This is the Flight Manual which forms part of the
Certificate of Airworthiness for aircraft G-BJHB

PILOT'S OPERATING HANDBOOK
and
FAA APPROVED
AIRPLANE FLIGHT MANUAL

Mooney M20J

NOTE: ~~"This is the flight manual which forms part of Certificate of Airworthiness Number 10559-1"~~

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR PART 3 AND MUST BE KEPT IN THE AIRPLANE AT ALL TIMES.

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

SERIAL NUMBER 24-1190

REGISTRATION NUMBER ~~N1145G~~ G-BJHB

FAA Approved: Don P. Watson

Don P. Watson, Chief
Engineering & Manufacturing Branch
FEDERAL AVIATION ADMINISTRATION
Southwest Region
Fort Worth, Texas

FAA APPROVED in Normal Category based on CAR 3, effective Model M20J, S/N 24-1038 and on.

MANUAL NUMBER 1225

PILOT'S OPERATING HANDBOOK
and
FAA APPROVED
AIRPLANE FLIGHT MANUAL

Mooney M20J

NOTE:

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR PART 3 AND MUST BE KEPT IN THE AIRPLANE AT ALL TIMES.

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

SERIAL NUMBER _____

REGISTRATION NUMBER _____

FAA Approved: Don P. Watson

Don P. Watson, Chief
Engineering & Manufacturing Branch
FEDERAL AVIATION ADMINISTRATION
Southwest Region
Fort Worth, Texas

FAA APPROVED in Normal Category based on CAR 3, effective Model M20J, S/N 24-0084, 24-0764 thru 24-1037

REVISION D MANUAL NUMBER 1223

CONGRATULATIONS . . .

WELCOME TO MOONEY'S NEW DIMENSION IN SPEED AND ECONOMY. YOUR DECISION TO SELECT A NEW MOONEY HAS PLACED YOU IN AN ELITE AND DISTINCTIVE CLASS OF AIRCRAFT OWNERS. WE HOPE THAT YOU FIND YOUR NEW 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 201, Model M20J. It is important that you--regardless of your previous experience--carefully read the handbook from cover to cover and review it frequently.

All information and illustrations in the manual are based on the latest product information available at the time of publication approval. 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 ready reference. Your cooperation in reporting presentation and content recommendations is solicited.

REVISING THE MANUAL

Page i of this manual is 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 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 will be received to replace the previous one.

This handbook will be kept current by Mooney Aircraft Corporation when the revision card in the front of this handbook has been filled in and mailed to Mooney Aircraft Corporation, P.O. Box 72, Kerrville, TX 78028.

CAA APPROVED CHANGE SHEETS & SUPPLEMENTS
FOR EMBODIMENT IN THIS MANUAL

DATE	ORIGIN AND TITLE	APPROVAL AUTHORITY	POSITION IN MANUAL
7-May 81	CAA Change Sheet. No 1 - issue 1. (King KFC 200 AFCS)	CAA	Facing page 3 of Moone King KFC 200 AFCS Supp.
1-8-83	CAA CHANGE SHEET N° 1 ISSUE 2. (KING KFC 200 AFCS)	CAA	FACING PAGE 3 OF MOONE KING KFC 200 AFCS EXA 22
21/3/02	CAA AIRWORTHINESS NOTICE N° 88.	CAA	FACING PAGE REF OF SECTIO IX

CONGRATULATIONS . . .

WELCOME TO MOONEY'S NEW DIMENSION IN SPEED AND ECONOMY. YOUR DECISION TO SELECT A NEW MOONEY HAS PLACED YOU IN AN ELITE AND DISTINCTIVE CLASS OF AIRCRAFT OWNERS. WE HOPE THAT YOU FIND YOUR NEW 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 201, Model M20J. It is important that you--regardless of your previous experience--carefully read the handbook from cover to cover and review it frequently.

All information and illustrations in the manual are based on the latest product information available at the time of publication approval. 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 ready reference. Your cooperation in reporting presentation and content recommendations is solicited.

REVISING THE MANUAL

Page i of this manual is 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 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 will be received to replace the previous one.

This handbook will be kept current by Mooney Aircraft Corporation when the revision card in the front of this handbook has been filled in and mailed to Mooney Aircraft Corporation, P.O. Box 72, Kerrville, TX 78028.

LIST OF EFFECTIVE PAGES

Original	12-28-78
A	2-23-79
B	10-10-79
C	12-18-79
D	11-20-80

Always destroy superseded pages when inserting revised pages.

Title Page	D
"A" Page	Original
i through v	D
1-1 through 1-3.	Original
1-4	D
1-5	B
1-6 through 1-8	Original
1-9(1-10 BLANK)	B
2-1 and 2-2.	Original
2-3 through 2-7	D
2-8	B
2-9	D
2-10	A
2-11	D
2-12 and 2-13	Original
2-14	D
3-1	D
3-2	Original
3-3	A
3-4	Original
3-5 and 3-6	D
3-7	Original
3-8	D
3-9	Original
3-10 and 3-11(3-12 BLANK)	D
4-1	D
4-2	Original
4-3 through 4-14	D
5-1(5-2 BLANK) and 5-3	C
5-4 through 5-7	Original

D

LIST OF EFFECTIVE PAGES

5-8	D
5-9 through 5-19	Original
5-20 through 5-37(5-38 BLANK)	B
6-1 and 6-2	Original
6-3 through 6-6	B
6-7	C
6-8 through 6-11	Original
6-12	D
6-13	Original
6-14 through 6-20	B
7-1	Original
7-2	D
7-3	Original
7-4 and 7-5	D
7-6	Original
7-7	D
7-8	Original
7-9 through 7-35/7-36 (BLANK)	D
8-1 and 8-2	Original
8-3	D
8-4 and 8-5	Original
8-6	D
8-7 through 8-12	Original
8-13(8-14 BLANK)	D
9-1 Supplemental Data	Original
10-1 through 10-19(10-20 BLANK)	C

D

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

WARNING: This manual may not include the latest revisions.

Revision Number	Revised Pages	Description of Revision	FAA Approved	Date
D	Title Page	Revised Information	Jack E. Owens	11-20-80
	1-4	Added Information		
	2-3 and 2-4	Added Information		
	2-5	Punctuation Revision		
	2-6	Added and Revised Information		
	2-7	Revised Information		
	2-9	Revised Information		
	2-11	Added Information		
	2-14	Added Information		
	3-1	Added Information		
	3-5	Revised Information		
	3-6	Added Information		
	3-8	Added Information		
	3-10	Added Information		
	3-11(3-12 BLANK)	Deleted Information		
	4-1	Revised Information		
	4-3 through 4-6	Added Information		
	4-7 through 4-14	Revised and Rearranged Information		
	5-8	Revised Information		
	6-12	Revised Information		

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

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

WARNING: This manual may not include the latest revisions.

Revision Number	Revised Pages	Description of Revision	FAA Approved	Date
D	7-2	Added Information		
	7-4	Added Information		
	7-5	Revised Illustration		
	7-7	Added Information		
	7-9 through 7-35	Added, Revised & Relocated Info.		
	7-36 (BLANK)			
	8-3	Revised Information		
	8-6	Revised Information		
	8-13(8-14 BLANK)	Revised Information		

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

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

WARNING: This manual may not include the latest revisions.

Revision Number	Revised Pages	Description of Revision	FAA Approved	Date
A	5-13	Added Information	D A Turk	3-5-81
	5-37/5-38 BLANK	Grammatical Correction		
	6-3	Grammatical Correction & Added Info.		
	6-7	Revised Information		
	6-8	Added Information		
	6-10, 6-11	Revised Information		
	6-12	Revised & Relocated & Added Info.		
	6-13	Relocated & Added Information		
	6-14 thru 6-17	Revised & Relocated & Added Info.		
	6-18	Relocated & Revised Information		
	6-19	Relocated & Revised Information		
	6-20	Relocated & Revised & Added Info.		
	6-21	Relocated Information		
	6-22	Relocated & Revised Information		
	6-23, 6-24	Relocated & Revised & Added Info.		
	7-2	Revised & Added Information		
	7-10, 7-11	Revised Information		
	7-12	Grammatical Correction & Deleted Info.		
	7-13	Revised & Deleted Information		

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

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

WARNING: This manual may not include the latest revisions.

Revision Number	Revised Pages	Description of Revision	FAA Approved	Date
A	7-14, 7-15	Revised Information	DA Tuck	3-5-81
	7-16	Grammatical Correction		
	7-19 thru 7-21	Revised Information		
	7-23	Revised Information		
	7-26	Grammatical Correction		
	7-28	Deleted & Revised Information		
	7-29	Relocated & Revised & Added Info.		
	7-30	Added & Relocated Information		
	7-31	Grammatical Correction		
	7-33/7-34 BLANK	Grammatical Correction		
	8-1	Grammatical Correction		
	8-5	Added Information		
	8-8	Deleted Information		
	8-13/8-14 BLANK	Grammatical Correction		
	10-1	Revised Information		
	10-6	Revised Information		

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

TABLE OF CONTENTS

	SECTION
GENERAL	1
LIMITATIONS	2
EMERGENCY PROCEDURES	3
NORMAL PROCEDURES	4
PERFORMANCE	5
WEIGHT & BALANCE	6
AIRPLANE & SYSTEM DESCRIPTIONS	7
HANDLING, SERVICE & MAINTENANCE	8
SUPPLEMENTAL DATA	9
SAFETY INFORMATION	10

SECTION I.

GENERAL

TABLE OF CONTENTS

TITLE	PAGE
THREE VIEW	1-2
INTRODUCTION	1-3
DESCRIPTIVE DATA	1-3
LANDING GEAR	1-3
ENGINE	1-3
PROPELLER	1-4
FUEL	1-4
OIL	1-4
MAXIMUM CERTIFICATED WEIGHTS	1-4
STANDARD AIRPLANE WEIGHTS	1-5
BAGGAGE SPACE & ENTRY DIMENSIONS	1-5
SPECIFIC LOADINGS	1-5
SYMBOLS, ABBREVIATIONS & TERMINOLOGY	1-5
GENERAL AIRSPEED TERMINOLOGY & SYMBOLS	1-5
METEOROLOGICAL TERMINOLOGY	1-7
ENGINE POWER TERMINOLOGY	1-7
AIRPLANE PERFORMANCE & FLIGHT PLANNING TERMINOLOGY	1-8
WEIGHT & BALANCE TERMINOLOGY	1-8

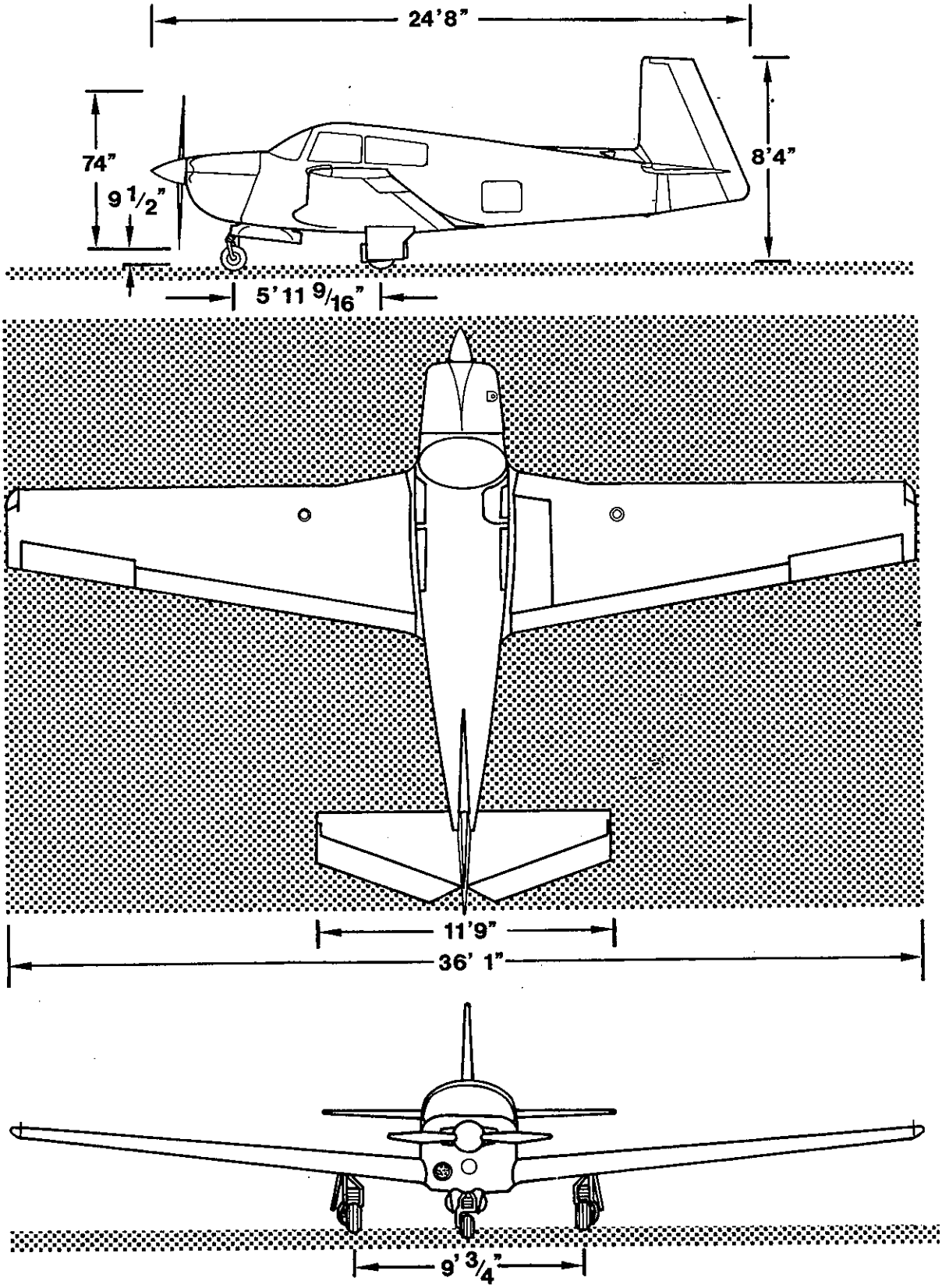


FIGURE 1-1 THREE VIEW

INTRODUCTION

This Pilot's Operating Handbook contains 9 sections and includes the material required to be furnished to the pilot by CAR Part 3. It also 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 Pilot's Operating Handbook.

DESCRIPTIVE DATA

LANDING GEAR

TYPE: Electrically operated tricycle gear with rubber shock discs, steerable nose wheel, and hydraulic disc brakes.

