may cause structural damage.

LANDING GEAR

CONSTRUCTION

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 aft stub spars. The nose gear mounts on cabin tubular steel frame and engine mount. Rubber discs in all gear leg assemblies absorb shock of taxiing and landing.

RETRACTION SYSTEM

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

~ CAUTION ~

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

WHEEL BRAKES

Main gear wheels incorporate self-adjusting, disc-type, dual puck hydraulic brakes. The pilot's rudder pedals have individual toe-actuated brake cylinders linked to the rudder pedals. Depressing both toe pedals and pulling parking brake control, on console, sets the brakes. Push parking brake control forward to release 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, emergency 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 (rotated aft) to engage the manual emergency extension mechanism. The mechanism has a spring retracted pull cable which manually drives the gear actuator to extend landing gear. 12-20 pulls are required to fully extend and lock landing gear down. The electrical extension or retraction system will not operate if the manual extension lever is not properly positioned (down).

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 landing gear is not down-and-locked and throttle is approximately 1/4 inch from idle position. The green light shows continuously when landing gear is fully extended. The red light shows whenever landing gear is in transit or not locked down but is OFF when landing gear is fully retracted. A visual gear-position indicator, located on floorboard, aft of the flap selector, shows that 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 wheel to permit retraction into the nose wheel well. Minimum turning radius on the ground is 40 feet (12.0 m) to the right and 48 feet (14.4 m) to the left. Adjustable steering stops have been incorporated on nose gear leg assembly.

~ CAUTION ~

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

CABIN

BAGGAGE COMPARTMENT

The baggage compartment is located aft of rear passenger seats. The standard compartment has 20.9 cubic feet (.59 cu.m.) of baggage or cargo space. A maximum of 120 pounds (54 Kg) may be loaded in this area. Tie-down straps provided. Passengers should not be allowed to occupy this space.
Additional cargo space is available by removing rear seat, bottom cushion and seat back cushion/cover (fold seat back forward and slide seat cover UP and OFF frame. Store cushions as desired).
To fold rear seat back down, pull lock pin (left side of seat). 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. Pivot seat back release handle UP to move catch down. Pivot seat bottom forward & down into seat cushion cavity.
Both rear seats can be folded down together or independent of each other.
The storage area located aft of the top of the aft baggage compartment bulkhead shelf rack is restricted to 10 pounds (4.5 Kg).

CARGO RESTRAINT

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

~ CAUTION ~

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

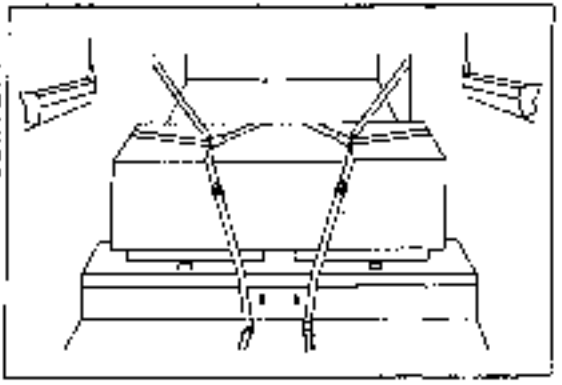


FIGURE 7 - 4 CARGO RETENTION (TYPICAL)

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 left side head crank (knob) until seat back is in desired position.

Both optional front seat configurations allow vertical seat height adjustment by turning right side hand crank to raise or lower the entire seat assembly.

The rear seat backs have four (4) adjustment positions. Each seat can be adjusted independent of the other by pulling up on respective release handle located on left or right of aircraft centerline at inboard spar. This allows adjustments from approximately 18° to 43° recline position.

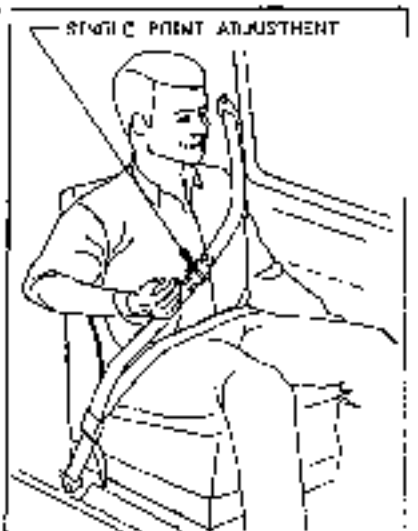


FIGURE 7 - 5 INERTIAL REEL HARNESS RETENTION

SEAT BELTS/SAFETY HARNESS

Safety restraints, if worn properly, (1 occupant per restraint) keep occupants firmly in their seats during T/O, landing, turbulent air and during maneuvers. The belt/harnesses are mechanically simple and comfortable to wear. The front seat inertia belt/harnesses are attached to hardpoints on side structure and seats. The rear seat belts are attached to brackets firmly mounted to structural hardpoints. Shoulder harnesses are provided for rear seat occupants. Safety belt/harnesses MUST be fastened for take-off and landing operations. It is recommended that all infants and small children below 40 lbs. weight and/or under 40 in. height be restrained in an approved child restraint system appropriate to their height and weight.

The single diagonal type safety harness is designed so the chest strap crosses diagonally from the outboard shoulder to an attachment point as near the inboard hip as possible. Rear seat occupants should take care to conform with this procedure in adjusting chest strap and lower belt length. This diagonal configuration places body torso-of-gravity inside the triangle formed by chest strap and lap belt. The lap belt should be adjusted comfortably tight. As a result, the body is restricted from rolling out to-

ward the unrestricted shoulder or open side of the harness, then forward if slack. Refer to Figure 7-5 for proper seat belt/harness adjustment.

DOORS, WINDOWS & EXITS

CABIN DOOR

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

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 pushed in flight above 152 KIAS.

EMERGENCY EXITS

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

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

ENGINE

GENERAL

The engine installed is a Teledyne Continental Motors IO-550-G(*), normally aspirated fuel injected engine. The following designation describes engine:

I	Denotes "FUEL INJECTED"
O	Denotes "OPPOSED" (refers to the horizontally opposed cylinders)
550	Denotes piston displacement in "CUBIC INCHES"
G(*)	Denotes a specific equipment configuration

* Refer to TCDS for engine configuration required.

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

ENGINE CONTROLS

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

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

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

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

be made by pushing button on end of control and positioning control where desired. The non-vernier throttle has an integral friction device.

ENGINE INSTRUMENTS

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

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

ENGINE OPERATION AND CARE

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

OIL SYSTEM

The engine has a full-pressure, wet sump oil system with an 8 quart (7.57 liters) capacity. A conventional dip-stick is provided for determining oil quantity. The oil system is depicted in Figure 7-8. The propeller governor boosts engine oil pressure for operation of the propeller. It controls oil pressure going to the propeller hub to maintain or change propeller blade angles. This oil flows through propeller shaft to reach the propeller.

LUBRICATION SYSTEM

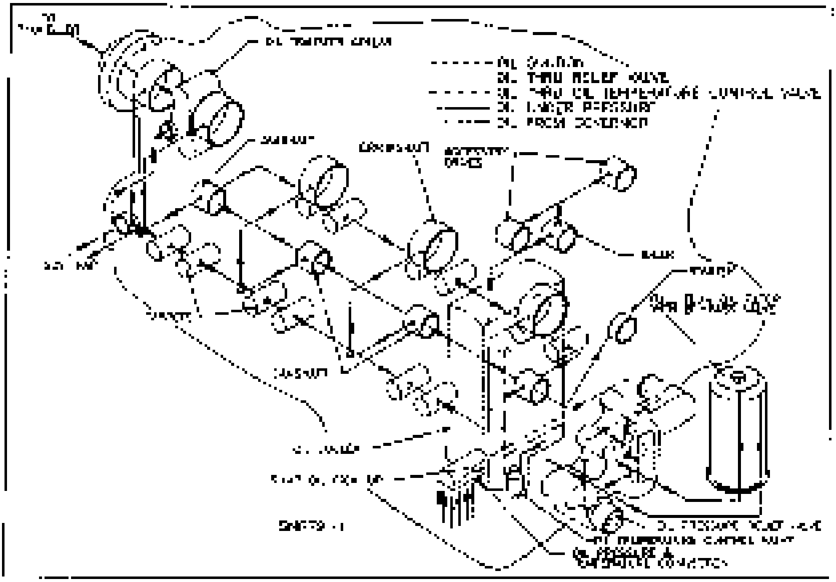


FIGURE 7 - 8 OIL SYSTEM SCHEMATIC

BREATHER FOR CRANKCASE
The crankcase is vented overboard to a near static location.

IGNITION SYSTEM

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

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

AIR INDUCTION SYSTEM

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

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

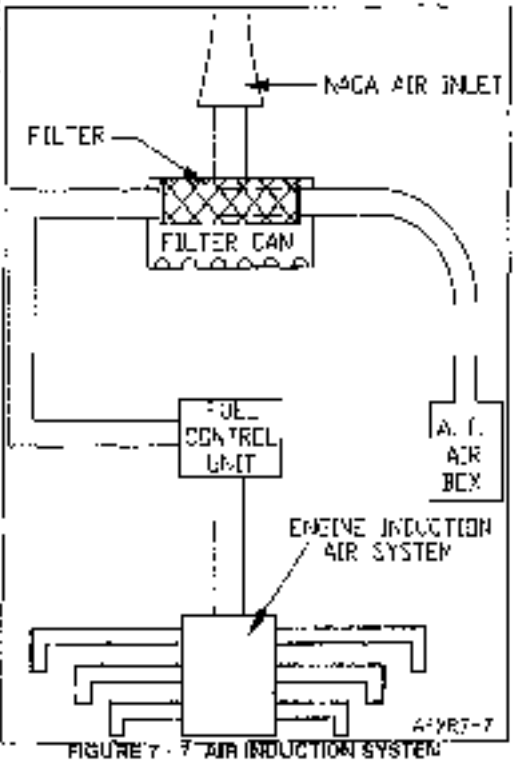


FIGURE 7-7 AIR INDUCTION SYSTEM SCHEMATIC

ICING PROTECTION

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

EXHAUST SYSTEM

The exhaust system consists of tubes from each cylinder which

out an exhaust pipe on the left side of aircraft. The left collector pipe crosses through muffler and out an exhaust pipe on the right side of aircraft. A short tail pipe attaches to the end of each exhaust pipe.

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

FUEL INJECTION

The fuel injection system is of the multi-nozzle, continuous flow type which controls fuel flow to match engine requirements. Any change in air throttle position, engine speed or a combination of these causes changes in fuel pressure to match relation to engine requirements. A manual mixture control is provided for precise leaning at any altitude and power setting. A fuel flow system is installed for digital readout of fuel flow in gallons per hour. However, fuel flow is NOT to be used as reference for manual leaning. Use the EGT gauge for this purpose.

The continuous-flow system permits the use of a typical rotary vane pump with integral relief valve. With this system there is no need for an intricate mechanism for timing fuel injection to the engine. The fuel injector pump is equipped with a separator where vapor is separated by a swirling augmentor system from the liquid fuel and returned to the tank selected. The fuel injector pump forces liquid fuel into the metering unit assembly.

The fuel metering unit (air throttle) controls the amount of intake air admitted into the intake manifold and meters the proportionate amount of fuel to the fuel manifold valve. The assembly has three control units, one for air, in the air throttle assembly, and two for the fuel control unit.

The manifold valve receives fuel from the metering unit. When fuel pressure reaches approximately 3.6 PSI, a check valve opens and admits fuel to six ports in the manifold valve (one port for each fuel nozzle line). The manifold valve also serves to provide a clean cutoff of fuel to the cylinder when engine is shut down.

The injector nozzle lines connect the manifold valve to the six fuel injector nozzles.

The injector nozzles (one per cylinder) are "air aided" type fuel nozzles which spray fuel directly into the intake port of the cylinder. When engine is running, flow through the nozzle is continuous and will enter the cylinder combustion chamber when the intake valve opens.

Since the size of the fuel nozzles are fixed, the amount of fuel flowing through them is determined by the pressure applied. For this reason, fuel flow may be accurately determined by measuring fuel pressure at the manifold valve.

ENGINE COOLING AIR

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

ENGINE STARTING SYSTEM

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

The engine firing order is 1-4-3-2-5-6. The ignition harnesses are connected to the magnetos so the right magneto fires the upper plugs on the right side and lower plugs on the left. The left magneto fires the upper plugs on the left and the lower plugs on the right.

ACCESSORIES

ALTERNATOR

Standard electrical power is supplied by a gear driven, 28 Volt, 100 ampere alternator.

An optional, gear driven, 28 Volt, 20 ampere stand-by alternator is available.

VACUUM PUMP

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

EXHAUST GAS TEMPERATURE PROBE

The exhaust gas temperature (EGT) probe measures exhaust gas temperature as it exits the exhaust valves into the exhaust manifold. The EGT probe varies electrical current (milliamps), based on exhaust gas temperature, and supplies this to an EGT gauge located on instrument panel. The EGT gauge is used as the primary source to lean the mixture.

PROPELLER

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

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

FUEL SYSTEM

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

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

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

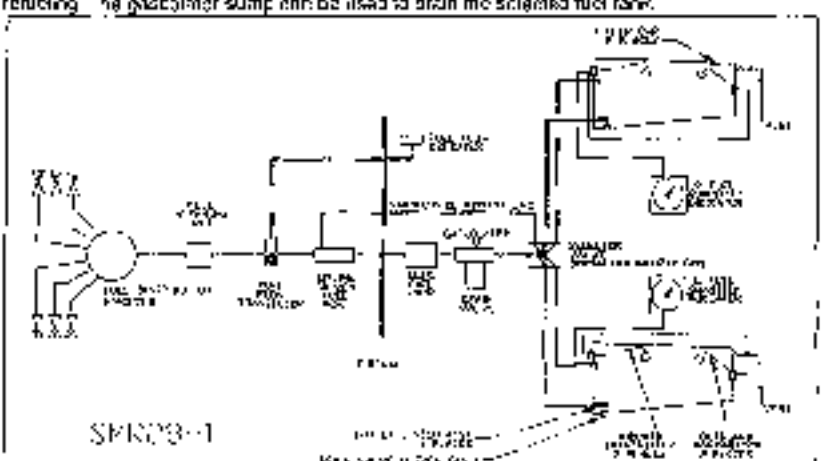


FIGURE 7 - 6 FUEL SYSTEM SCHEMATIC

Fuel is delivered, by the engine driven pump, to a throttle body fuel injector where pressure is regulated and the correct volume of fuel is metered to each cylinder of the engine.
Fuel not needed by the engine is returned to the tank from which it is drawn.

An electric Fuel Boost Pump is provided which has the capability of operating engine at partial power in case of engine driven fuel pump failure. The pump is controlled by two switches. The "BOOST PUMP" switch is to be used for priming engine during normal starting procedures (See SECTION IV) or purging fuel vapor from system when environmental conditions or a heat soaked engine may require it. (See SECTION III). The BOOST PUMP switch connects the pump through a voltage regulator for correct pump output. A guard on the "HIGH BOOST" switch prevents inadvertent operation and must be lifted for switch operation. (See SECTION III). "HIGH BOOST" is to be used when engine driven fuel pump has malfunctioned and will provide sufficient fuel for partial power operation or if a precautionary landing can be made in case of malfunction.

Two electric fuel-level transmitters, working in series in each wing tank operate the appropriate, left or right, fuel quantity gauges. The master switch actuates the fuel quantity indicator system to depict an indication of fuel remaining in each tank. Vents in each fuel tank allow for overflow and pressure equalization.
The optional, visual fuel quantity indicators, in each wing, are to be used for PARTIAL FUEL LOADING only and NOT for preflight inspection purposes.

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

ELECTRICAL SYSTEM

ALTERNATOR & BATTERY

Two 24-volt, 10-ampere-hour storage batteries (in the tailcone) and one 100 ampere self-rectifying alternator (produces 68 amps) supplies electrical power for equipment operation. The No. 1 battery, left side of tailcone, is normally used as the primary to start the aircraft. The No. 2 battery, right side of tailcone, is normally considered as back-up and is kept in a fully charged condition by trickle charge, through a diode system.

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

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

SCHEMATIC (See FIGURE 7-9)

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

CIRCUIT BREAKER PANEL (See FIGURE 7-10)

(Illustration depicts typical C/B panel; may vary from your aircraft)

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

The alternator's push-pull circuit breaker, on the main breaker panel, furnish an emergency overload break between the alternators and the power buss. Since the alternator is rated at output in excess of circuit breaker capacity, a tripped breaker normally indicates a fault within the alternator.

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

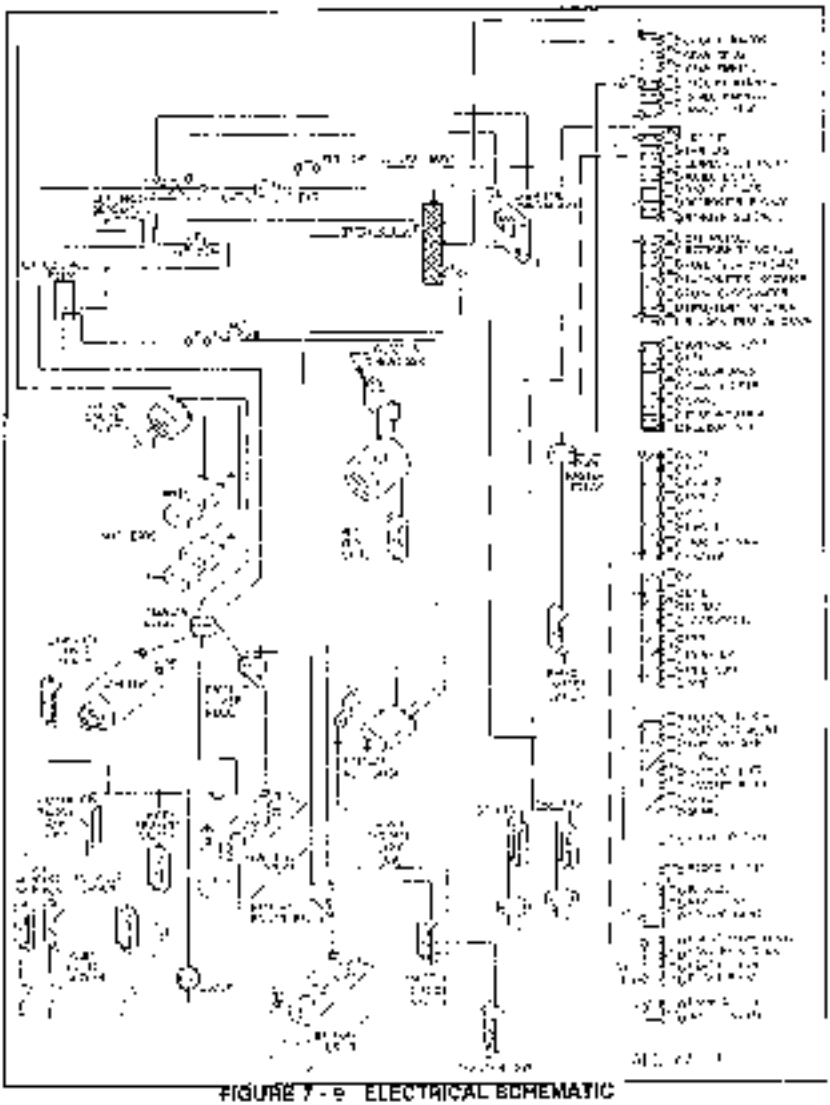


FIGURE 7 - 9 ELECTRICAL SCHEMATIC

output voltage exceeds 16 volts. The overvoltage warning light illuminates steadily and the alternator field circuit breaker trips.