Wheel Base	5 ft. 11-9/16 in.
Wheel Tread	9 ft. 3/4 in.
Tire Size:	
Nose	(6 Ply) 5.00 x 5
Main	(6 Ply) 6.00 x 6
Tire Pressure:	
Nose	49 PSI
Main	30 PSI
Min. Turning Radius (No Brakes Applied)	41 ft.

ENGINE

TYPE: Four-cylinder, horizontally opposed, air cooled, and fuel-injected engine with a wet-sump lubricating system.

Number of Engines	1
Model (Lycoming)	IO-360-A3B6D
Recommended TBO	1600 Hrs.
Rated HP @ 2700 RPM	200 BHP @ Sea Level

Bore	5.125 in.
Stroke	4.375 in.
Displacement	361.0 Cu. In.
Compression Ratio	8.7:1
Fuel Injector, Bendix	RSA-5-AD1
Magnetos, Bendix	D4LN 2021 or D4LN 3021

PROPELLER

TYPE: Constant-speed, hydraulically controlled propeller with a single-acting governor.

Model (McCauley)	B2D34C214/90DHB-16E
Diameter	74 in. max. 73 in. min.
Number of Blades	2
Blade Angle @ 30 In. Sta.:	
Low	$13.9^{o} \pm .2^{o}$
High	$33^{o} \pm .5^{o}$

FUEL

Total Fuel Capacity	66.5 U.S. Gal.
Usable Fuel Capacity	64 U.S. Gal.

Minimum Fuel Octane Rating & Color

Grade	Color
100	Green
100 LL	Blue

OIL

Oil Capacity (6 QTS MIN for flight)	8 QTS.

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

MAXIMUM CERTIFICATED WEIGHTS

Maximum Loading (unless limited by loading envelope):

Gross Weight	2740 LBS.
Baggage Area	120 LBS.
Hat Rack	10 LBS.

STANDARD AIRPLANE WEIGHTS

Basic Empty Weight	See Page 1-8
Standard Useful Load	1100 LBS.

BAGGAGE SPACE AND ENTRY DIMENSIONS

Baggage Area	24"x 35"x 35"H (17 cu. ft.)
Hat Rack	30"W x 19"D x 12H (Max.) (2.6 cu. ft.)
Baggage Door Opening	
Above Ground (Sill)	46"
Entry Width	17"
Entry Height	20.5"

SPECIFIC LOADINGS

Wing Loading @ G.W.	16.4 PSF
Power Loading @ G.W.	13.7 PHP

SYMBOLS, ABBREVIATIONS & TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY & SYMBOLS

GS — Ground Speed is the speed of an airplane relative to the ground.

KCAS — Knots Calibrated Airspeed means 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 is the speed of an aircraft as shown on its airspeed indicator. IAS values published in this handbook assume zero instrument error.

KTAS — Knots True Airspeed is the airspeed of an airplane relative to undisturbed air.

V_A Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.

V_{FE} Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

V_{LE} Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.

V_{LO} Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.

V_{NE} Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.

V_{NO} Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.

V_S Stalling Speed or the minimum steady flight speed at which the airplane is controllable.

V_{SO} Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.

V_X Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.

V_Y Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time with gear and flaps up.

METEOROLOGICAL TERMINOLOGY

Density Altitude	Altitude as determined by pressure altitude and existing ambient temperature. In standard atmosphere (ISA) density and pressure altitude are equal. For a given pressure altitude, the higher the temperature, the higher the density altitude.
Indicated Pressure Altitude	The number actually read from an altimeter when and only when, the barometric subscale has been set to 29.92 inches of mercury.
ISA	International Standard Atmosphere assumes that (1) The air is a dry perfect gas; (2) The temperature at sea level is 15° Celcius; (3) The pressure at sea level is 29.92 inches Hg; (4) The temperature gradient from sea level to the altitude at which the temperature is -56.5°C is -0.00198°C per foot.
OAT	Outside Air Temperature is the free air static temperature, obtained either from inflight temperature indications or ground meteorological sources. It is expressed in degrees Celcius (previously Centigrade).
Pressure Altitude	Pressure altitude is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.

ENGINE POWER TERMINOLOGY

BHP	Brake Horsepower is the power developed by the engine.

MP	Manifold Pressure is a pressure measured in the engine's induction system and is expressed in inches of mercury (Hg).
RPM	Revolutions Per Minute is engine speed.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

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

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 basic empty weight of an aircraft is the actual weight of the airplane and includes all operating equipment (including optional equipment) that has a fixed location and is actually installed in the aircraft. It includes the weight of the unusable fuel and full oil.
Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.

C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
Maximum Weight	The maximum weight is the maximum authorized weight of the aircraft and its contents as listed in the aircraft specifications.
Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance from the reference datum.
Tare	Tare is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Usable Fuel	Fuel available for airplane propulsion.
Useful Load	The useful load is the basic empty weight subtracted from the maximum weight of the aircraft. This load consists of the pilot, crew if applicable, fuel, passengers and baggage.

SECTION II.

LIMITATIONS

TABLE OF CONTENTS

TITLE	PAGE
INTRODUCTION	2-2
AIRSPEED LIMITATIONS	2-3
AIRSPEED INDICATOR MARKINGS	2-4
POWER PLANT LIMITATIONS	2-5
POWER PLANT INSTRUMENT MARKINGS	2-6
WEIGHT LIMITS	2-7
CENTER OF GRAVITY LIMITS	2-7
MANEUVER LIMITS	2-8
FLIGHT LOAD FACTOR LIMITS	2-9
KINDS OF OPERATION LIMITS	2-9
FUEL LIMITATIONS	2-9
OTHER INSTRUMENTS AND MARKINGS	2-9
DECALS & PLACARDS	2-10
CABIN INTERIOR	2-10
FUSELAGE INTERIOR	2-14
EXTERIOR	2-14
OPTIONAL	2-15/2-16 BLANK

INTRODUCTION

Section II includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the airplane, its engine, standard systems and standard equipment. The limitations included in this section have been approved by the Federal Aviation Administration. When applicable, limitations associated with optional systems or equipment such as autopilots are included in Section IX.

NOTE

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

Your Mooney is certificated under FAA Type Certificate No. 2A3 as Mooney M20J.

AIRSPEED LIMITATIONS

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

SPEED		CAS (mph) (kts)	IAS (mph) (kts)	REMARKS
V_{NE}	Never Exceed Speed	225 196	228 198	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	200 174	203 176	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed	135 118	138 120	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed	123 109	132 115	Do not exceed these speeds with the given flap settings.
V_{LE}	Maximum Landing Gear Extended Speed	250 130	153 133	Maximum speed at which the aircraft can be safely flown with the landing gear extended.
V_{LO} (EXT)	Maximum Speed for Gear Extension	150 130	155 134	Maximum speed at which the landing gear can be safely extended.
V_{LO} (RET)	Maximum Speed for Gear Retraction	120 104	125 108	Maximum speed at which the landing gear can be safely retracted.
	Maximum Pilot Window Open Speed	150 130	155 134	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	CAS VALUE OR RANGE MPH (KTS)	SIGNIFICANCE
White Arc	61 - 125 (53 - 109)	Full Flap Operating Range. Lower limit is maximum weight V_{S_0} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	68 - 200 (59 - 174)	Normal Operating Range. Lower limit is maximum weight V_S with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	200 - 225 (174 - 196)	Operations must be conducted with caution and only in smooth air.
Radial Red Line	225 (196)	Maximum speed for all operations.

FIGURE 2-2. AIRSPEED INDICATOR MARKINGS

POWER PLANT LIMITATIONS

Engine Manufacturer: Avco Lycoming.
Engine Model Number: IO-360-A3B6D
Engine Operating Limits for Takeoff and
Continuous Operations:
Maximum Power: 200 BHP
Maximum Engine Speed: 2700 RPM.
Maximum Cylinder Head Temperature: 475°F (246°C)
Maximum Oil Temperature: 245°F (118°C)

Transient Engine RPM Limit - 2970 RPM for 3 Seconds or Less

Oil Pressure, Minimum: 25 psi.
Maximum: 100 psi
Fuel Pressure, Minimum: 14 psi
Maximum:30 psi
Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: B2D34C214/90DHB-16E
Propeller Diameter, Minimum: 73 inches.
Maximum: 74 inches.

Propeller Operating Limits: Avoid continuous operation between 1500 and 1950 RPM with power settings below 15" HG manifold pressure.

Propeller Blade Angle at 30 Inch Station, Low 13.9°+.2°
High 33.0°±.5°

POWER PLANT INSTRUMENT MARKINGS

Tachometer	
Radial Red Line (Rated)	2700 RPM
Green Arc-- (Rated operating range)	1950-2700 RPM
Yellow Arc (Caution Range)	1500-1950 RPM
Cylinder Head Temperature	
Radial Red Line (Maximum)	475 ^{O}F or 246^{O}C
Green Arc (Operating range)	300^{O}-450^{O}F or 149^{O}-232^{O}C
Oil Pressure	
Radial Red Line (Minimum idling)	25 PSI
Radial Red Line (Maximum)	100 PSI
Green Arc (Operating range)	60 to 90 PSI
Yellow Arc (Idling range)	25 to 60 PSI
Yellow Arc (Starting & warm-up range)	90 to 100 PSI
Fuel Pressure	
Radial Red Line (Minimum)	14 PSI
Radial Red Line (Maximum)	30 PSI
Green Arc (Operating range)	14 to 30 PSI
Oil Temperature	
Radial Red Line (Maximum)	245^{O}F or 118^{O}C
Green Arc (Operating range)	150^{O}-245^{O}F or 65^{O}-118^{O}C

WEIGHT LIMITS

Maximum Weight (Takeoff & Landing) . . . . 2740 LBS.

Maximum Weight in Baggage Compartment . . . . . 120 Lbs. @ Fus. Sta. 95.5

Maximum Weight in Hatrack . . 10 Lbs. @ Fus. Sta. 119.0

CENTER OF GRAVITY LIMITS (GEAR DOWN)

Most Forward Fus. Sta. 41.0 IN.
13.4% MAC . . . . . 2250 LBS.
Intermediate Forward Fus. Sta. 41.8 IN.
14.7% MAC . . . . . 2470 LBS.
Forward Gross Fus. Sta. 45.0 IN.
20.1% MAC . . . . . 2740 LBS.
Rear Gross Fus. Sta. 50.1 IN.
28.7% MAC . . . . . 2740 LBS.
MAC (At Wing Sta. 93.83) Fus. Sta. 59.18 IN.

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

MANEUVER LIMITS

This airplane must be operated as a Normal Category airplane. Aerobatic maneuvers, including spins, are not approved.

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

WARNING

Prolonged sideslips, steep descents, or takeoff maneuvers may cause loss of power if the selected fuel tank contains less than 48 lbs. (8 gallons) of fuel.

NOTE

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

NOTE

Slow throttle movement required at airspeeds above 190 MPH IAS (164 KTS). Above 190 MPH IAS (164 KTS), rapid throttle reduction may result in momentary propeller RPM overspeed.

FLIGHT LOAD FACTOR LIMITS

Maximum Positive Load Factor, Flaps Up 3.8g

Maximum Positive Load Factor, Flaps Down (33°). 2.0g

Maximum Negative Load Factor, Flaps Up 1.52g

KINDS OF OPERATION LIMITS

Do not operate in known icing conditions.

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

FUEL LIMITATIONS

2 Standard Tanks: 33.25 U.S. Gallons Each
Total Fuel: 66.5 U.S. Gallons

Usable Fuel : 64 U.S. Gallons

Unusable Fuel : 2.5 U.S. Gallons

NOTE

A reduced fuel quantity indicator is installed in each tank. These indicators show the 25 U.S. gallon usable fuel level in each tank.

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

OTHER INSTRUMENTS AND MARKINGS

The following equipment is vacuum operated:

1. Artificial horizon
2. Directional gyro

DECALS & PLACARDS

INTERIOR

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

OPERATIONAL LIMITATIONS

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS. NO AEROBATIC MANEUVERS, INCLUDING SPINS, ARE APPROVED. MAX SPEED WITH LANDING GEAR EXTENDED, 150 MPH (130 KTS). MAX SPEED TO RETRACT GEAR, 120 MPH (104 KTS). MAX SPEED TO EXTEND GEAR, 150 MPH (130 KTS). MAX MANEUVERING FLIGHT LOAD FACTOR—FLAPS UP +3.8, -1.5; DN +2.0, -0.

EMERGENCY MANUAL GEAR EXTENSION

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

CAUTION

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

On Left Side Panel

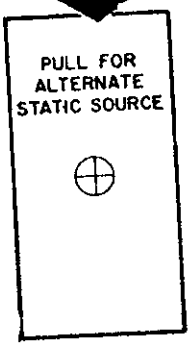
CABIN VENT PULL ON	DEFROSTER PULL ON	CABIN HEAT PULL ON

CHECK LIST

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

Console Below Controls

On Lower Left Instrument Panel



On Pilots Window

DO NOT OPEN ABOVE
150 MPH (130 KTS)

On Right Instrument Panel Below Manifold Pressure Gage

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

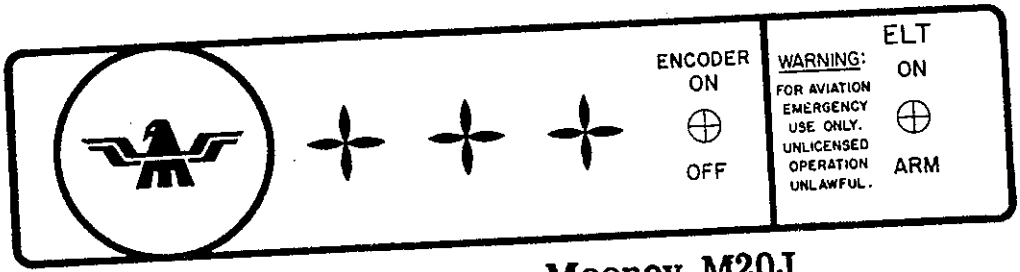
On Lower Console Below Controls

RAM AIR
PULL ON

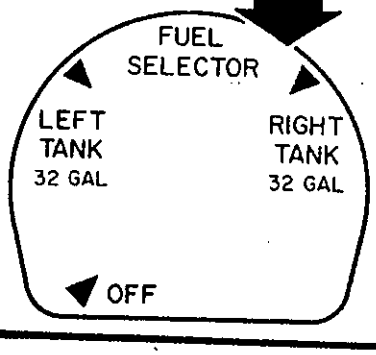
PARK BRAKE
PULL ON

COWL FLAPS
PULL OPEN

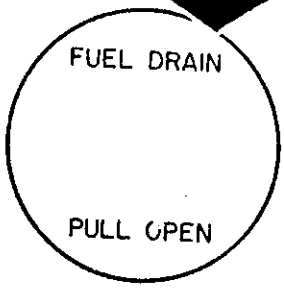
ELT Placard
(Legend Varies With Equipment Installed)



On Fuel Selector Valve



On Gascolator



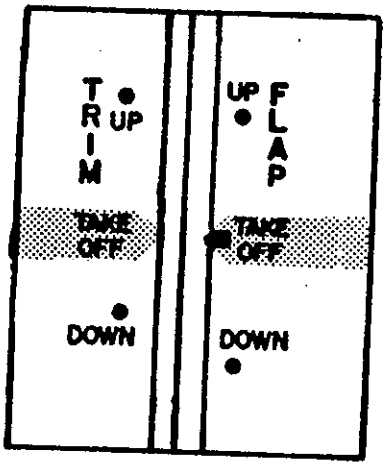
Above Baggage Compartment On Hatrack Shelf.