Resetting the alternator field circuit breaker should reset alternator. If the circuit breaker will not reset, continue flight with minimum electrical load. The flight will be over quickly using only battery power, caution is advised to not drain both batteries if electrical power will be required before you are able to land. Land when practical to correct the malfunction.

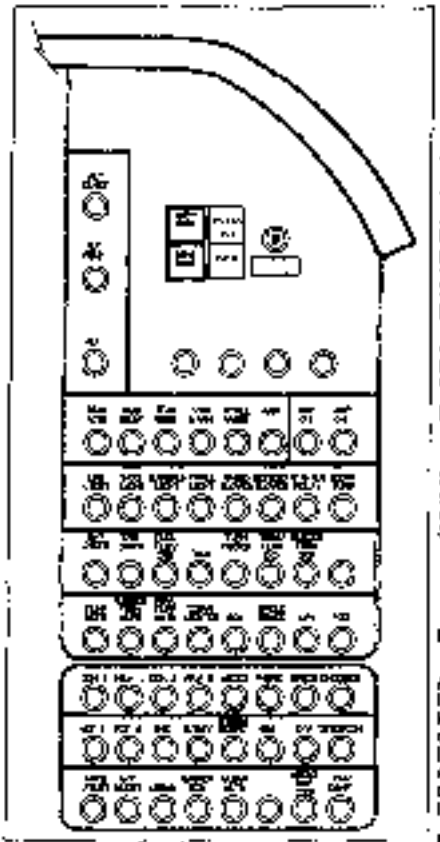


FIGURE 7 - 10 CIRCUIT BREAKER PANEL (TYPICAL)

NOTE

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

ANNUNCIATOR PANEL

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

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

ELT PANEL

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

LIGHTING SYSTEM

INSTRUMENT & PLACARD LIGHTS

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

MAP LIGHT

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

CABIN LIGHTING

Two sets of overhead lights illuminate the cabin.

CAUTION

The Cabin Light rocker switches are connected directly to battery.

All passenger overhead lights are controlled by a Master Light switch located on the pilot's arm rest. With Master Light Switch ON, individual overhead cabin lights are controlled by rocker switches located on each passenger's arm rest (excluding front seat passenger). Front seat passenger's light switch is located forward of cabin door hinge on side panel.

EXTERIOR LIGHTING

Conventional navigation and high intensity strobe lights are located on the wing tips and on the rudder trailing edge (strobe light only). Landing and Taxi lights are installed in the right and left wing leading edge. Split switches are used to control either the left or right taxi or landing lights. All exterior light switches are located on overhead panel just behind top of control stick.

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

CABIN ENVIRONMENT

HEATING & VENTILATION SYSTEMS

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

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 (Vernatics) 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 temperature by use of the Cabin Vent and Cabin Heat 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.

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

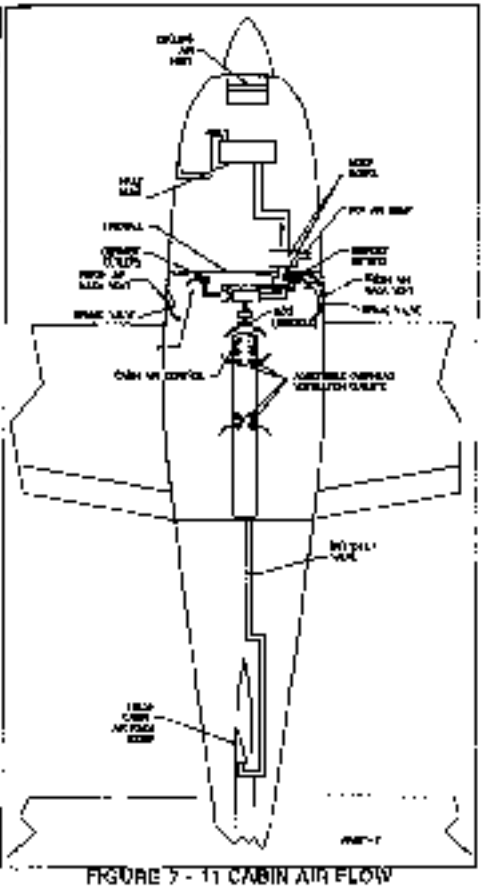


FIGURE 7 - 11 CABIN AIR FLOW

WINDSHIELD DEFROSTING SYSTEM

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

PITOT PRESSURE & STATIC SYSTEM

A pitot tube, mounted on lower surface of the left wing, picks up ram air for airspeed indicator / pitot heater prevents pitot tube icing when flying in moisture laden air. A pitot system drain valve is located on the forward bottom skin of the left wing to fuselage fillet. Static ports on each side of the fuselage supply static air pressure for the altimeter, the airspeed indicator, and vertical speed indicator. A static system drain valve is located on fuselage bottom skin below the left

side, tailcone access door and is used to drain moisture that might collect in static system lines. An alternate static pressure source valve handle is installed in the instrument panel below the pilot's control wheel shaft. Alternate static air is taken from within 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 left wing leading edge, to energize stall warning horn located in the cabin. The stall warning switch is adjusted to provide aural warning at 5 to 10 KIAS before actual stall is reached and will remain on until aircraft flight attitude is changed toward a non-stalled condition.

| NOTE |

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

OXYGEN SYSTEM

An optional four-place oxygen system provides supplementary oxygen necessary for continuous flight at high altitude. An oxygen cylinder is located in the equipment bay, accessible through a removable panel on the aft wall of the baggage compartment, or through the standard external, right side, panel in the tailcone. A combined pressure regulator/shutoff valve, attached to the cylinder, automatically reduces cylinder pressure to the delivery pressure required for operating altitude. The oxygen cylinder filler valve is located under a spring-loaded door on the baggage door.

A pilot's oxygen panel contains a cylinder pressure gauge, on the pilot's arm rest, effectively a quantity gauge, and a control knob, below arm rest, which is mechanically connected to the shutoff valve of the cylinder. The supply of oxygen can thus be shut off from the cockpit when not required. When the control is in the "ON" position, sufficient oxygen flow is available at the maximum airplane operating altitude (see Section II Limitations) while at lower altitudes the conducting valve automatically economizes the flow to conserve oxygen for longer duration or for future availability, without requiring any action by the pilot. (See Fig. 7-13).

Four oxygen outlets are provided in the overhead panel between the pilot's and co-pilot's seat for the convenience of all occupants. Oxygen flows from the outlets only when a mask hose is connected. Four partial re-breathing type masks are provided, each with vinyl plastic hoses and flow indicators. The three passenger masks are of the disposable type. The pilot's mask is a permanent type with a built-in microphone for ease of radio communication while using oxygen. To use the mask-microphone, connect its lead to the microphone jack located left of the instrument panel, in place of the aircraft or headset microphone lead, and key the switch on the control yoke.

The oxygen cylinder, (composite) when fully charged, contains 115.7 ft.^{3} of aviator's breathing oxygen (Spec No. MIL-O-27210) under a pressure of 1650 PSI at 21°C (70° F).
Filling pressures will vary, however, due to ambient temperature in filling area, and the rise of temperature resulting from compression of the oxygen. Because of this, merely filling to 1650 PSI will not necessarily result in a properly filled cylinder. Fill to pressures indicated on Fig. 7-12 for ambient temperatures.

WARNING

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

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

FIGURE 7-12 - OXYGEN FILLING PRESSURES

| NOTE |

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

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

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

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

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

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

4. As an example of the above procedure, 1400 PSI of pressure will safely sustain the pilot and one passenger for 4 hours and 55 minutes (Fig. 7-13) at 28,000 ft.; however, cruising at 30,000 ft. would permit an oxygen duration of 7 hours and 55 minutes (Fig. 7-13).
Light crew loads at relatively low altitudes will permit oxygen durations off the chart. Such durations can be calculated by determining the duration at 30,000 feet (by steps 1 and 3 above) and multiplying by the "duration multiplier" shown on the right of the appropriate cruising altitude. Example, Pilot only, at 1500 PSI has 11.25 hours duration at 30,000 ft. Duration Multiplier at 12.4 for 20,000 ft., gives 26 hours and 54 minutes duration. Oxygen duration off the chart naturally extend the airplanes duration. However, judicious choices of altitude for the number of persons on board can permit flight planning for several fuel stops, without need for recharging oxygen system at each stop.

CAUTION

Facial hair, beards & mustaches may prevent a proper seal between face and mask, causing 18 - 67% leakage. Duration chart may be invalid.

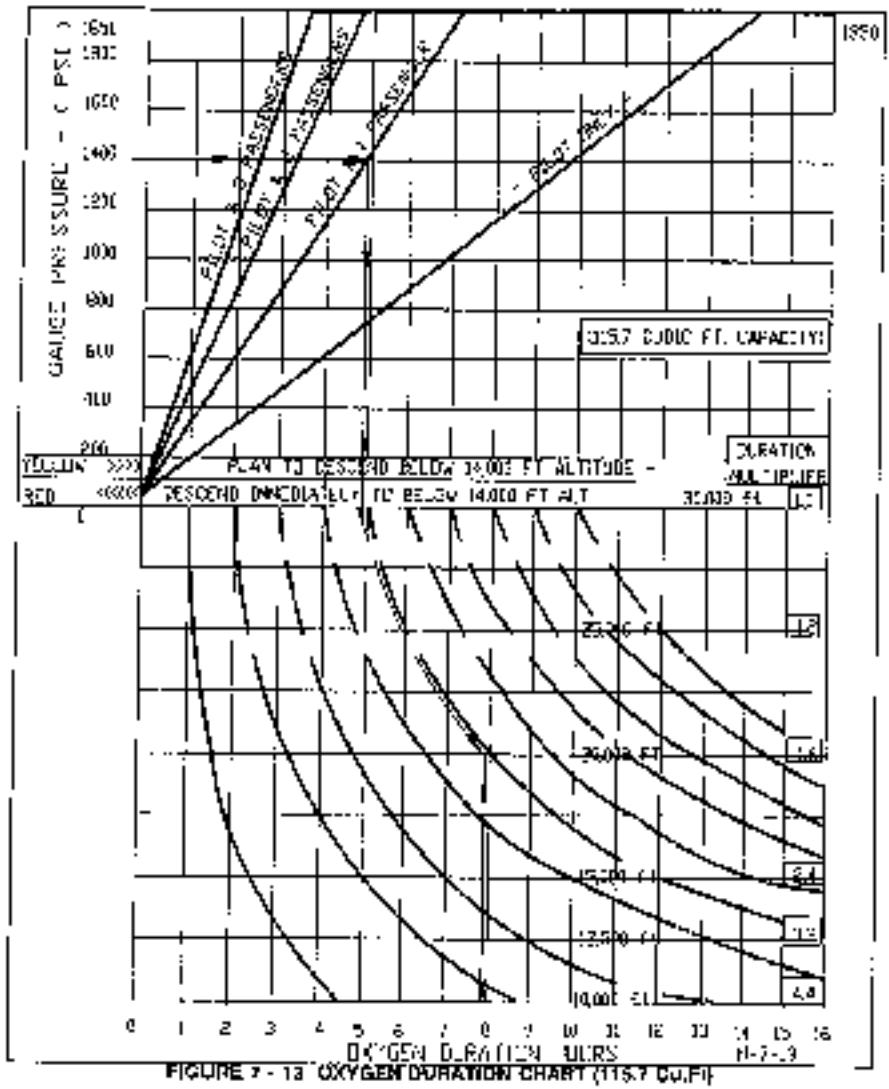


FIGURE 7 - 13 OXYGEN DURATION CHART (115.7 CU.FT)

VACUUM SYSTEM

The standard vacuum system on the M20R consist of a main vacuum pump, regulator, filters and a clutch activated, engine driven stand-by vacuum pump. The main vacuum pump operates when engine is running. The standard stand-by vacuum pump is coupled to the engine accessory drive but the electrically activated clutch must be turned ON, by pushing the STBY VAC switch, before the pump is on line. An optional Stand-by Vacuum Pump System is located in the nacelle when the optional, two 2 alternator system is installed.

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

EMERGENCY LOCATOR TRANSMITTER

The Emergency Locator Transmitter (ELT) is located in the tailcone and is accessible from the battery access door on the right side of the tailcone. The emergency locator transmitter meets the requirements of FAR 91.52 and is automatically activated by a longitudinal force of 5 to 7 g's. The ELT transmits a distress signal on both 121.5 MHz and 243.0 MHz for a period of from 48 hours in low temperature areas and up to 100 hours in high temperature areas. The unit operates on a self-contained battery. The battery should be checked at each annual inspection. The battery has a useful life of four years. However, to comply with FAA regulations it must be replaced after two years of shelf life. The battery should also be replaced if the transmitter has been used in an emergency situation or if accumulated test time exceeds one hour. The battery replacement date is marked on the transmitter label.

On the unit itself is a three position selector switch, placarded "ARM", "OFF", "ON". The "ARM" position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until battery is drained to depletion or until the switch is manually moved to "OFF". "ARM" position is selected when the transmitter is installed at the factory and switch should remain in that position whenever unit is installed in the airplane. The "ON" position is provided so 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 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 ELT switch, located at the top of right hand radio panel, is provided to allow transmitter to be controlled from inside cabin. The pilot's remote switch is placarded "ON" & "ARM". The unit will start transmitting with switch in "ON" position and will stop when remote switch is returned to "ARM" position during cockpit checkout.

| NOTE |

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

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

TABLE OF CONTENTS

INTRODUCTION

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

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

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

Scheduling of ALL maintenance is the responsibility of the aircraft operator. A general knowledge of the aircraft is necessary to perform day-to-day service procedures and to determine when non-routine or special 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 Appendix A 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 their expertise and experience. Remember your airplane is designed to maintain it. Should an extraordinary or difficult situation arise concerning the repair or upkeep of your Mooney, consult the Product Support Department, Mooney Aircraft Corporation, Louis Schreiner Field, Kerrville, TX. 78028. Telephone: Area Code (830) 896-9000 (ext. 2092) or (830) 792-2092.

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

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

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

Engine information should be obtained from: Teledyne Continental Motors, P.O. Box 90, Mobile, AL 36601, USA, Telephone: (205) 438-3411.

GROUND HANDLING

TOWING

For maneuvering the aircraft in close quarters, in the hanger, or on the ramp, use the manual 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 wing leading edges
and
(2) on inboard portion of propeller blades adjacent to 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 11° Left or 13° Right of center. Exceeding the turn limits shown on the turn indicator may cause structural damage.

TIEDOWN

As a precaution against wind damage, always tie down the aircraft when parked outside. Remove 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 pins (hooks) when it is necessary to lift the aircraft with jacks. The tail tiedown point is part of the tail skid.

TO TIE DOWN AIRCRAFT:

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

JACKING

When it is necessary to raise the aircraft off the ground:

a. Install jack points in tiedown mounting holes outboard of each main gear.
b. Use standard aircraft jacks at both wing hoist points (wing tiedown eyebolt receptacles) outboard of the main gears. While holding jack point in place, raise jack to firmly contact jack point.
c. Place a jack under front jack point (Sta. 5.51) to lift nose wheel.
d. Raise aircraft, keeping wings as nearly level as possible.
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 entire aircraft. Wheels not being raised should be chocked fore and aft.

SERVICING

REFUELING

Integrally sealed tanks, inboard, inboard sections of wing (LH & RH), carry the standard fuel quantity. With aircraft positioned on level ground, service each fuel tank after flight with 100 octane or 100LL aviation grade gasoline. The fuel tank is considered full when fuel completely covers bottom of standpipe.

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

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

CAUTION

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

Fuel samples from the sump drain of each tank should always be taken before the first flight of the day to check for water, sediment or other contamination. It is recommended fuel tank samples be taken prior to each flight. 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 tank and fuel drain valve before taking fuel samples or draining gascolator.

Tank sump drains are near each wing root, forward of the wheel wells. A small plastic cup is supplied as loose equipment for sampling fuel sump. To collect a fuel sample, insert cup actuator prong into sump drain receptacle, push upward to open valve momentarily and drain fuel into cup. If water is in fuel, a distinct line separating water from gasoline will be seen through transparent cup wall. Water, being heavier, will settle to bottom of cup while colored fuel will remain on top. Continue taking fuel samples until all water is purged from tank. Aircraft should be in a level position to prevent the possibility of any contamination not being at sump drain area.

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

NOTE

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

ENGINE LUBRICATION

Operate and service new engine within limitations given in SECTION II and per TCM Maintenance and Operators Manual.
Before every flight, check engine oil level and replenish as necessary.
The oil filler cap access door is located in top cowling. Any lubricating oil must conform with TCM Specification MHS24 or MHS25 to be acceptable for use in engine. See TCM Maintenance and Operators Manual for specifically approved products.
New or newly overhauled engines should be operated on aviation grade mineral oil during the first 25 HOURS of operation or until oil consumption has stabilized. The aircraft is delivered from Mooney with multi-viscosity mineral oil. Single viscosity mineral oil may be added to multi-viscosity mineral oil if necessary.