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

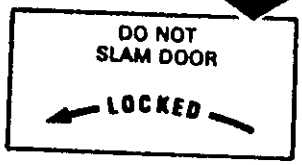
On Top Baggage Door Jamb.

LOAD IN COMPLIANCE WITH
LOADING SCHEDULE. MAXIMUM
BAGGAGE ALLOWABLE — 120 LBS.

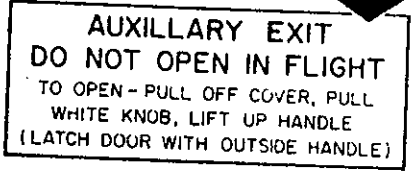
On Lower Engine Control Console

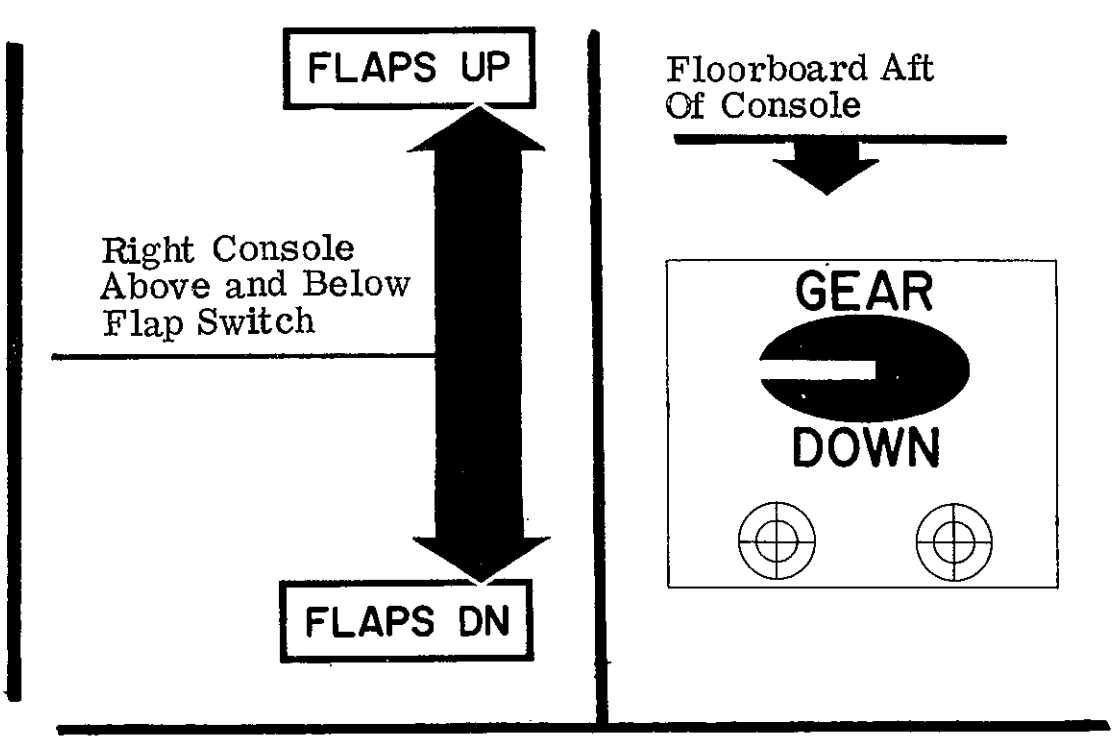


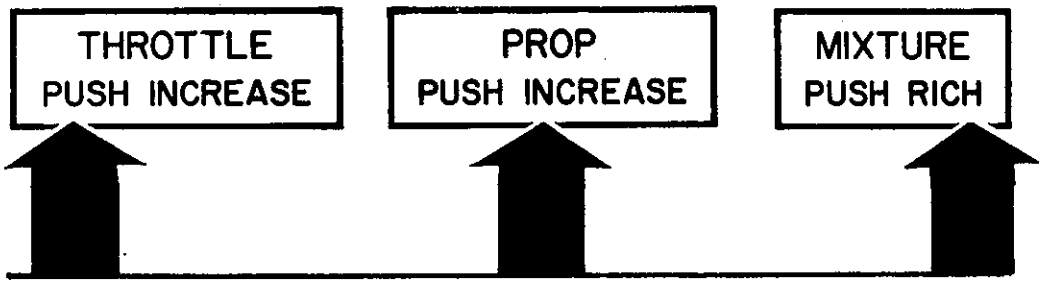
Above Inside Door Handle



Above Inside Baggage Door Handle







Above Each Control on Lower Instrument Panel

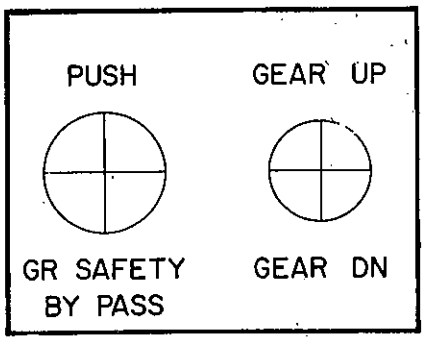
Above Baggage Compartment On Hatrack Shelf.

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

On Top Baggage Door Jamb.

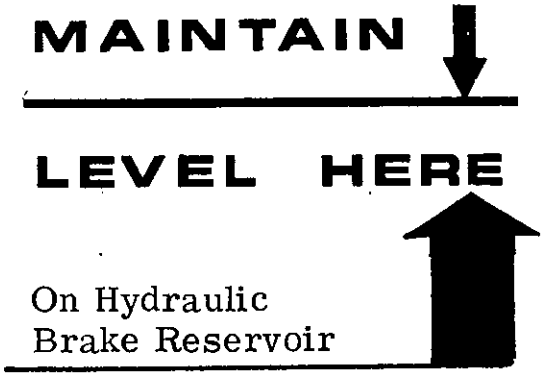
LOAD IN COMPLIANCE WITH LOADING SCHEDULE. MAXIMUM BAGGAGE ALLOWABLE – 120 LBS.

Upper Center
Instrument Panel



FUSELAGE INTERIOR

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



EXTERIOR:

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

On Main Gear Doors

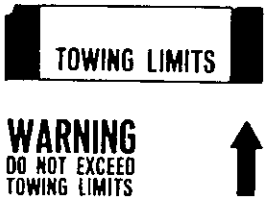
On Nose Gear Door

TIRE PRESSURE 49 LBS

On Fuel Tank Caps

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

On Nose Gear Leg



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

DO NOT PUSH

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

NO STEP

On Underside of Wings (2 plcs)

HOIST POINT

OPTIONAL:

See Section IX Supplements for optional placards required.

SECTION III.

EMERGENCY PROCEDURES

TABLE OF CONTENTS

TITLE	PAGE
INTRODUCTION	3-2
ANNUNCIATOR PANEL WARNING LIGHTS	3-3
ENGINE FIRE-GROUND	3-4
ENGINE FIRE IN FLIGHT	3-4
ELECTRICAL FIRE IN FLIGHT	3-4
ENGINE FAILURE DURING GROUND ROLL	3-5
ENGINE FAILURE AFTER LIFT OFF	3-5
ROUGH ENGINE OR LOSS OF POWER	3-5
AIR START	3-6
POWER OFF LANDING	3-7
SPINS	3-7
FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY	3-8
GEAR-UP LANDING	3-8
UNLATCHED DOOR IN FLIGHT	3-9
ALTERNATOR POWER LOSS	3-9
FLIGHT IN ICING CONDITIONS	3-10
ALTERNATE STATIC AIR SOURCE	3-10
EXITING AIRCRAFT	3-10
FAILURE OF LANDING GEAR TO RETRACT AFTER TAKEOFF	3-11

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 9.

NOTE

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

ANNUNCIATOR PANEL WARNING LIGHTS

Warning Light	Fault & Remedy
Gear Unsafe	Landing gear is not in fully extended/ retracted position. Refer to "Failure of landing gear to extend electrically" procedure on page 3-8 or "Failure of landing gear to retract after take-off" procedure on page 3-11.
Left or Right Fuel Low	2 1/2 to 3 gallons of fuel remain in the respective tanks. Switch to fuller tank.
VAC (Flashing)	Suction is below 4.25 inches of mercury.
VAC (Steady)	Suction is above 5.5 inches of mercury. Attitude and directional gyros are unreliable. Vacuum system should be checked and/or adjusted as soon as practicable.
Volts (Flashing)	Low voltage.
Volts (Steady)	Overvoltage or trippage of voltage relay. Refer to "Alternator Power Loss" on page 3-9.
Ram Air	Ram air is on (when landing gear extended); close before landing.

ENGINE FIRE- GROUND

1. Mixture - Idle Cutoff (Full Aft)
2. Fuel Selector Valve Off
3. Master Switch - Off
4. Magneto/Starter Switch - Off
5. Extinguish with Fire Extinguisher

ENGINE FIRE- IN FLIGHT

1. Fuel Selector Valve - OFF
2. Throttle - Closed (Full Aft)
3. Mixture Control - IDLE CUTOFF (Full Aft)
4. Magneto/Starter Switch - Off
5. Cabin Ventilation & Heating Controls - CLOSED (Control Forward)
6. Landing Gear - DOWN OR UP, depending on terrain.
7. Wing Flaps - EXTEND. As Necessary.

NOTE

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

ELECTRICAL FIRE IN FLIGHT

(Smoke in Cabin)

1. Master Switch - OFF.

WARNING

Stall warning is not available with master switch OFF.
Gear warning is not available with master switch OFF.

2. Cabin Ventilation - Open
3. Heating Controls - Closed (Control Forward)
4. Circuit Breakers - CHECK. To identify faulty circuit if possible.
5. Land as soon as practicable.

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

1. Master Switch - ON.
2. Select essential switches ON one at a time, and permit a short time to elapse before activating an additional circuit.

ENGINE POWER LOSS DURING GROUND ROLL

1. Throttle - CLOSED.
2. Braking - Maximum.
3. Fuel Selector - OFF.
4. Master and Magneto/Start Switch-OFF.

ENGINE POWER LOSS AFTER LIFTOFF AND DURING CLIMB

1. Fuel Selector - Select Other Tank.
2. Electric Fuel Boost Pump - ON.
3. Mixture Control - FULL RICH.
4. Magneto/Start Switch - CHECK ON BOTH.

If engine does not restart, proceed to POWER OFF landing.

ROUGH ENGINE OR LOSS OF POWER IN FLIGHT

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

1. Low Fuel Quantity - FUEL SELECTOR TO FULLEST TANK.
2. Low Fuel Pressure - AUX. FUEL PUMP ON - OFF IF NO IMPROVEMENT NOTED.
3. Mixture Control - FULL RICH.
4. Magneto/Starter Switch - Switch to left and right single magneto operation; if no improvement, switch to BOTH.

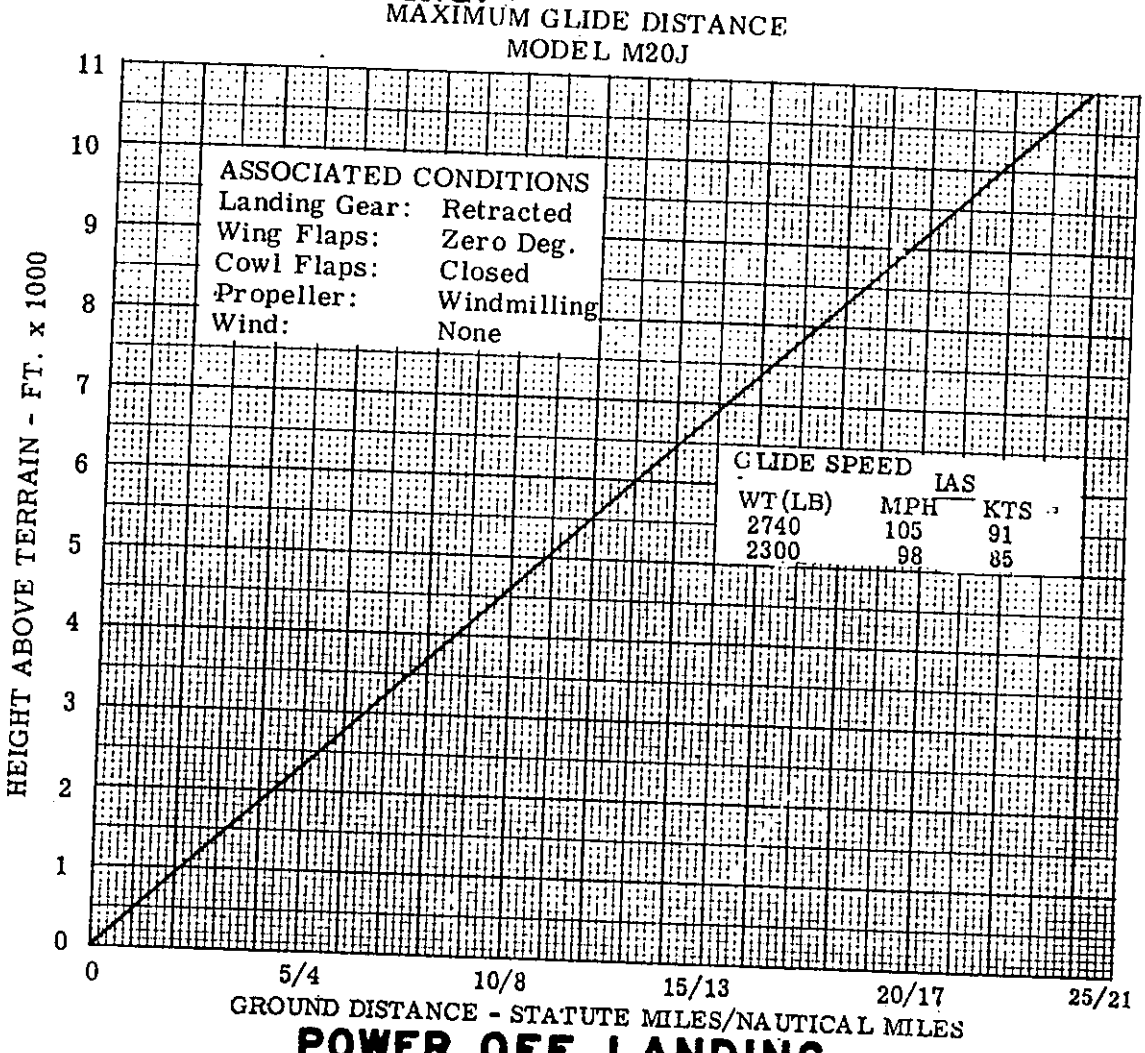
If no improvement is noted, proceed to land as soon as practicable.

AIR START PROCEDURE

1. Propeller - High RPM (Full Forward).
2. Fuel Selector - Fuller Tank.
3. Mixture Control - Idle Cutoff (Full Aft).
4. Fuel Pressure - Check. If no fuel pressure is noted, turn electric fuel boost pump ON.
5. Throttle - Open 1/4 Travel.
6. Magneto/Starter Switch Both.

7. Mixture Control - Move slowly and smoothly to FULL RICH (Forward).
8. Re-establish cruise power and RPM - then lean mixture as required.

If engine fails to start establish best glide speed indicated by the chart below, then proceed to POWER OFF LANDING.



POWER OFF LANDING

If an engine failure occurs, prepare for a landing as follows:

1. Emergency Locator Transmitter - ON , As Required. (if installed)
2. Seat Belts and Shoulder Harnesses - SECURE.
3. Mixture Control - IDLE CUTOFF (Full Aft).
4. Fuel Selector Valve - OFF.
5. Magneto/Starter Switch - OFF.
6. Wing Flaps - FULL DOWN (33°)
7. Landing Gear - Down or Up depending on terrain.

8. Approach Speed - 81 MPH (71 Kts) IAS.
9. Master Switch - OFF, Prior to Landing.

SPINS

WARNING

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

NOTE

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

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

1. Rudder - Apply FULL RUDDER opposite the direction of spin.
2. Control Wheel - FORWARD of neutral in a brisk motion. Additional FORWARD elevator control may be required if the rotation does not stop.
3. Ailerons - NEUTRAL.
4. Throttle - RETARD TO IDLE.

Hold anti-spin controls until rotation stops:

5. Flaps - If extended, RETRACT as soon as possible.
6. Rudder - NEUTRALIZE.
7. Control Wheel - Smoothly move aft to bring the nose up to a level flight attitude.

FAILURE OF LANDING GEAR TO EXTEND ELECTRICALLY

To extend the landing gear manually:

1. Slow aircraft to 150 MPH/ 130 KTS IAS.
2. Pull landing gear actuator circuit breaker to OFF position.
3. Place gear switch in DOWN position.
4. Push latch forward and lift lever back to allow drive mechanism to engage.
5. Slowly pull "T" handle 1 to 2 inches to rotate clutch mechanism and allow it to engage drive shaft.
6. Pull the "T" handle and allow to return to original position. Continue this step until the gear is down and locked and the green light comes on. In case of electrical malfunction, check the visual gear-down indicator marks for alignment.
7. Latch down red lever before operating electrically.
8. Reset landing gear actuator circuit breaker.

CAUTION

Do not attempt to manually retract the electric landing gear.

WARNING

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

GEAR-UP LANDING

If possible, choose firm sod or foamed runway. Make a normal approach, using full flaps. When you are sure of making the selected landing spot:

1. Fuel Selector Valve - OFF.
2. Throttle - CLOSED (Full Aft).
3. Mixture - IDLE CUT-OFF (Full Aft).
4. Master Switch and Magneto/Start Switches - OFF.
5. Keep wings level during touchdown.

UNLATCHED DOOR IN FLIGHT

If the cabin door is not locked 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 open, but the flight characteristics of the airplane will not be affected. Return to the field in a normal manner. If practicable, during the landing flare-out have a passenger hold the door to prevent it from swinging open.

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

1. Slow to approximately 110 mph/96 kts.
2. Open the storm window to reduce cabin air pressure.
3. Bank to the right.
4. Simultaneously apply left rudder (which will result in a right slip) and close the door.

ALTERNATOR POWER LOSS

If the red voltage warning light illuminates steadily, turn off the radio master and then turn the master switch off and on to reset the voltage regulator. If the voltage light comes on again pull the alternator field circuit breaker out. All electrical equipment not essential for flight should be turned off and the flight terminated as soon as practical to correct malfunction. A flashing voltage light indicates low voltage caused by an alternator malfunction, belt slippage, or tripped breaker. If resetting the alternator field breaker does not restore the alternator, turn off all electrical equipment not essential for the flight and terminate the flight as soon as practical.

NOTE

A tripped main alternator circuit breaker can only be caused by a shorted alternator circuit and cannot be corrected by resetting the breaker. This should be verified by attempt-

ing to reset the breaker not more than one time. If this fails, pull the alternator field breaker, turn off all non-essential electrical equipment and terminate the flight as soon as practical.

FLIGHT IN ICING CONDITIONS

DO NOT OPERATE IN KNOWN ICING CONDITIONS.

If icing conditions are inadvertently encountered:

1. Turn OFF ram air. Do not turn ram air on again when entering clear air until assured all ice and snow has melted from the aircraft.
2. Shut cabin heat OFF until engine operation is normal.
3. Push ON pitot heat. (If installed)
4. Pull static air source to ALTERNATE (If installed).
5. Turn back or change altitude to obtain an outside air temperature less conducive to icing.

ALTERNATE STATIC SOURCE

(if installed)

The alternate static air source should be used whenever it is suspected that the normal static air sources are blocked. Selecting the alternate position changes the source of static air for the altimeter, airspeed indicator and rate-of-climb from the outside of the aircraft to the cabin interior.

When the alternate static air source is in use adjust the indicated airspeed and altimeter readings according to the appropriate alternate static source airspeed and altimeter calibration tables in Section 5.

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

EXITING AIRCRAFT

Refer to Section VII, page 7-35 for procedure.

FAILURE OF LANDING GEAR TO RETRACT AFTER TAKEOFF

NOTE

In the event that the gear fails to retract when the landing gear control switch is placed in the "UP" position due to the failure of the airspeed sensing safety switch to activate after takeoff, the following procedure should be used as an alternate means to allow retraction:

(1) If the safety switch fails to actuate, as evidenced by illumination of the "GR SAFETY BY PASS" switch, both gear annunciator lights, and the activation of the gear warning horn, depress "GR SAFETY BY PASS" switch and hold until gear is fully retracted. This is evidenced by both the " gear unsafe and gear down" annunciator lights not being illuminated.

(2) Pull "GEAR CONT." circuit breaker to shut off gear horn. (Note: This does not affect normal operation of the horn, but must be reset prior to normal extension of the landing gear).

(3) To extend gear, reset the "GEAR CONT." circuit breaker and then place the gear control switch in the "DOWN" position.

(4) Check "AIRSPEED" safety switch to determine nature of malfunction as soon as practical.

SECTION IV.
NORMAL PROCEDURES

TABLE OF CONTENTS

TITLE	PAGE
PREFLIGHT INSPECTION	4-2
BEFORE STARTING CHECK	4-4
STARTING ENGINE	4-4
FLOODED ENGINE CLEARING	4-5
BEFORE TAKEOFF	4-6
TAKEOFF	4-8
NORMAL	4-8
OBSTACLE CLEARANCE	4-9
CLIMB	4-9
NORMAL	4-9
BEST RATE	4-10
CRUISE	4-11
DESCENT	4-12
BEFORE LANDING	4-12
GO AROUND (BALKED LANDING)	4-13
LANDING	4-13
TAXI	4-13
SHUTDOWN	4-14
SECURING THE AIRCRAFT	4-14

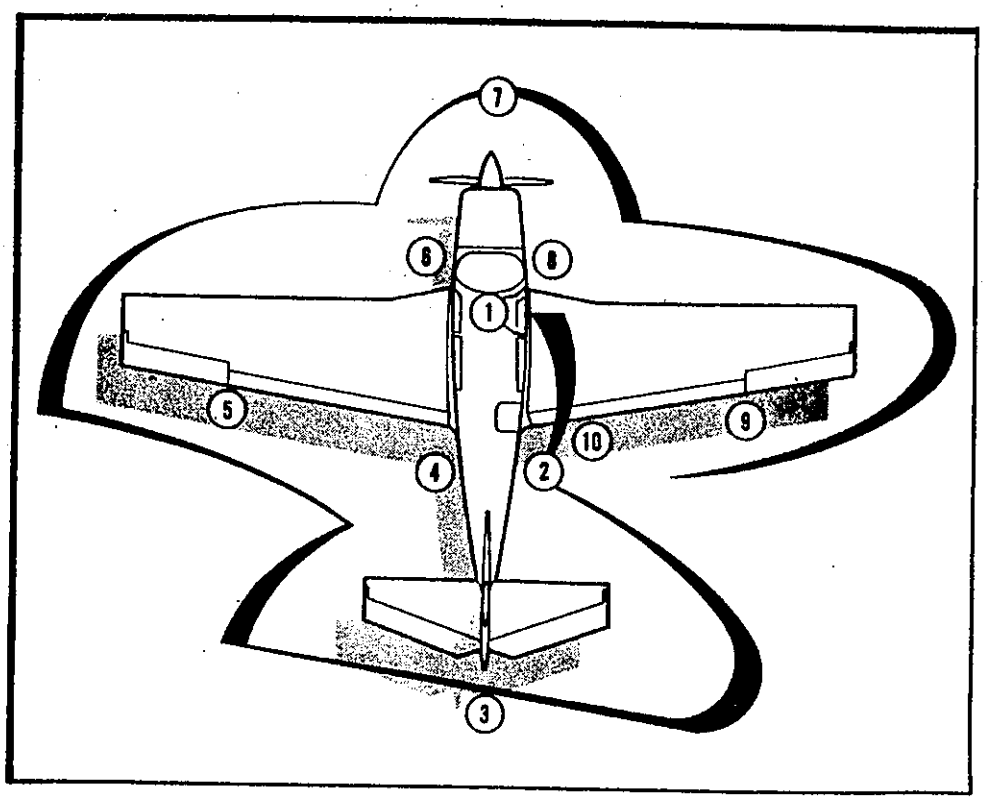


FIGURE 4-1. PREFLIGHT WALK AROUND DIAGRAM

PREFLIGHT INSPECTION

1. Magneto/Starter Switch--OFF.
   Gear Switch--DOWN.
   Master Switch--ON to check outside lights, fuel gages, then OFF.
   Fuel Selector Drain --Selector handle on R; pull gascolator ring and hold for five seconds.
   Repeat procedure with selector handle on L.

2. Instrument Static Port--UNOBSTRUCTED.
   Tail Tiedown--REMOVE.

3. Empennage--CHECK. Elevator & rudder attach points. Remove all ice, snow, or frost.

4. Instrument Static Port--UNOBSTRUCTED.
   Tail Cone Access Door--SECURE.
   Static System Drain--CHECK.

5. Wing Skins--CHECK.
Flap and Attach Points--CHECK.
Aileron and Attach Points--CHECK.
Wing Tip Strobe and Navigation Light--CHECK.
Remove all ice, snow, or frost.

6. Left Wing Leading Edge--CHECK.
Pitot Tube--UNOBSTRUCTED, Heat Element Operative.
Stall Switch Vane--UNOBSTRUCTED.
Fuel Tank--CHECK QUANTITY, Secure Cap.

NOTE

A reduced fuel indicator is located in the filler neck. This indicator is used to indicate useable fuel capacity of 25 U. S. gallons.

Chock and Tiedown--REMOVE.
Left Main Gear, Shock Discs and Tire--CHECK.
Fuel Tank Sump Drain--SAMPLE.
Pitot System Drain--CHECK.
Tank Vent--UNOBSTRUCTED.
Fuel Selector Drain Valve--CLOSED.
Windshield--CLEAN.
Left Side Engine Cowl Fasteners--SECURE.

7. Propeller--CHECK for nicks, cracks and oil leaks.
Forward Engine Components--CHECK starter, alternator belt, etc.
Ram Air Door--CHECK, off and secure.
Landing Light--CHECK.
Nose Gear--CHECK tire; check for towing damage.
Nose Gear Door & Cowl Flaps--CHECK for loose linkage.
Shock Discs--CHECK.
Chocks--REMOVE.

8. Right Side Engine Cowl Fasteners--SECURE.
Engine Oil Level--CHECK (Full for extended flight).
Exhaust Pipe-SECURE.
Windshield--CLEAN.
Fuel Tank Sump Drain--SAMPLE.
Tank Vent--UNOBSTRUCTED.
Chock and Tiedown--REMOVE.
Right Main Gear, Shock Discs and Tire--CHECK.
Right Wing Leading Edge--CHECK.

Fuel Tank--CHECK QUANTITY.

NOTE

A reduced fuel indicator is located in the filler neck. This indicator is used to indicate useable fuel capacity of 25 U.S. gallons.

9. Wing Skins--CHECK.
   Wing Tip Strobe(if installed) and Navigation Light--CHECK.
   Aileron and Attach Points--CHECK.
   Flap and Attach Points--CHECK.
   Remove all ice, snow, or frost.

10. Baggage Door--SECURE & Lock before flight.

BEFORE STARTING CHECK

1. Preflight Inspection--COMPLETE.
2. Emergency Locator Transmitter--ARM (if installed)
3. Seats, Seat Belts and Shoulder Harness (if installed) - ADJUST AND SECURE.
4. Fuel Selector Handle--SET for fuller tank.
5. Parking Brake Control--DEPRESS BRAKE PEDALS AND PULL ON.
6. Magneto/Starter Switch and Master Switches--OFF.
7. Radio Master Switch--OFF.
8. Cowl Flaps--OPEN (Control Full Aft)
9. Ram Air Control--OFF.
10. Landing Gear Switch--DOWN.
11. Mixture Control--IDLE CUTOFF.
12. Propeller--FORWARD HIGH RPM.
13. Throttle--CLOSE (Full Aft).
14. Electric Fuel Boost Pump--OFF.
15. All External Lights--OFF.
16. Cabin Heat--OFF.
17. Main Circuit Breaker Panel--CHECK.
18. Alternate static air control--CHECK IN.
19. Passengers - Emergency and General Information Briefing.