The engine is equipped with an external, full flow, oil filter. Engine oil change intervals are recommended at each 50-HOUR INTERVALS if small capacity oil filter is installed. If large capacity oil filter is installed, the oil change interval may be increased to 100-HOUR INTERVALS provided the oil filter is replaced every 50 hours. The external oil filter element is recommended to be replaced at 50-HOUR INTERVALS in all cases.

"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 the engine is in an extremely dirty condition, the switch to additive oil should be delayed 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 mineral oil. Drain 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, the following grades of oil are recommended.

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

* Refer to the latest edition of TCM Maintenance and Operators Manual for approved brands of oil.

Mooney Service Centers stock 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 paper induction air filter every **500 HOURS** or at **ONE YEAR** intervals, whichever occurs first.

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

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

"CAUTION"

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

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

NOTE

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

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

NOTE

A Donaldson D-3400 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. for filter drying.

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

GEAR & TIRES

The aircraft is equipped with 6-ply, Type III, standard-brand tires and tubes. Keep main gear tires inflated at 42 PSI and nose gear at 49 PSI for maximum service life. Proper inflation will minimize the wear and impact damage. Visually inspect tires during preflight for cracks, cuts, bruises and worn spots. 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 prevent retraction interference and binding. It is recommended that retraction/extension cycles (5 minimum) be done any time any tire is replaced to assure that no interference exists during the cycle.

CAUTION

After any landing, other than a smooth touchdown and rollout, when aircraft is above 3200 Lbs (1,452 Kg), the aircraft should undergo the Gear System Operational Inspection as outlined in M20R Service and Maintenance Manual, No. 180, Chapter 32-30-01.

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

BATTERIES

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

To service batteries, remove tailcone access cover(s) to gain access to battery(ies). 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 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 battery at full charge to prevent freezing in cold weather and to prolong service life.

CAUTION

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

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

HYDRAULIC BRAKE RESERVOIR SYSTEM

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

MAINTENANCE

ENGINE PERFORMANCE CHECKS

When the aircraft leaves the factory the IO-550-B(3) engine has been properly tuned and will perform at optimum efficiency. To insure that the engine is continuing to perform properly certain maintenance action should be performed during the 100 HOUR or ANNUAL inspection or whenever it is suspected that engine performance is not correct.

Refer to M20R SERVICE AND MAINTENANCE MANUAL or TCM maintenance manuals for specific maintenance actions to adjust engine, if necessary.

PROPELLER CARE

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

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

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

EXTERIOR CARE

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

"CAUTION"

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

Remove grease or oil from the exterior by wiping with a cotton cloth saturated in kerosene. Flush away dirty 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 non-oxidized or protected 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

In fact, 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 overall detergent and fresh water.

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

INTERIOR CARE

Normal household cleaning practices are recommended for routine interior care. Frequently vacuum clean seats, carpets, fabric side panels and headliner to remove as much surface dust and dirt as possible. For cleaning all leather side panels and wood upper cabin panels, use Woolite, mixed 1 part Woolite to 3 parts water. Other type cleaners are not recommended at this time.

— CAUTION —

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

Foam type shampoos may be used for routine cleaning of carpets. To minimize carpet wetting, keep foam type cleaners as dry as possible and gently rub in circular motion. Use vacuum cleaner to remove foam and dry the material. Grease spots on carpet should be removed with jelly-type spotter. Do not saturate carpet with solution which could damage backing materials.

Use a damp cloth to clean 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:

A. 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).

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

NOTE

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

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

Since the Regulations of other nations may require other documents and data owners of airplanes not registered in the United States should check with their own aviation officials to determine their individual requirements.

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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, M20R

WITH

AA80 "InterVOX" Intercom System

REG. NO. ~~G-BVZX~~ OY-ELW

OEKGG

SERIAL NO. 29-0045

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, M20R). 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

Issue Date: 1 - 8 - 90
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MOONEY AIRCRAFT CORPORATION

P. O. BOX 72

Kerrville, Texas 78029-0072

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date
A	ALL PAGES	Added M20R to Heading of all pages	[signature]	[illegible]

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 avfailing 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 isonormal 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 78029-0072

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

Mooney Aircraft Model

M20M, M20R

WITH

PROPELLER DE-ICE SYSTEM

REG. NO. ~~G-BVZV~~ OY-EHV

SERIAL NO. 29-0045 VE-KGG

This Supplement must be attached to the applicable FAA Approved Pilot's Operating Handbook and Airplane Flight Manual (POH/AFM) when the Propeller Deice System is installed in accordance with Mooney Drawing M20003. 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

Issue Date: 6 - 29 - 89
REV. A: 5 - 5 - 90
REV. B: 12 - 93
REV. C 8 - 94

MOONEY AIRCRAFT CORPORATION

P. O. BOX 72

Kerrville, Texas 78029-0072

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date
C	All Pages	Added M20R to Heading of all pages.		

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

SECTION I - GENERAL

The propeller de-ice system is intended for use if unexpected icing conditions are encountered. The system is operated by a rocker switch/circuit breaker located in the pilot's panel.
When the switch is placed in the "ON" position, current flows to a timing device which supplies power to the heating elements in the propeller boots. Each propeller blade boot contains heating elements which are cycled ON and OFF every 90 seconds by the timer. An annunciator light is illuminated whenever the de-ice rocker switch is turned on and will cycle ON & OFF with timer, indicating when current is being applied to heating elements.

SECTION II - LIMITATIONS

There is no change to the airplane limitations when the propeller de-ice system is installed.

Flight into known icing conditions is prohibited.

SECTION III - EMERGENCY PROCEDURES

No change

SECTION IV - NORMAL PROCEDURES

If unexpected icing conditions are encountered, the following procedure is recommended:

1. "PROP DE-ICE" switch - ON.
2. Verify "PROP DE-ICE" light (BLUE) is illuminated on the annunciator panel.

NOTE
The airplane ammeter should fluctuate slightly as the timer cycles ON and OFF every 90 seconds.

SECTION V - PERFORMANCE

Sea level rate of climb will be reduced approximately 50 FPM, with no reduction in cruise true airspeed.

SECTION VI THROUGH X

No Change

EASA APPROVED FLIGHT MANUAL SUPPLEMENT
FOR AIRCRAFT EQUIPED WITH
GARMIN GTX 33 Mode S Transponder

AIRCRAFT MAKE: Mooney Aircraft

AIRCRAFT MODEL: M20R

S/N: 29-0045

This document must be carried in the aircraft at all times. It provides limitations and other information for operation of aircraft equipped with the GARMIN GTX 33 Mode S Transponder, installed in accordance with DAO Aviation Minor Change DAO DO-04-15 rev.02

This document serves as the EASA Approved Supplemental Flight Manual for the Garmin GTX 33 Mode S Transponder

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

ISSUED DATE: 10/4-12

RECORD OF REVISIONS

This "Record of Revisions" identifies all revisions to this document. When changes to this document are needed, revisions will be issued by the Applicant for this AFMS and if necessary approved by the EASA.

Applicant:

EASA DOA: EASA.21J.275

Name: DAO Aviation A/S
Address: Flyngevej 11 F
4000 Roskilde

The "Record of Revisions" shall remain in this document at all times. Upon receipt of revision, insert page(s) into the document and enter the revision number, revision date, insertion date and signature of the person incorporating the revision into the document in the appropriate spaces below.

Revision Number	Pages affected	Revision date	EASA Approved by
02	01-05		

ISSUED DATE 10/4/12

Table of Contents

SECTION I: GENERAL

1. The aircraft is equipped with a Garmin GTX 33 ATC Mode A/C/S transponder with ID/ENT capability. Control of the transponder is done via the installed GTN series navigator system.

2. The installed Mode S system satisfies the data requirements of ICAO Doc. 9688, "Regional Supplementary Procedures for Secondary Surveillance Radar (SSR) Mode S Elementary Surveillance" in designated European airspace. The capability to transmit data parameters complies with EASA TCL 15 rev 1.

3. The transponder installed does not transmit any Enhanced (EHS) surveillance parameters.

SECTION II: LIMITATIONS

1. Software version 6.0 or later must be installed in the GTX33 to avoid transmission of EHS parameters.

INTRODUCTION

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

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

SECTION III: EMERGENCY PROCEDURES

No change

SECTION IV: NORMAL PROCEDURES

I DETAILED OPERATING PROCEDURES

- Note -
Expected coverage from the GTX 33 is limited to line of sight. Low altitude or aircraft antenna shielding by the aircraft itself may result in reduced range. Range can be improved by climbing to a higher altitude.

The GTX 33 will power up together with the GTN series navigator system. The GTX 33 air/ground configuration is controlled from the GTN. The airground threshold is the groundspeed at which the GTN transitions from a ground state to an airborne state, and vice versa. It is set to 30 knots. The GTX 33 will automatically switch to Ground.

Manual operation:

After Engine Start

1. Knob/Mode Switch ..... GTN
The transponder will turn on together with the GTN series navigator system in the same mode of operation selected at the last power down and will display the last entered configuration code.

Before Takeoff

1. Touch Altitude reporting key (GTN series : each screen) ..../ALT displays in the squawk code field

The transponder will be on and respond to Air Traffic Control (ATC) Mode C (altitude and identification) interrogations.

- Note -
Touch On to turn the transponder On for Mode A operation (On displays in the squawk code field).
The transponder will transmit the squawk code when interrogated.
Touch VFR to set the squawk code to 7000.