STARTING ENGINE

1. Propeller Control--FORWARD/HIGH RPM.
2. Throttle Control--FORWARD 1/4.
3. Master Switch--ON.

4. Mixture Control -- FULL FORWARD.
5. Electric Fuel Boost Pump Switch -- ON TO ESTABLISH PRESSURE, THEN OFF.
6. Mixture Control -- FULL AFT (IDLE CUT-OFF).
7. Propeller Area -- CLEAR.
8. Magneto/Starter Switch -- TURN AND PUSH TO START, RELEASE TO BOTH WHEN ENGINE STARTS.
9. Mixture -- MOVE SLOWLY AND SMOOTHLY TO RICH.
10. Oil Pressure Gage--If minimum oil pressure not indicated within 30 seconds, STOP ENGINE, and determine trouble.

NOTE

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

11. Throttle - Set for 1000 to 1200 RPM.

FLOODED ENGINE CLEARING

1. Throttle--FULL OPEN (FULL FORWARD).
2. Mixture Control--IDLE CUTOFF (FULL AFT).
3. Electric Fuel Boost Pump--OFF.
4. Magneto/Starter Switch--turn to "START" and PUSH forward.
5. Throttle--RETARD when engine starts.
6. Mixture Control--OPEN slowly to FULL RICH (FULL FORWARD).
7. Oil Pressure Gage--If minimum oil pressure not indicated within 30 seconds, STOP ENGINE, and determine trouble.

WARM ENGINE STARTING

1. Fuel boost pumps - OFF.
2. Throttle - Slightly open.
3. Mixture - Full aft (idle cut off)
4. Magneto Starter Switch - Turn and push to start, release to both when engine starts.
5. Mixture - Move slowly to Rich.

6. Throttle - Set for 1000 to 1200 RPM.
7. Engine Oil Pressure - If minimum oil pressure not indicated within 30 seconds, stop engine and determine problem.

BEFORE TAXIING

1. Radio Master Switch - On.
2. External Lights - As desired.
3. Directional Gyro - Set.
4. Instruments - Normal.
5. Radios - Check.
6. Altimeter - Set.
7. Fuel Selector - Switch tanks, verify engine runs on other tank.

TAXIING

NOTE

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

1. Parking brake - Release.
2. Brakes - Check.
3. Directional Gyro - Proper indication during turns.
4. Turn Coordinator - Proper indication during turns.
5. Artifical Horizon - Erect during turns.

BEFORE TAKEOFF

1. Parking Brake--SET.
2. Controls--CHECK FREE AND CORRECT MOVEMENT.
3. Radio Master--ON
4. Instruments and Radios-- CHECK AND SET AS DESIRED.

5. Strobe Lights and Rotating Beacon--ON (if installed).

6. Annunciator Lights -- CHECK WITH PRESS-TO-TEST & THROTTLE RETARDED.

7. Trim -- TAKEOFF SETTING. If forward CG set trim to upper portion of band and to lower portion when at aft CG.

8. THROTTLE -- 1900-2000 RPM.

9. Magnetos -- CHECK. Make magneto check at 1900-2000 RPM, as follows:

   a. Magneto/Starter Switch - BOTH to R. Note RPM.

   b. Magneto/Starter Switch - BOTH. Allow time for plugs to clear.

   c. Magneto/Starter Switch - L. Note RPM.

   d. Magneto/Starter Switch - BOTH. The RPM drop should not exceed 175 RPM on either magneto or indicate greater than a 50 RPM differential between magnetos.

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.

10. Propeller Control - CYCLE/RETURN TO HIGH RPM (full forward).

11. Throttle - IDLE RPM.

12. Cabin Door - LOCK.

13. Seat Belts and Shoulder Harness - SECURE.

14. Wing Flaps - TAKEOFF (15°)

TAKEOFF

NOTE

Move the controls slowly and smoothly. In particular, avoid rapid opening and closing of the throttle as the engine is equipped with a counterweighted crankshaft and there is a possibility of detuning the counterweights and overspeeding with subsequent engine damage.

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

When takeoff must be made over a gravel surface, it is important that the throttle be applied slowly. This will allow the aircraft to start rolling before a high RPM is developed, and gravel or loose material will be blown back from the prop area instead of being pulled into it.

TAKEOFF (Normal)

1. Electric Fuel Boost Pump - ON at start of takeoff roll.

2. Power - FULL THROTTLE and 2700 RPM.

3. Aircraft Attitude - LIFT NOSE WHEEL AT 71 MPH (62 KTS.) IAS.

4. Climb Speed - 82 MPH (71 KTS) IAS.

5. Landing Gear - RETRACT IN CLIMB BEFORE ATTAINING AN AIRSPEED OF 125 MPH (108 KIAS).

6. Wing Flaps - RETRACT IN CLIMB.

7. Electric Fuel Boost Pump - OFF, CHECK PRESSURE.

TAKEOFF (Obstacle Clearance)

1. Electric Fuel Boost Pump - ON at start of takeoff roll.

2. Power - FULL THROTTLE AND 2700 RPM.

3. Aircraft Attitude - LIFT NOSE WHEEL AT 71 MPH (62 KTS.) IAS.

4. Climb Speed - 76 MPH (66 KTS.) IAS until clear of obstacle, then accelerate to 105 to 115 MPH (91 to 100 KTS.) IAS.

5. Landing Gear - RETRACT IN CLIMB AFTER CLEARING OBSTACLE.

6. Wing Flaps - RETRACT AFTER CLEARING OBSTACLE.

7. Electric Fuel Boost Pump - OFF, CHECK PRESSURE.

CLIMB

CLIMB (Normal)

1. Throttle - 26" HG MANIFOLD PRESSURE.

2. Propeller - 2600 RPM.

3. Mixture - LEAN FOR SMOOTH OPERATION.

4. Cowl Flaps - FULL OPEN.

5. Airspeed - 105-115 MPH (91-100 KTS).

6. Ram Air - ON AFTER ENTERING CLEAR AIR.

CLIMB (Best Rate)

1. Power - FULL THROTTLE & 2700 RPM.
2. Mixture - LEAN FOR SMOOTH OPERATION.
3. Cowl Flaps - FULL OPEN.
4. Airspeed - 101 MPH (88 KTS) IAS at Sea Level decreasing to 94 MPH (82 KTS) IAS at 10,000 Ft.
5. Ram Air -ON AFTER ENTERING CLEAR AIR.

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

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

WARNING

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

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

CRUISE

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

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

A. Leaning using exhaust gas temperature gage (EGT) (if installed)

1. Lean the mixture until temperature peaks on the EGT indicator.

   ECONOMY CRUISE - Enrich mixture (push mixture lever forward) until the EGT indicator drops 25°F or more below peak.
   BEST POWER MIXTURE - Enrich mixture until EGT indicator drops 100°F (38°C) below peak.

NOTE

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

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

B. Leaning without exhaust gas temperature gage (EGT)

1. Slowly move mixture control lever aft from "Full Rich" position toward lean position.
2. Continue leaning until slight loss of power is noted (loss of power may or may not be accompanied by roughness).

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

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

DESCENT

1. Mixture - RICH/OR LEAN FOR SMOOTH OPERATION.
2. Power - AS DESIRED.

CAUTION

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

NOTE

Exercise caution with power settings below 15" Hg manifold pressure at airspeeds between 80-130 MPH (70-113 Kts.) IAS to preclude continuous operation in the 1500-1950 RPM restricted range.

3. Cowl Flaps - CLOSED (control full forward).
4. Ram Air - OFF before entering dusty air layers.

BEFORE LANDING

1. Seats, Seat Belts and Shoulder Harnesses - ADJUST AND SECURE.
2. Landing Gear - EXTEND BELOW 155 MPH (135 KTS.) IAS.
3. Mixture Control - FULL RICH.
4. Fuel Selector - RIGHT OR LEFT (Fullest tank).
5. Propeller Control - HIGH RPM.
6. Wing Flaps - FULL DOWN (33^{o}) BELOW 132 MPH (115 KTS) IAS.

7. Trim - ADJUST, as necessary.

8. Electric Fuel Boost Pump - ON.

9. Ram Air - OFF; WARNING LIGHT OFF.

10. Check Gear Down - GEAR DOWN LIGHT ON - MARKS ALIGNED IN VISUAL INDICATOR IN FLOOR.

GO AROUND (BALKED LANDING)

1. Power - FULL THROTTLE AND 2700 RPM.

2. AIRSPEED - 75 MPH (65 KTS) IAS.

3. Flaps - AFTER CLIMB ESTABLISHED RETRACT TO 0 DEGREES WHILE ACCELERATING TO 84 MPH (73 KTS) IAS.

4. Gear - RETRACT AFTER CLIMB IS ESTABLISHED.

5. Cowl Flaps - FULL OPEN.

LANDING

1. Airspeed on Final - 81 MPH (71 KTS) IAS WITH FULL FLAPS.

2. Touchdown - MAIN WHEELS FIRST.

3. Landing Roll - LOWER NOSE WHEEL GENTLY.

4. Brakes - MINIMUM REQUIRED.

5. Wing Flaps - RETRACT AFTER CLEARING RUNWAY.

6. Cowl Flaps - OPEN

7. Electric Fuel Boost Pump - OFF AFTER LANDING.

8. Trim - TAKEOFF POSITION.

TAXI

1. Throttle--1000 to 1200 RPM.

2. Lighting--As required.

3. Stabilizer Trim--TAKEOFF.

SHUTDOWN

1. Throttle--IDLE at 1000 to 1200 RPM until cylinder head temperature starts to drop.
2. Cowl Flaps--OPEN.
3. Radio Master Switch--OFF.
4. Electrical Equipment Switches--OFF.
5. Mixture Control--IDLE CUTOFF.
6. Throttle--RETARD as engine stops firing.
7. Magneto/Starter Switch--OFF when propeller stops.
8. Parking Brake--Set (for short-term parking).
9. Trim--TAKEOFF.
10. Flaps--RETRACTED.
11. Master Switch--OFF.
12. Control Wheel--LOCK with seat belt.
13. Oxygen System (If equipped) - OFF.

SECURING THE AIRCRAFT

1. Parking Brake - SET.
2. Radio Master and Electrical Equipment - OFF.
3. Magneto/Starter Switch and Master Switch - OFF.
4. Mixture Control - IDLE CUTOFF.
5. Parking Brake - RELEASE AND INSTALL WHEEL CHOCKS.
6. For Extended Parking or in Gusty Wind Conditions - SECURE PILOTS CONTROL WHEEL WITH SEAT BELT, TIE DOWN AIRCRAFT AT WING AND TAIL POINTS.

SECTION V.

PERFORMANCE

TABLE OF CONTENTS

INTRODUCTION 5-3
NOISE LIMITS 5-3
ALTITUDE CONVERSION 5-4

TEMPERATURE CONVERSION 5-5

AIRSPEED CONVERSION 5-6

AIRSPEED CALIBRATION 5-7
NORMAL STATIC SYSTEM - Flaps & Gear Up . . . 5-7
NORMAL STATIC SYSTEM - Flaps & Gear Down . . 5-8
ALTERNATE STATIC SYSTEM 5-9

ALTIMETER CORRECTIONS . . . . . .
NORMAL STATIC SYSTEM - Flaps & Gear Up . . . 5-10
NORMAL STATIC SYSTEM - Flaps & Gear Down . . 5-11
ALTERNATE STATIC SYSTEM 5-12

STALL SPEEDS 5-13

TAKEOFF DISTANCES MAXIMUM PERFORMANCE . 5-14

TAKEOFF DISTANCES NORMAL 5-15

CLIMB PERFORMANCE 5-16

TIME, FUEL & DISTANCE TO CLIMB 5-17

CRUISE, RANGE AND ENDURANCE CHARTS 5-19
BEST ECONOMY 5-20
BEST POWER 5-28

LANDING DISTANCES 5-36
NORMAL LANDING 5-36
MAXIMUM PERFORMANCE 5-37

All performance tables and graphs are grouped in this section of the manual for quick and easy reference. The information is presented to show performance that may be expected from the aircraft, and to assist you in planning your flights with reasonable detail and accuracy. All data has been compiled from both calculations and actual test flights with the aircraft and engine in good operating condition while using average piloting techniques. The cruise performance data makes no allowance for variables present with a specific aircraft or for wind and navigation errors. In using this data, allowances must be made for actual conditions.

A carefully detailed and analyzed flight plan will yield maximum efficiency. After making a flight plan based on estimates taken from the data in this section, you should check your actual performance and note the difference between your forecast conditions and actual flight performance so that your future estimates may be more accurate.

NOISE LIMITS

The certificated Noise Level for the Model M20J at 2740 pounds maximum weight is 74 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of any airport.