ISSUED DATE: 10/4/12

After Landing

1. Touch Ground reporting key (GTN series touch screen). . . GND displays in the squawk code field

* Note *
Touch Ground to place transponder in Ground mode
Mode S interrogations will be allowed. (GDN displays in the squawk code field)

SECTION VI PERFORMANCE

No change

SECTION VII WEIGHT AND BALANCE

See current weight and balance data

SECTION VIII AIRPLANE & SYSTEM DESCRIPTIONS

See GTX 33 Pilot's Guide for a complete description of the GTX 33 system.

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

_____
Make and Model Airplane

Registration Number: _____ Serial Number: _____

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate 10037SY 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 unsupplemented Airplane Flight Manual.

EASA APPROVED

European Aviation Safety Agency
Piotr HATTON
Project Certification Manager

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	EASA Approved
1	7 Dec 2011	All	Complete Supplement	Date [illegible]

Table of Contents

Section 1. GENERAL

1.1 Garmin GTN Navigators

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

GTN navigation 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, 118.000 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 I minimums, 328.6 to 335.4 MHz frequency range			X		X
Moving map including topographic, terrain, aviation, and geopolitical data	X	X	X	X	X
Display of datalink weather products (optional)	X	X	X	X	X
Display of terminal procedures data (optional)				X	X
Display of traffic data (optional)	X	X	X	X	X
Display of Stormscope® data (optional)	X	X	X	X	X
Display of marker beacon annunciations				X	X
Remote audio panel control				X	X
Remote transponder control	X	X	X	X	X
[illegible]	X	X	X	X	X
TSO-C151b Class B TAWS	X	X	X	X	X
Supplemental calculations and timers	X	X	X	X	X

Table 1 – GTN Functions

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

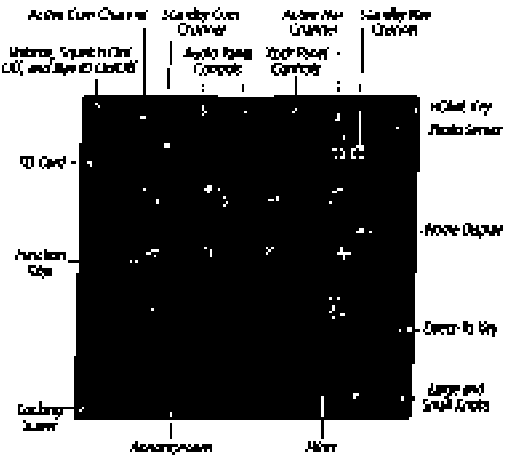

Figure 1 - GTN 750 Control and Display Layout

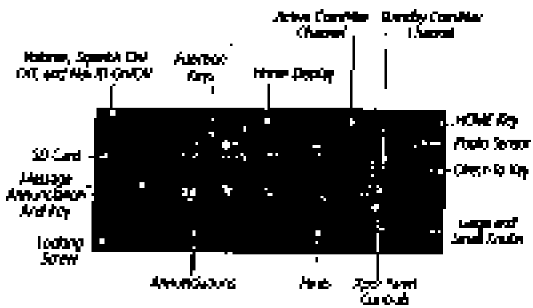

Figure 2 - GTN 635/650 Control and Display Layout

1.2 Capabilities

GPS/SBAS TSO-C146c / ETSO C146 Class 3 Operation:

The GTN, when installed in accordance with STC 10037574, 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 (GNSS)" 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".

The Garmin GNSS navigation system as installed in this aircraft 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 as installed in this aircraft 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 GTNs. The Garmin GNSS navigation system, as installed in this aircraft, 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.

Applicable to dual installations consisting of two GTNs. The Garmin GNSS navigation system, as installed in this aircraft, 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, as installed in this aircraft, 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 / ETSO-C146 Class 3 approved Garmin GTN Navigation Systems. The Garmin GNSS navigation system as installed in this aircraft complies with the equipment requirements for P-RNAV and B-RNAV/RNAV 5 operations in accordance with AC 90-96A CHG 1 and JAA TGL 10 Rev 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 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 References

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

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

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

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

1.4 Definitions

The following terminology is used within this document:

ADF: Automatic Direction Finder

APR: Approach

CDI: Course Deviation Indicator

DME: Distance Measuring Equipment
EHSI: Electronic Horizontal Situation Indicator
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
MDA: Minimum Descent Altitude
MDH: Minimum Descent Height
MLS: Microwave Landing System
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
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
WDDB:	WAAS Fault Data Correction
XPDR:	Transponder

Section 2 LIMITATIONS

2.1 Cockpit Reference Guide

The Garmin GTN 650X or GTN 750X 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 650X Cockpit Reference Guide P/N 190-01004-04 Rev A
- GTN 750X Cockpit Reference Guide P/N 190-01007-04 Rev A

2.2 Modes of Operation

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

IFR approved aircraft may have a GTN installed that is limited to VFR operations only. GTN installations limited to VFR are placarded in close proximity to the GTN: "GPS LIMITED TO VFR USE ONLY". Navigating with this placard are not approved for GPS navigation during IFR operations.

2.3 Minimum Equipment

If the installation of the GTN is not limited to VFR, the GTN must have the following system interfaces fully functional in order to be used for IFR operations:

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

Table 2 – Required Equipment

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

<u>Single engine piston aircraft under 6,000 lbs. maximum takeoff weight:</u>
Required Equipment for IFR operations: Single GTN Navigator

<u>Single engine turbine aircraft or multi-engine piston aircraft under 6,000 lbs maximum takeoff weight:</u>
Required Equipment for IFR operations: Single GTN Navigator plus a second source of GPS navigation or a separate source of VHF navigation

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

<u>Aircraft over 6,000 lbs maximum takeoff weight:</u>
Required Equipment for IFR operations: Single GTN Navigator plus a second source of GPS navigation or a separate source of VHF navigation.

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

2.4 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the pilot 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 data, 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 AUGUR GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home. For other areas, use the Garmin WFDE Prediction program. This requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight. The route planning and WFDE prediction program may be downloaded from the 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, 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 should 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 should be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to installations consisting of two GTNs: For flight planning purposes, operations where the route requires Class II navigation the aircraft's operator or pilot-in-command 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) availability will exceed 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.

Applicable to installations consisting of two GTNs: 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 GPS sensor.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs) and Obstacle Departure Procedures (ODPs), 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 (GNSS) 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 operations.

The only approved sources of course guidance are on the external CDI, HSI, or EFIS 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 EASA Approved versions for this STC)
Main SW Version	2.00
GPS SW Version	4.0
Com SW Version	2.01
Nav SW Version	6.01

Table 3 - Software Versions

2.7 SD Card

Proper function of the unit is no longer based on the SD card being present. Garmin cannot ensure functionality if the SD card is inserted or removed while the unit is powered on.

2.8 Navigation Database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the pilot 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 (GNSS)" instrument approaches using the Garmin navigation system are prohibited unless the pilot 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 pilot 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 pilot 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 pilots comply with altitude restrictions.

NOTE

When the unit annunciates "LNAV + V", the vertical guidance being provided on the CDI is advisory only and cannot be used as the primary means to meet altitude restrictions prescribed in the approach procedure. The pilot must adhere to all step-down approach altitudes utilizing the barometric altimeter installed in the aircraft, and LNAV minimums must be used for the approach MDA/MDH.

e) Not all published Instrument Approach Procedures (IAP) are in the Navigation database. Pilots 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 Display of Distance to Waypoint

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 deleted from these pages.

2.12 Terrain Proximity Function (All Units)

Terrain proximity 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 proximity and obstacle information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain proximity 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)

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

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 (XM Weather, Optional)

Datalink weather data is provided by an optional GDL 69 or 69A interface. The weather information display on the GTN is a supplementary weather product for

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 pilot determines, based on all available information, that turning in addition to the 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 source 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.
- 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, LNAV/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 GPS 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 to 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 pilot action. These failures may result in an unresponsive or blank display, or a red X over the com frequency display area. In any case, attempt to use the communication radio and expect it to be tuned to 121.5, regardless of the displayed active com frequency.

3.2.4 LOSS OF AUDIO PANEL FUNCTIONS (GMA 35 Only)

Audio Panel Circuit Breaker .... PULL

NOTE

This procedure will force the audio panel to provide the pilot only with communications on the Non-GTN 750 radio. If only a GTN [illegible] is installed in the aircraft, then the pilot will have communications on the GTN 750. The crew and passenger intercom will not function.

3.3.5 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.

3.3.6 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

3.3.7 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.

3.3.8 HEADING DATA SOURCE FAILURE

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.
- A/C overlaying traffic data from a TAS/TCAS I system on the main map display. The pilot must use the dedicated traffic page on the GTN system to display TAS/TCAS I data.
- All overlaying StormScope® data on the main map display. The pilot 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.

7.4.9 PRESSURE ALTITUDE DATA SOURCE FAILURE

Without a pressure altitude source to the GTN, the following features will not operate:

- Automatic log sequencing of logs requiring an altitude source. The pilot can manually sequence altitude logs, as prompted by the system.

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 2.1 for normal operating procedures and a complete list of system messages and associated pilot 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 prevent operations without 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

4.2 Before Takeoff

System Messages and Annunciations .... 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 while 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 approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

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.

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

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

4.3 Coupling the autopilot during approaches

CAUTION

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

☐ This installation prompts the pilot and requires the pilot to enable the approach outputs 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 Box on.....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 upon 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 autopilot does not support any vertical capture or tracking in this installation.

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

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 A or later
- GTN 7XX Pilot's Guide — P/N 190-01007-03 Rev A 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 pilot 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 pilot 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

☒ In this installation, the GTN will autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed to initiate guidance on the missed approach procedure.

☐ In this installation, the GTN will not autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed to initiate guidance on the missed approach procedure. The pilot must manually switch from VLOC to GPS on the external course deviation indicator if GPS guidance is desired after the missed approach point.

7.5 Terrain Proximity and TAWS

- The Terrain Database has an area of coverage from North 75° Latitude to South 60° Latitude in all longitudes.
- 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 A. 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.

3.7 Traffic System (Optional)

This system is configured for the following type of traffic system. The Garmin GTN 650X or GTN 750X Cockpit Reference Guide or Garmin GTN 650Xi or GTN 750Xi 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.

3.8 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 in 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 orientationally related to the current relative position of the aircraft nose.

Track Up mode:

If the GTN system is not receiving valid heading information, either because a compatible heading system is not installed, or the manufactured heading system has malfunctioned, the StormScope® page will operate in the track up mode as indicated by the label "TRK UP" in the upper right corner of the display. When operating in the track up mode, StormScope® information is displayed relative to the current GPS track of the aircraft that is automatically oriented to the upward area. In track up mode, the pilot must be aware that, if the combination of aircraft speed and crosswind results in a crab angle in excess of a few degrees, the relative bearing of StormScope® information on the GTN display will be offset by an amount equal to the aircraft crab angle. Because the difference between GPS track and aircraft heading can be very large when on the ground, use of the GTN to display StormScope® information in TRK UP mode is prohibited while on the ground.

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 GARMIN [illegible] 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	Toggles the com active / standby frequencies.
NAV RMT XFR	Toggles 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

TABLE OF CONTENTS

INTRODUCTION

The best of engineering know-how and manufacturing craftsmanship have gone into the design and building of your Mooney aircraft. Like any high performance airplane, it operates most efficiently and safely in the hands of a skilled pilot.

We urge you to be thoroughly familiar with the contents of your operating manuals, placards, and check list to insure maximum utilization of your airplane. When the airplane has changed ownership, some of these may have been misplaced. If any are missing, replacements should be obtained from any Mooney 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. Preflight 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 crosswind runways.
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 low 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 attitude or course to minimize exposure.
6. Don't apply controls abruptly or with high forces that could exceed design loads of the airplane.
7. Don't fly when physically or mentally exhausted.
8. DON'T TRUST TO LUCK.

GENERAL SOURCES OF INFORMATION

There is a wealth of information available to the pilot created for the sole purpose of making your flying easier, faster, and safer. Take advantage of this knowledge and be prepared for an emergency in the remote event 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 facets 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, general 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 Airmen 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, airmails newest 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 given through 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 calculated 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 its 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 any 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 periods 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

Preflight available.
Required documents on board.
Use the check list.
All internal control locks removed (if installed).
Check freedom of controls.
Cabin and baggage door properly closed.
Seat belts and shoulder harnesses fastened.
Passengers briefed.
Engine and propeller operating satisfactorily
All engine gauges checked for proper readings.
Fuel selector in proper position.
Fuel quantity checked by gauges.
Altimeter setting checked.

FLIGHT OPERATIONS

GENERAL

The pilot should be thoroughly familiar with all information published by the manufacturer concerning the airplane. The pilot is required by FAA to operate in accordance with the FAR's and the FAA Approved Airplane Flight Manual and/or placards installed.

TURBULENT WEATHER

A complete weather briefing prior to beginning a flight is the start of assurance of a safe trip. Updating of weather information enroute is another assurance. However, the wise pilot will know weather conditions change quickly at times and trade weather forecasting 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 cells 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 tornadoes 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. Turbulence encountered in cruise or descent (airspeed predictable 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 attitude; 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 misstrimmed 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 5 to 10 miles downwind from the ridge. This zone is characterized by the presence of "roll clouds". If sufficient moisture is present, lenticular (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 (eventual) descent is required (or at destination) is an extremely hazardous position for the VFR pilot.

Accepting a clearance out of certain airport control zones with no minimum ceiling and one-mile visibility as permitted with " Special VFR " is not a recommended practice for VFR pilots.

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

VFR - AT NIGHT

When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain a safe minimum altitude as dictated by terrain, obstacles such as TV towers, or communities in the area flown. This is especially true in mountainous terrain, where there is usually very little ground reference and absolute minimum clearance is 2,000 feet. Don't depend on your being able to see obstacles in time to miss them. Flight on dark nights over sparsely populated country can be almost the same as IFR and should be avoided by untrained pilots.

VERTIGO -DISORIENTATION

Disorientation can occur in a variety of ways. During flight, inner ear balancing mechanisms are subjected to varied forces not normally experienced on the ground. This combined with loss of outside visual reference can cause vertigo. False interpretations (illusions) result and may confuse the pilot's conception of the attitude and position of the airplane.

Under VFR conditions the visual sense, using the horizon as a reference, can override the illusions. Under low visibility conditions (night, fog, clouds, haze, etc.) the illusions predominate. Only through awareness of these illusions, and proficiency in instrument flight procedures, can an airplane be operated safely in a low visibility environment.

Flying in fog, dense haze or dust, cloud banks, or very low visibility, with strobe lights, and particularly rotating beacons turned on frequently causes vertigo. They should be turned off in these conditions, particularly at night.

All pilots should check the weather and use good judgment in planning flights. The VFR pilot should use extra caution in avoiding low visibility conditions.

Motion sickness often precedes or accompanies disorientation and may further jeopardize the flight.

STALLS, SPINS AND SLOW FLIGHT

Stalls and slow flight should be practiced at safe altitudes to allow for recovery. Any of these maneuvers should be performed at an altitude in excess of 5,000 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, recover the moment the stall occurs. The following is suggested:

1. Do not carry passengers. Be certain that the airplane's center of gravity is as far forward as possible. Forward CG aids spin recovery.
2. Be certain that both student pilot and instructor pilot have a full set of operable controls.
3. Conduct such practice at altitudes in excess of 5,000 ft. above ground level.

Remember that an airplane at or near traffic pattern altitude probably will not recover from a spin before impact with the ground. When descending to traffic pattern altitude and during operation in the traffic pattern and approach, maintain a safe margin above stall speed. During takeoff or go-around, be especially careful to avoid departure/stalls associated with turns at low speed. Maintain speeds recommended in this handbook(Section II & V).

STANDARD PROCEDURE FOR SPIN RECOVERY

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

Throttle	RETARD to IDLE
Ailerons	NEUTRAL
Rudder	Apply FULL RUDDER opposite the direction of spin.
Control Wheel	FORWARD of neutral in a brief motion to break stall. Additional FORWARD elevator control may be required if rotation does not stop.
Flaps (if extended)	RETRACT at once as possible
Rudder	NEUTRALIZE when spin stops.
Control Wheel	Smoothly MOVE AFT to bring the nose up to a level flight attitude after spin has stopped.

VORTICES - WAKE TURBULENCE

Every airplane generates wakes of turbulence while in flight. Part of this is from the propeller or jet engine(s) and part from the wing tip vortices. The larger and heavier the airplane the more pronounced wake turbulence will be. Wing tip vortices in the 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 fact, vortex velocities of 133 knots have been recorded.
Exhaust velocities from large airplanes at takeoff have been measured at 25 mph, 2 Mil 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. The 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 does give 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 clues at all times, regardless of size.

The Airman's Information Manual contains a section on wake turbulence. FAA Advisory Circular AC 90-23G 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 before Maximum Landing Gear Operating Airspeed.

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

Use caution when taking off or landing in gusty winds. Be aware of special wind conditions caused by buildings or other obstructions located near runways in a crosswind pattern.

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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. His 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 pressures of business, financial worries and family problems, can be contributing factors. If your fatigue is a factor prior to a given flight, don't fly. To prevent fatigue effects during long flights, keep mentally active by checking ground checks and radio-navigation position plots.

HYPOXIA

Hypoxia in simple terms is a lack of sufficient oxygen to keep the brain and other body tissues functioning properly. There is wide individual variation in susceptibility to hypoxia. In addition to progressively insufficient oxygen at higher altitudes, anything interfering with the blood's ability to carry oxygen can contribute to hypoxia (anemias, carbon monoxide, and certain drugs). Also, alcohol and various drugs decrease the brain's tolerance to hypoxia. Your body has no built-in alarm system to let you know when you are not getting enough oxygen. It is impossible to predict when or where hypoxia will occur during a flight, or how it will manifest itself. A major early symptom of hypoxia is an increased sense of well-being (referred to as euphoria). This progresses to slow reactions, impaired thinking ability, unusual fatigue, and dull headache feeling.

Symptoms are slow but progressive, insidious in onset, and are most marked at altitudes starting above 10,000 feet. Night vision, however, can be impaired starting at altitudes lower than 10,000 feet. Heavy smokers may experience early symptoms of hypoxia at altitudes lower than non-smokers. Use oxygen on flights above 10,000 feet and at any time when symptoms appear.