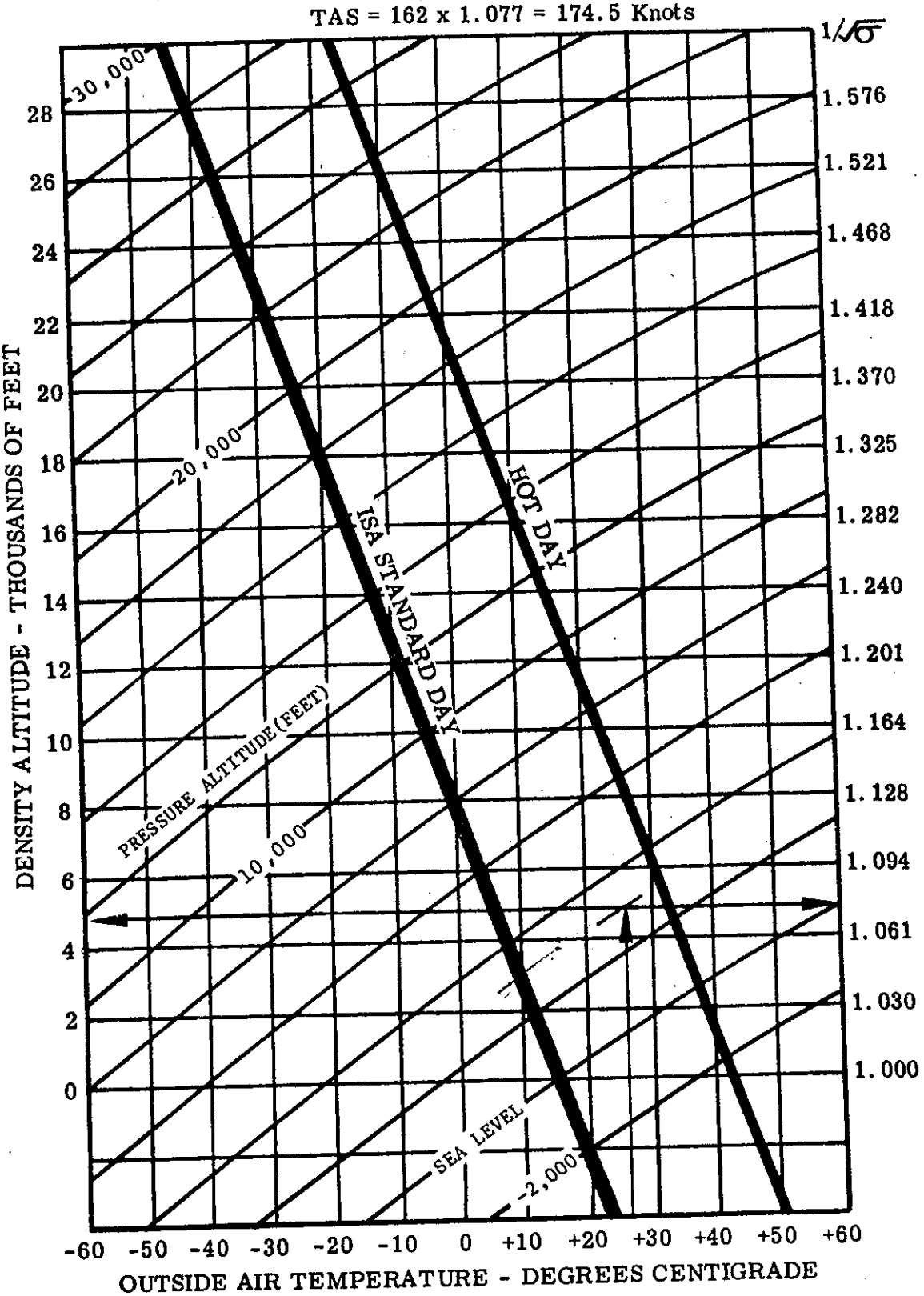
ALTITUDE CONVERSION

$TAS = CAS \times 1/\sqrt{\sigma}$

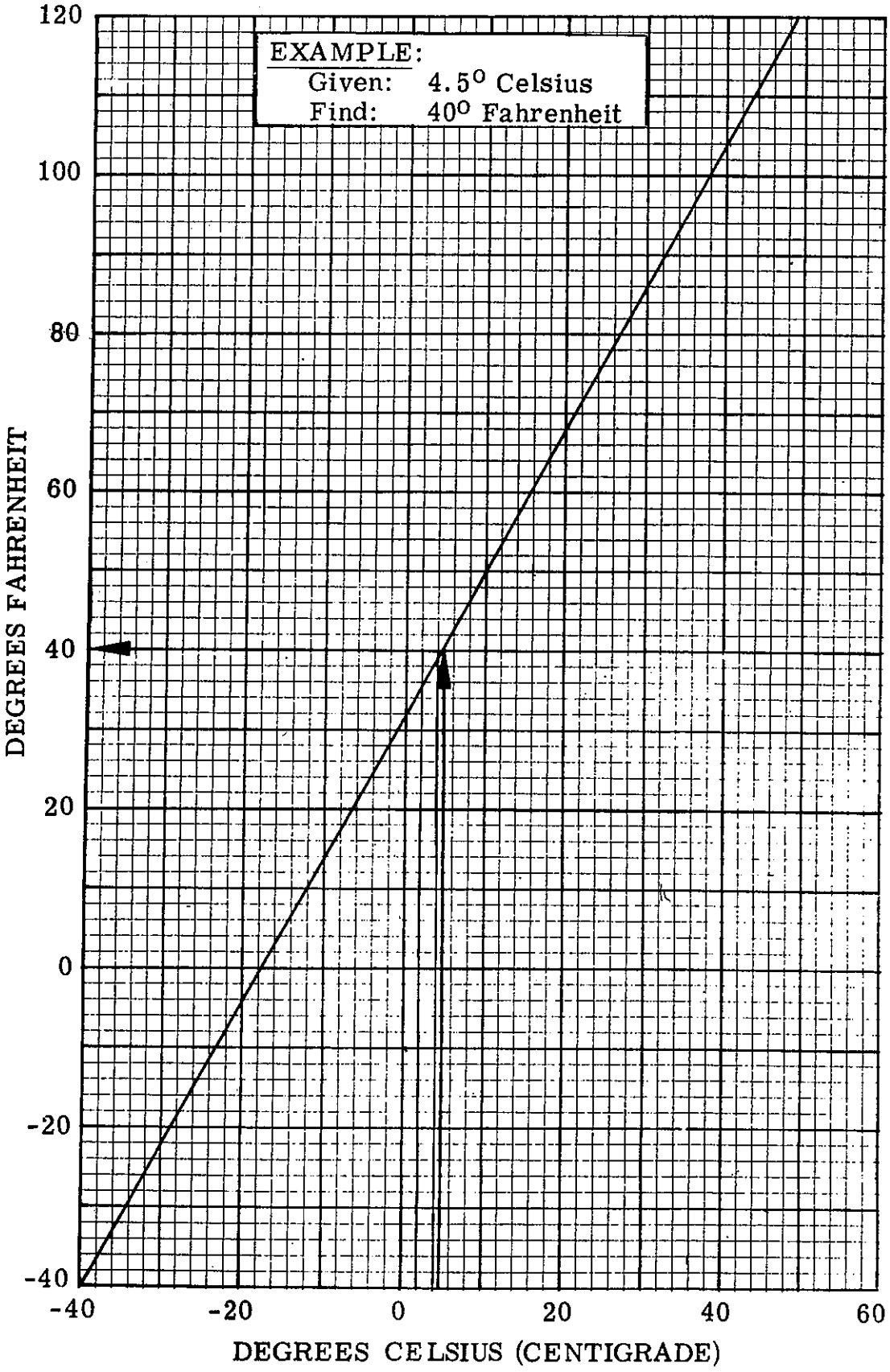
EXAMPLE:

Given: 26°C Outside Air Temperature
3000 Ft. Pressure Altitude
162 Knot CAS

Find: 4950 Ft. Density Alt.
$1.077 = 1/\sqrt{\sigma}$
TAS = 162 x 1.077 = 174.5 Knots

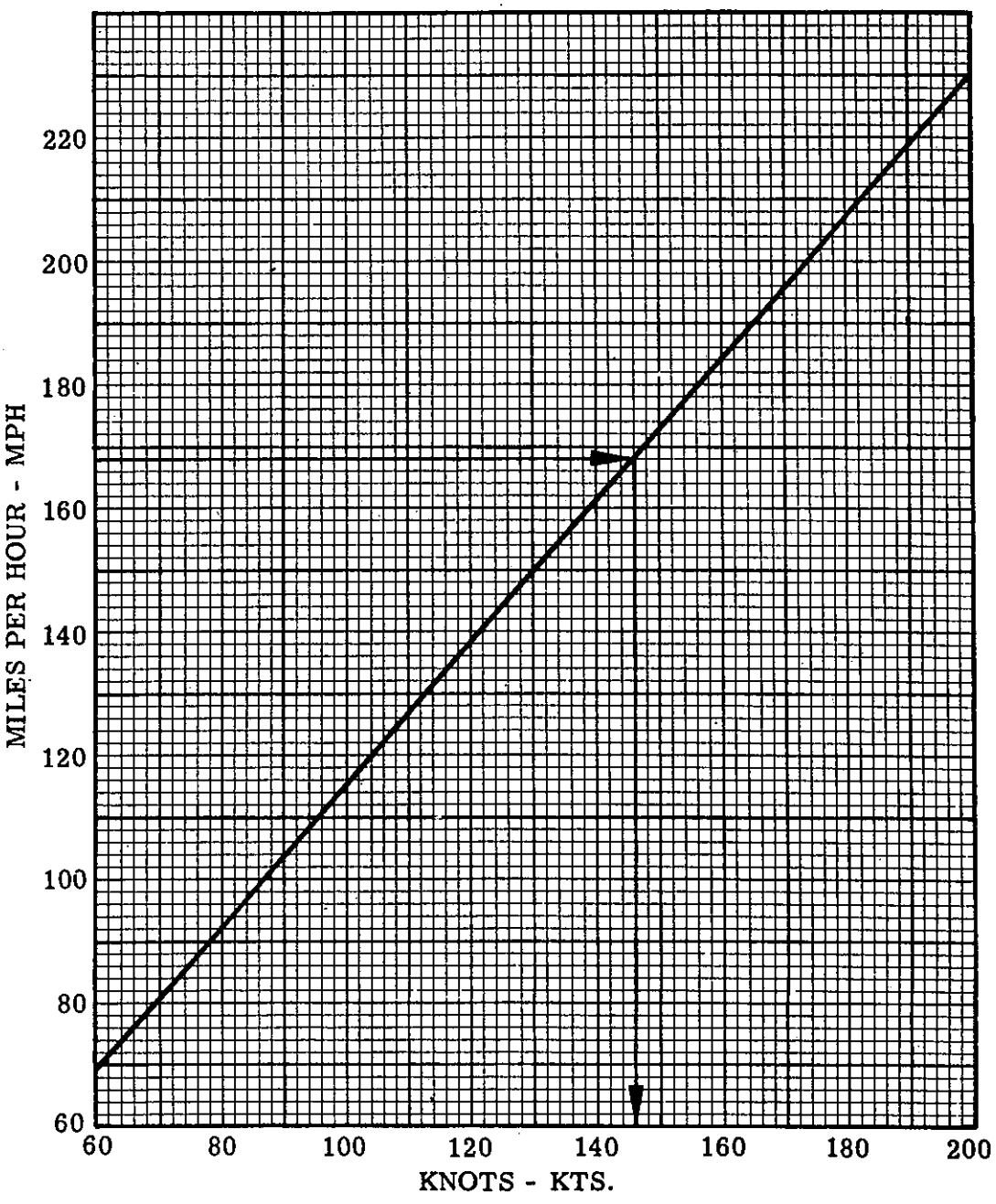


TEMPERATURE CONVERSION



AIRSPEED CONVERSION

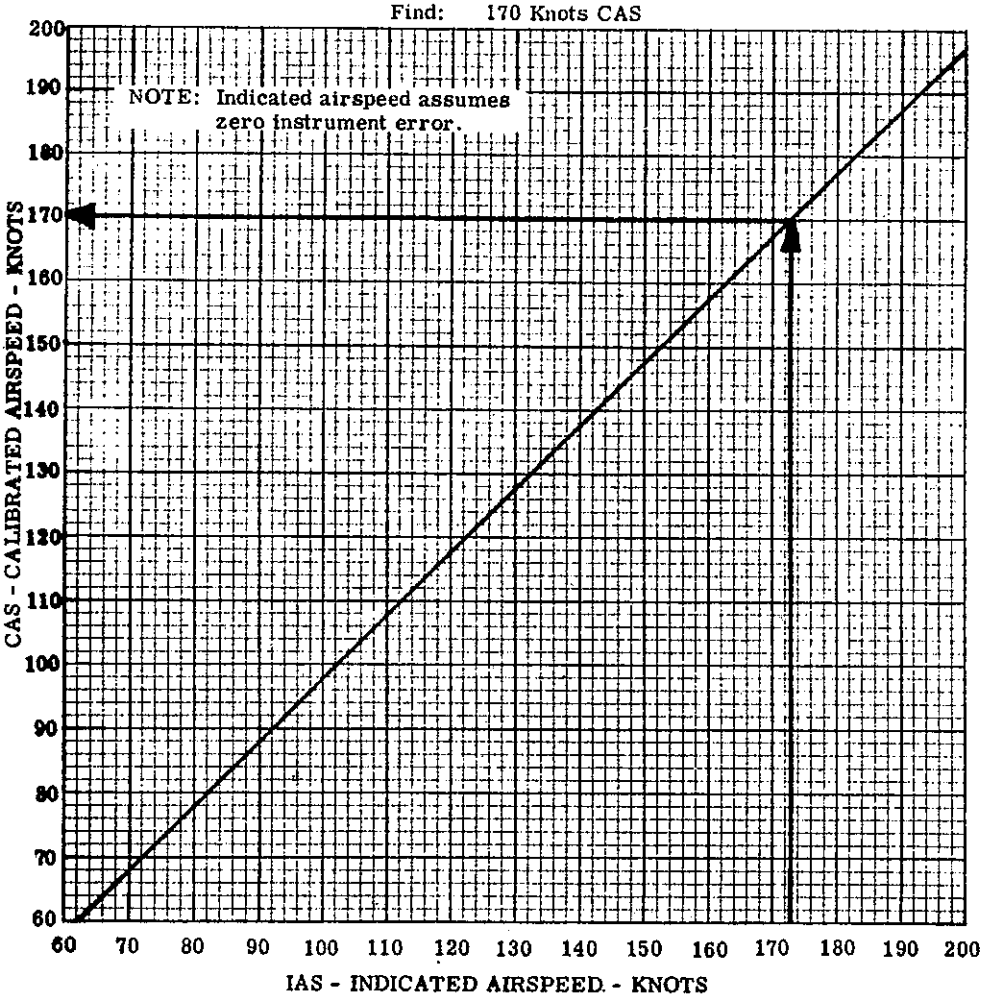
EXAMPLE: Given: 168 MPH
Find: 146 KTS.