HYPERVENTILATION

Hyperventilation or over-breathing, is a disturbance of respiration that may occur in individuals as a result of emotional tension or anxiety. Under conditions of emotional stress, fright, or pain, breathing rate may increase, causing increased lung ventilation, although the carbon dioxide output of the body cells does not increase. As a result, carbon dioxide is "washed out" of the blood. The most common symptoms of hyperventilation are: dizziness; hot and cold sensations; tingling of the hands, legs and feet; aching; nausea; sleepiness and finally unconsciousness.

Should symptoms occur that cannot definitely be identified as either hypoxia or hyperventilation try three or four deep breaths of oxygen. The symptoms should improve markedly if the condition was hypoxia (recovery from hypoxia is rapid). If the symptoms persist, discontinue use of oxygen; consciously slow your breathing rate until symptoms clear; then resume normal breathing rate. Normal breathing can be aided by talking aloud.

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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 cc/cc(.08 liters) of alcohol at 18,000 feet produce the same adverse effects as 8 cc/cc(.19 liters) at sea level. In other words, the higher you get, "the higher you get".

DRUGS

Self-medication or taking medicine in any form when you are flying can be extremely hazardous. Even simple home or over-the-counter remedies drugs such as aspirin, antihistamines, cold tablets, cough mixtures, laxatives, tranquilizers, and appetite suppressors, may seriously impair the judgment and coordination needed while flying. The safest rule is to TAKE NO MEDICINE before or while flying, except on the advice of your Aviation Medical Examiner.

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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.

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Weather or Not
Disorientation
Pilots' Safety
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

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TABLE OF CONTENTS

INTRODUCTION

The best of engineering know-how and manufacturing craftsmanship have gone into the design and building of your Mooney aircraft. Like any high performance aircraft, 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 checklist 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 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 TRUST TO LUCK.**

GENERAL SOURCES OF INFORMATION

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

RULES AND REGULATIONS

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

This document covers such subjects as:

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

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

FEDERAL AVIATION REGULATIONS, PART 39 -AIRWORTHINESS DIRECTIVES

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

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

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

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

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

ADVISORY INFORMATION

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

GENERAL INFORMATION ON SPECIFIC TOPICS

FLIGHT PLANNING

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

All pilots are urged to obtain a complete preflight briefing. This would consist of weather; local enroute and destination, plus alternates, enroute navaid information. Also airport runways active, length of runways, take-off and landing distances for the airplane for conditions expected should be known.

The prudent pilot will review his planned enroute track and stations and make a list for quick reference. It is strongly recommended a flight plan be filed with Flight Service Stations even though the flight may be VFR. Also, advise Flight Service Stations of changes or delays of one hour or more and remember to close the flight plan at destination.

The pilot must be completely familiar with the performance of the airplane and performance data in the airplane manuals and placards. The resultant effect of temperature and pressure altitude must be taken into account in determining performance if not accounted for on the charts. Applicable FAA manuals must be aboard the airplane at all times including the weight and balance forms and equipment lists.

The airplane must be loaded so as not to exceed the weight and the weight and balance loading center of gravity (c.g.) limitations. Also, that at least minimum fuel for takeoff is aboard and sufficient for the trip plus reserves. Oil in the engines should be checked and filled as required.

INSPECTIONS - MAINTENANCE

In addition to maintenance inspections and preflight information required by FAR Part 91, a complete pre-flight inspection is imperative. It is the responsibility of the owner and operator to assure that the airplane is maintained in an airworthy condition and proper maintenance records are kept.

While the following items cannot substitute for the preflight specified for each type of airplane, they will serve as reminders of general items that should be checked.

SPECIAL CONDITIONS CAUTIONARY NOTICE

Airplanes operated for Air Taxi or other than normal operation and airplanes operated in humid tropics or cold and damp climates, etc., may need more frequent inspections for wear, corrosion and/or lack of lubrication. In these areas periodic inspections should be performed until the operator can set his own inspection periods based on experience.

NOTE

The required periods do not constitute a guarantee that the item will reach the period without malfunction, as the aforementioned factors cannot be controlled by the manufacturer.

Corrosion and its effects must be treated at the earliest possible opportunity. A clean dry surface is virtually immune to corrosion. Make sure that all drain holes remain unobstructed. Protective films and sealants help to keep corrosive agents from contacting metallic surfaces. Corrosion inspections should be made most frequently under high-corrosion-risk operating conditions, such as in regions of heavy airborne salt concentrations (e.g., near the sea) and high-humidity areas (e.g., tropical regions).

WALK AROUND INSPECTIONS

All airplane surfaces free of ice, frost or snow
Tires properly inflated
All external locks, covers and tie downs removed
Fuel sumps drained.
Fuel quantity, adequate for trip, plus reserve, (visually checked) and access doors secured.
Oil quantity checked and access doors secured.
Check general condition of airplane, engine, propeller, exhaust stacks, etc.
All external doors secured

COCKPIT CHECKS

Flashlight available
Required documents on board.
Use the check list.
All internal control locks removed (if installed).
Check freedom of controls.
Cabin and baggage door properly closed
Seat belts and shoulder harnesses fastened
Passengers briefed.
Engine and propeller operating satisfactorily.
All engine gauges checked for proper readings
Fuel selector in proper position.
Fuel quantity checked by gauges.
Altimeter setting checked.

FLIGHT OPERATIONS

GENERAL

The pilot should be thoroughly familiar with all information published by the manufacturer concerning the airplane. The pilot is required by FAA to operate in accordance with the FAR's and the FAA Approved Airplane Flight Manual and/or placards installed

TURBULENT WEATHER

A complete weather briefing prior to beginning a flight is the start of assurance of a safe trip. Updating of weather information en route is another assurance. However, the wise pilot also knows weather conditions change quickly at times and treats weather forecasting 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 extent turbulence should be regarded as extremely dangerous and MUST be avoided. Hail and turnadic 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 revealing 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 normal 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 attitude; 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 rotor clouds. If sufficient moisture is present, also cumulus standing lenticular clouds are also visible signs that a mountain wave exists, but their presence is likewise dependant on moisture. Mountain wave turbulence can, of course, occur in dry air and the absence of such clouds should not be taken as any assurance that mountain wave turbulence will not be encountered. A mountain wave downdraft may exceed the climb capability of your airplane.

— — AVOID MOUNTAIN WAVE DOWNDRAFTS — —

VFR - LOW CEILINGS

If you are not instrument rated, avoid "VFR On Top" and "Special VFR". Being caught above an undercast when an emergency descent is required (or at destination) is an extremely hazardous position for the VFR pilot.

Accepting a clearance out of certain airport control zones with no minimum ceiling and one-mile visibility as permitted with " Special VFR " is not a recommended practice for VFR pilots.

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

VFR - AT NIGHT

When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain a safe minimum altitude as dictated by terrain, obstacles such as TV towers, or communities in the area flown. This is especially true in mountainous terrain, where there is usually very little ground reference and absolute minimum clearance is 2,000 feet. Don't depend on your hand able to see obstacles in time to miss them. Flight on dark nights over sparsely populated country can be almost like same as IFR and should be avoided by unskilled pilots.

VERTIGO -DISORIENTATION

Disorientation can occur in a variety of ways. During flight, inner ear balancing mechanisms are subjected to varied forces not normally experienced on the ground. This combined with loss of outside visual reference can cause vertigo. False interpretations (illusions) result and may confuse the pilot's conception of the attitude and position of his airplane.

Under VFR conditions the visual sense, using the horizon as a reference, can override the illusions. Under low visibility conditions (night, fog, clouds, haze, etc.) the illusions predominate. Only through awareness of these illusions, and proficiency in instrument flight procedures, can an airplane be operated safely in a low visibility environment.

Flying in fog, dense haze or dust, cloud banks, or very low visibility, with strobe lights, and particularly rotating beacons turned on frequently causes vertigo. They should be turned off in these conditions, particularly at night.

All pilots should check the weather and use good judgment in planning flights. The VFR pilot should use extra caution in avoiding low visibility conditions.

Motion sickness often precedes or accompanies disorientation and may further jeopardize the flight.

STALLS, SPINS AND SLOW FLIGHT

Stalls, and slow flight should be practiced at safe altitudes to allow for recovery. Any of these manoeuvers 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 sure that the airplane's center of gravity is as far forward as possible. Forward CG aids spin recovery.
2. Be certain that both student pilot and instructor pilot have a full set of operable controls.
3. Conduct such practice at altitudes in excess of 6,000 ft. above ground level.

Remember that an airplane at or near traffic pattern altitude probably will not recover from a spin before impact with the ground. When descending to traffic pattern altitude and during operation in the traffic pattern and approach, maintain a safe margin above stall speed. During takeoff or go-around, be especially careful to avoid departure stalls associated with turns at low speed. Maintain speeds recommended in this Handbook (Section II & V).

STANDARD PROCEDURE FOR SPIN RECOVERY

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

Throttle	**RETARD** to IDLE
Ailerons	**NEUTRAL**
Rudder	Apply **FULL RUDDER** opposite the direction of spin
Control Wheel	**FORWARD** of neutral in a brisk motion to break stall. Additional **FORWARD** elevator control may be required if rotation does not stop.
Flaps (if extended)	**RETRACT** as soon as possible
Rudder	**NEUTRALIZE** when spin stops.
Control Wheel	Smoothly **MOVE AFT** to bring the nose up to a level flight attitude after spin has stopped.

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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".

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