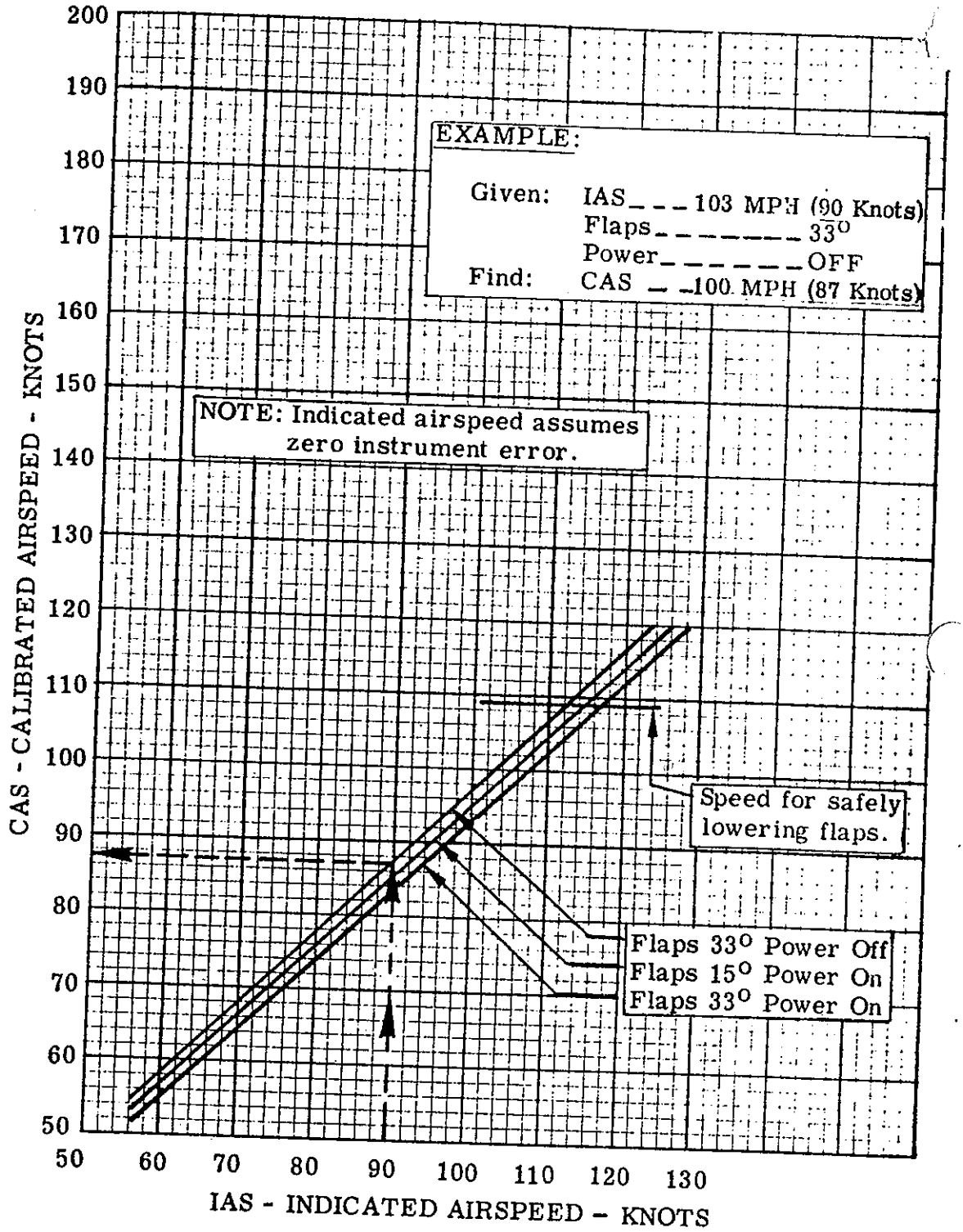
AIRSPEED CALIBRATION

NORMAL STATIC SYSTEM - FLAPS AND GEAR UP, POWER ON

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



NORMAL STATIC SYSTEM - FLAPS AND GEAR DOWN



AIRSPEED CALIBRATIONS
ALTERNATE STATIC SOURCE

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

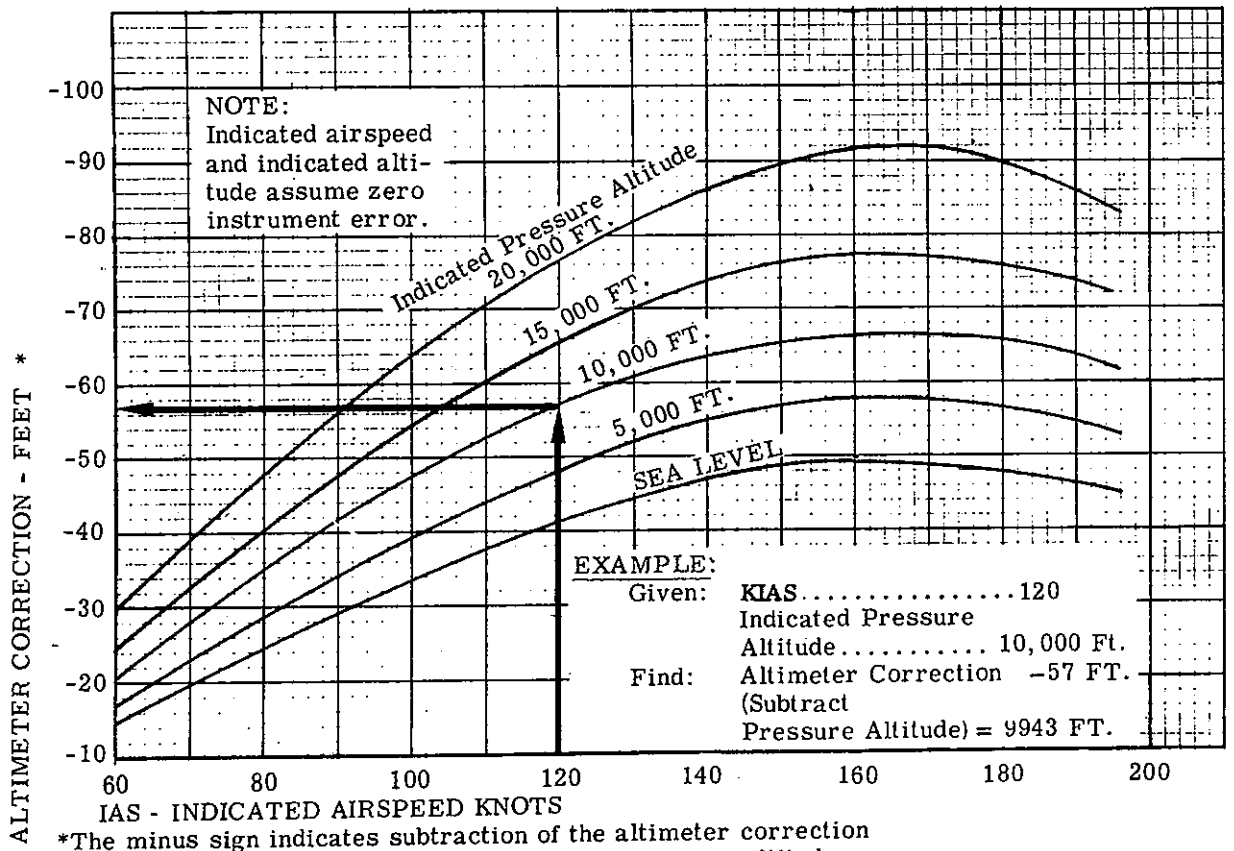
The minus sign indicates subtraction of the given numbers from KIAS to obtain KCAS assuming zero instrument error

CONDITIONS: Storm Window and Vents: Closed
Defroster: Maximum

Power On

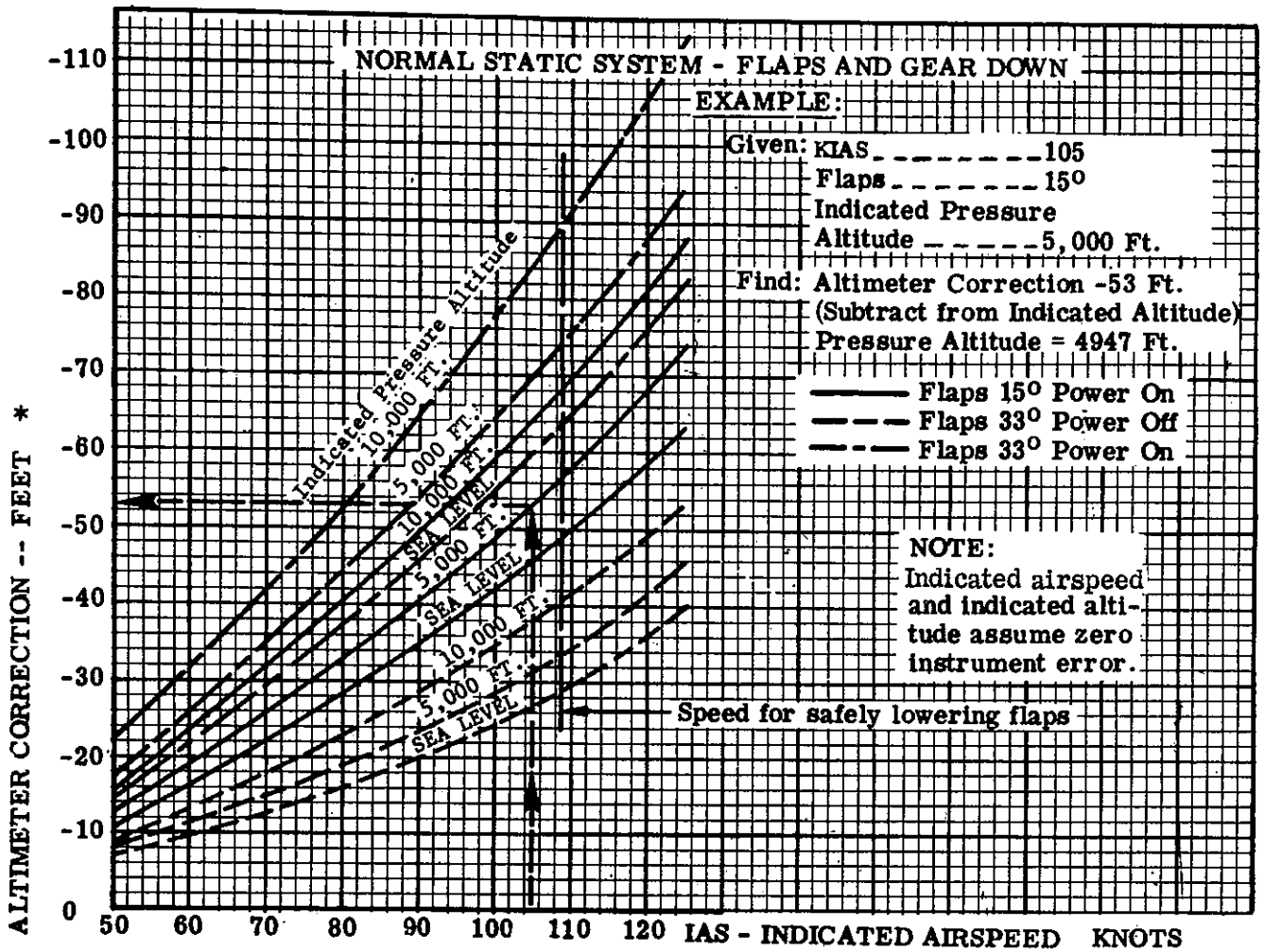
ALTIMETER CORRECTIONS

NORMAL STATIC SYSTEM - FLAPS & GEAR UP & POWER ON



*The minus sign indicates subtraction of the altimeter correction from indicated pressure to obtain corrected pressure altitude.

ALTIMETER CORRECTIONS



*The minus sign indicates subtraction of the altimeter correction from indicated pressure altitude to obtain corrected pressure altitude.

ALTIMETER CORRECTIONS
ALTERNATE STATIC SOURCE

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

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

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

STALL SPEEDS

ASSOCIATED CONDITIONS:

Gross Weight = 2740 LBS.
Forward CG
Power - Idle
Stall Speeds are indicated airspeeds in KNOTS and assume zero instrument error.

NOTE

Maximum altitude loss during stall recovery is approximately 290 feet

WEIGHT LBS.	ASSOCIATED CONDITIONS		Stall Speeds - KNOTS			
			Angle of Bank			
			0°	20°	40°	60°
2740	Flaps & Gear Up	KNOTS	63	64	71	86
	Flaps 15° Gear Down	KNOTS	57	59	66	83
	Flaps 33° Gear Down	KNOTS	55	57	63	77

EXAMPLE:

Given:	Weight	2740 LBS.
	Landing Gear	Down
	Flaps	33°
	Angle of Bank	20°
Find:	Stall Speed	57 KIAS

ASSOCIATED CONDITIONS:

TAKEOFF DISTANCES (Maximum Performance)

POWER------ FULL THROTTLE, 2700 RPM (Before Brake Release)
MIXTURE --- LEAN FOR SMOOTH OPERATION
FLAPS ------ 15°
LDG. GEAR-- EXTENDED UNTIL OBSTACLE CLEARED

RUNWAY---------- PAVED, LEVEL, DRY SURFACE
WEIGHT---------- 2740 LBS.
TAKEOFF SPEED----- 62 KIAS
CLIMB OUT--------- 66 KIAS
COWL FLAPS-------- FULL OPEN

Wind Component Down Runway Knots	OAT °C	PRESSURE ALTITUDE: Sea Level Ground Roll Feet	Sea Level Total Over 50 Ft. Obstacle Feet	2000 FT. Ground Roll Feet	2000 FT. Total Over 50 Ft. Obstacle Feet	4000 FT. Ground Roll Feet	4000 FT. Total Over 50 Ft. Obstacle Feet	6000 FT. Ground Roll Feet	6000 FT. Total Over 50 Ft. Obstacle Feet	8000 FT. Ground Roll Feet	8000 FT. Total Over 50 Ft. Obstacle Feet
0	-20	679	1179	803	1387	1029	1740	1330	2175	1692	2678
	-10	732	1267	873	1498	1118	1879	1446	2351	1843	2898
	0	793	1364	946	1613	1211	2024	1566	2532	1993	3119
	10	857	1465	1022	1732	1309	2175	1692	2720	2153	3352
	20	924	1570	1101	1856	1410	2330	1823	2916	2329	3603
	30	993	1678	1183	1983	1516	2491	1960	3119	----	----
	40	1064	1789	1269	2116	1625	2657	2101	3327	----	----
10	-20	608	1071	722	1264	929	1591	1205	1994	1538	2461
	-10	657	1153	787	1368	1016	1726	1312	2158	1678	2667
	0	713	1243	854	1475	1097	1856	1424	2328	1818	2875
	10	772	1337	924	1586	1188	1998	1541	2505	1967	3094-
	20	834	1436	997	1702	1282	2143	1663	2689	2131	3329
	30	898	1537	1073	1821	1380	2294	1790	2879	----	----
	40	963	1640	1153	1946	1482	2450	1922	3075	----	----
20	-20	548	974	653	1154	843	1456	1097	1830	1405	2265
	-10	593	1050	713	1251	919	1577	1197	1984	1536	2459
	0	645	1135	775	1350	999	1704	1300	2143	1666	2654
	10	700	1223	840	1454	1083	1836	1409	2308	1805	2859
	20	757	1314	908	1563	1170	1972	1523	1481	1958	3081
	30	816	1408	978	1674	1262	2114	1642	2661	----	----
	40	877	1506	1053	1791	1357	2261	1765	2845	----	----

NOTE: 1) Maximum demonstrated crosswind velocity is 11 Knots. 2) Where distance value has been deleted, climb performance after lift off is less than 150 ft./min. 3) Conditions of high humidity can result in an increase of up to 10% to the above take-off distances.

TAKEOFF DISTANCES

ASSOCIATED CONDITIONS:

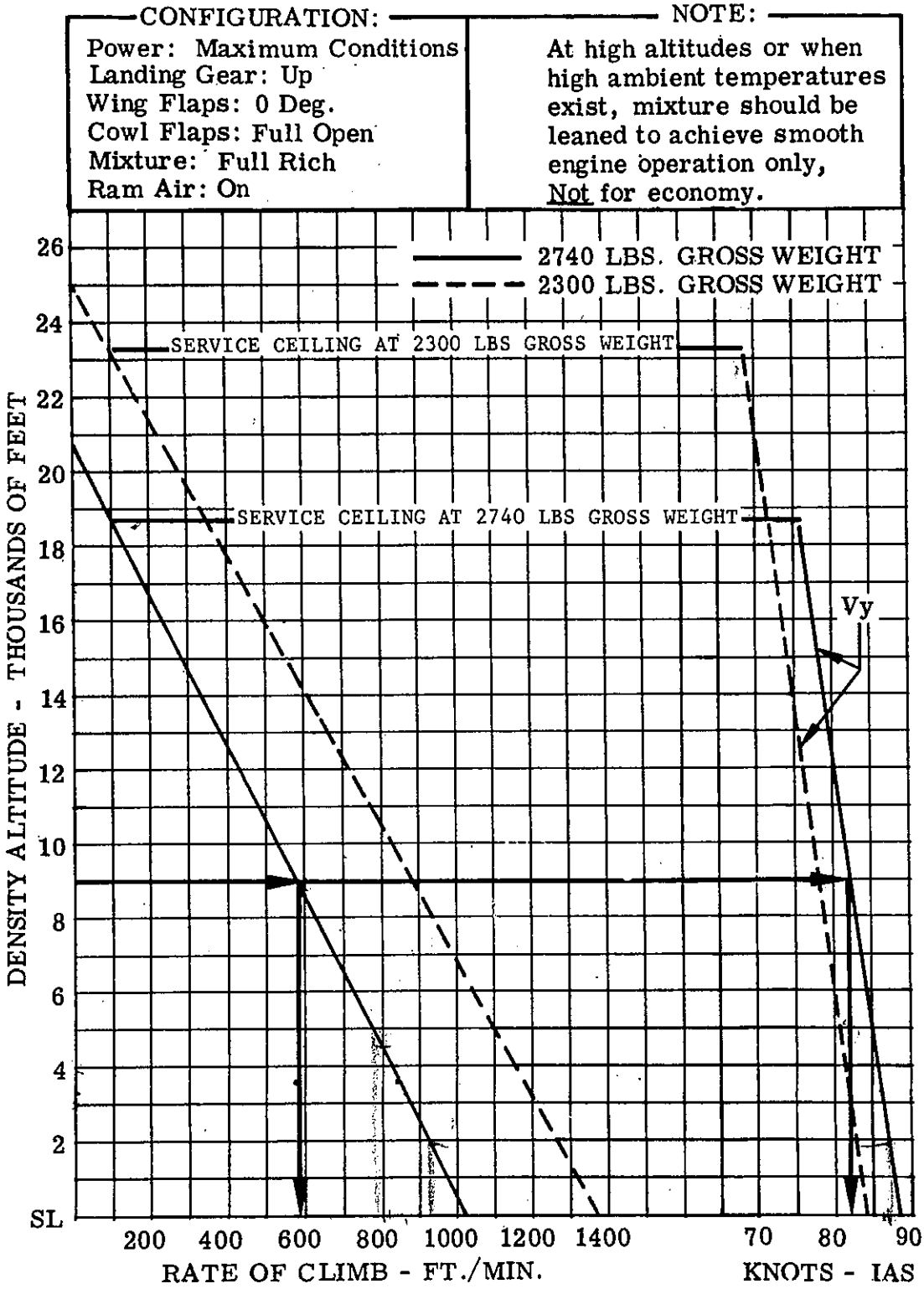
POWER------ FULL THROTTLE, 2700 RPM (Before Brake Release)
MIXTURE --- LEAN FOR SMOOTH OPERATION
FLAPS ------ 15°
LDG. GEAR-- EXTENDED UNTIL OBSTACLE CLEARED

RUNWAY---------- PAVED, LEVEL, DRY SURFACE
WEIGHT---------- 2740 LBS.
TAKEOFF SPEED------63 KIAS
CLIMB OUT----------71 KIAS
COWL FLAPS---------- FULL OPEN

Wind Component Down Runway Knots	OAT °C	PRESSURE ALTITUDE: Sea Level Ground Roll Feet	Sea Level Total Over 50 Ft. Obstacle Feet	2000 FT. Ground Roll Feet	2000 FT. Total Over 50 Ft. Obstacle Feet	4000 FT. Ground Roll Feet	4000 FT. Total Over 50 Ft. Obstacle Feet	6000 FT. Ground Roll Feet	6000 FT. Total Over 50 Ft. Obstacle Feet	8000 FT. Ground Roll Feet	8000 FT. Total Over 50 Ft. Obstacle Feet
0	-20	704	1374	854	1646	1049	2074	1392	2808	1778	3820
	-10	765	1482	928	1776	1140	2237	1513	3028	1933	4118
	0	829	1594	1005	1910	1235	2406	1639	3256	2094	4426
	10	896	1711	1086	2050	1334	2581	1771	3494	2262	4746
	20	965	1831	1170	2194	1438	2764	1908	3738	2437	5077
	30	1037	1955	1258	2344	1545	2951	2051	3992	----	----
	40	1112	2084	1349	2498	1657	3145	2199	4253	----	----
10	-20	632	1255	769	1507	948	1906	1263	2490	1619	3537
	-10	688	1356	837	1629	1032	2059	1375	2797	1763	3818
	0	747	1460	908	1754	1120	2217	1492	3011	1913	4109
	10	814	1575	983	1885	1212	2382	1615	3236	2070	4412
	20	872	1681	1061	2021	1309	2555	1743	3466	2233	4725
	30	939	1798	1143	2162	1408	2730	1876	3705	----	----
	40	1008	1919	1227	2306	1513	2914	2014	3952	----	----
20	-20	570	1446	696	1381	862	1753	1151	2389	1480	3275
	-10	622	1240	760	1495	940	1897	1255	2583	1615	3541
	0	676	1338	826	1613	1021	2045	1365	2786	1755	3815
	10	738	1445	895	1736	1107	2200	1479	2997	1901	4101
	20	793	1546	967	1862	1197	2362	1598	3214	2054	4397
	30	854	1654	1043	1995	1290	2528	1723	3441	----	----
	40	919	1768	1122	2131	1387	2700	1852	3674	----	----

NOTE: 1) Maximum demonstrated crosswind velocity is 11 Knots. 2) Where distance value has been deleted, climb performance after lift off is less than 150 ft./min. 3) Conditions of high humidity can result in an increase of up to 10% to the above take-off distances.

CLIMB PERFORMANCE



EXAMPLE

GIVEN: DENSITY ALTITUDE–9000 FEET
GROSS WEIGHT–2740 LBS.

FIND: BEST RATE OF CLIMB–590 FT./ MIN.
BEST RATE OF CLIMB SPEED–82 KIAS

TIME, FUEL AND DISTANCE TO CLIMB

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

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

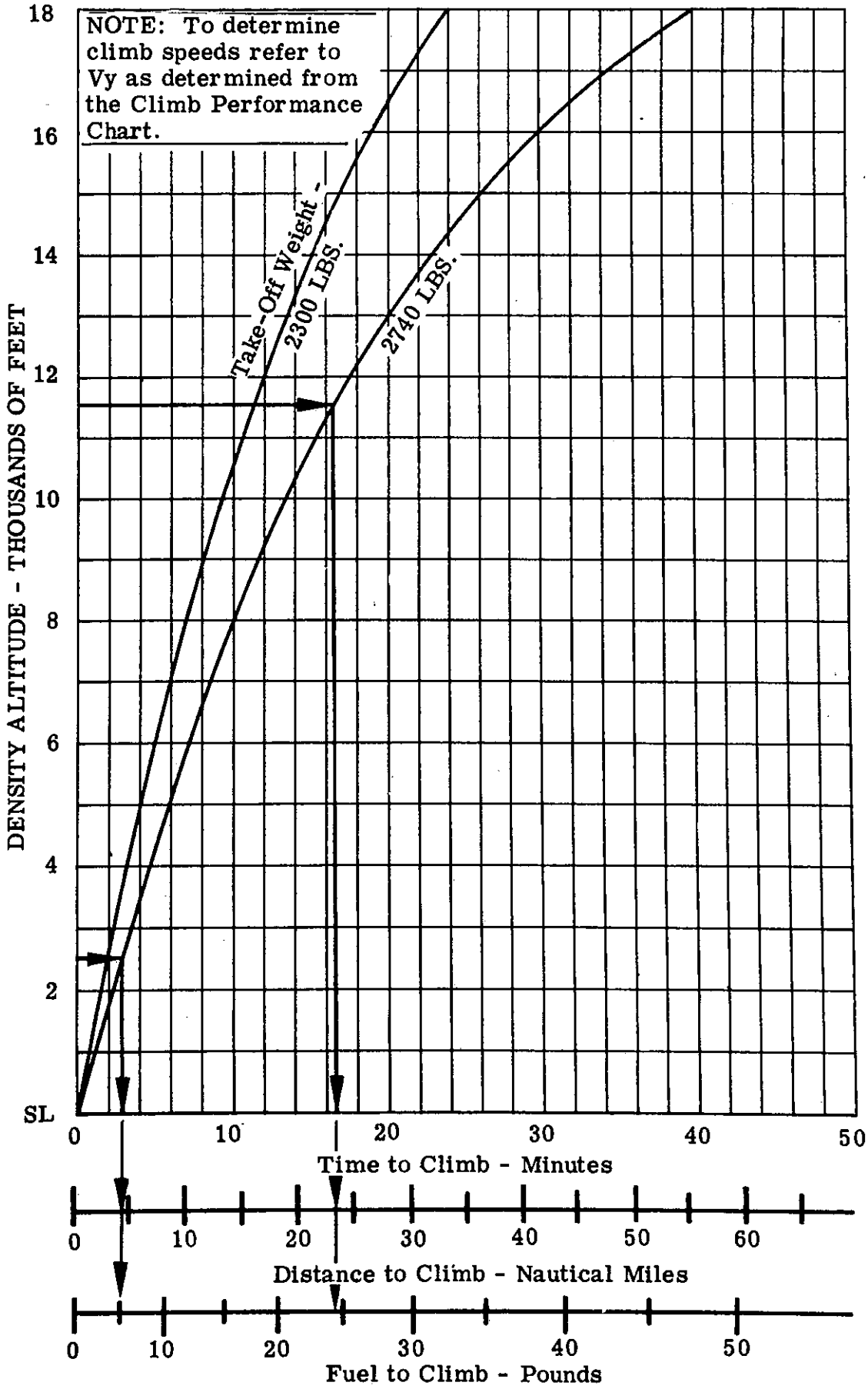
NOTE:

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

EXAMPLE:

Given:	Initial Density Altitude	2,500 Ft.
	Final Density Altitude	11,500 Ft.
	Takeoff Weight - 2740 Lbs.	
Find:	Time to Climb (16.5 - 3.0)	13.5 Minutes
	Distance to Climb (23.5 - 4.5)	19.0 Naut. Mi.
	Fuel to Climb (24.5 - 5.0)	19.5 Lbs.

TIME, FUEL AND DISTANCE TO CLIMB



CRUISE & RANGE DATA CONDITIONS

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

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

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

   a. Decrease true airspeed at normal cruise power setting by approximately 5 knots.
   b. Decreased range may be as much as 50 nautical miles for 64 gallon fuel capacity.

CRUISE & RANGE AT ECONOMY CRUISE
SEA LEVEL, 15°C

MIXTURE SETTING:
Lean mixture in accordance with instructions in Section IV.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	23.5	75	10.8	65.0	156	158	5:00	780	790
	22.0	70	10.3	61.5	152	155	5:20	810	826
	21.0	65	9.7	58.0	147	149	5:42	843	860
	19.5	60	9.2	55.0	142	145	6:08	864	891
	18.0	55	8.6	51.5	136	140	6:32	886	917
	14.0	40	7.0	42.0	113	120	8:20	921	977
2600	24.5	75	10.5	63.0	156	158	5:12	812	808
	23.0	70	10.0	60.0	152	155	5:30	843	856
	20.5	60	8.9	53.5	142	145	6:20	895	921
	19.0	55	8.3	50.0	136	140	6:45	917	951
	17.5	50	7.8	47.0	130	134	7:20	938	982
	15.0	40	6.8	40.5	113	120	8:35	951	1025
2400	27.0	75	10.3	62.5	156	158	5:20	834	827
	24.0	65	9.2	55.0	147	149	6:10	895	918
	21.0	55	8.1	48.5	136	140	7:00	951	977
	17.5	45	7.0	42.0	122	128	8:10	990	1036
	15.5	39	6.4	38.5	111	119	9:05	999	1064
2200	27.0	68	9.3	55.5	150	153	6:00	900	918
	22.5	55	7.8	47.0	136	140	7:15	986	1015
	21.0	50	7.3	44.0	130	134	7:30	1019	1050
	19.0	45	6.8	40.5	122	128	8:10	1079	1082
	17.5	37	5.9	35.5	106	116	9:25	1110	1125
2000	24.0	53	7.4	44.5	134	137	7:40	1030	1064
	23.0	50	7.1	42.5	130	134	8:10	1053	1090
	21.0	45	6.5	39.0	122	128	8:52	1079	1138
	17.0	36	5.6	33.5	103	113	10:40	1110	1221

CRUISE & RANGE AT ECONOMY CRUISE
2000 FT, 11°C

MIXTURE SETTING:
Lean mixture in accordance with instructions in Section IV.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	23.3	75	10.8	64.6	159	161	5:00	800	808
	20.6	65	9.7	58.0	149	153	5:40	849	869
	18.0	55	8.6	51.5	138	142	6:30	897	923
	14.8	43	7.3	43.5	121	127	7:50	947	994
2600	24.4	75	10.5	63.0	159	161	5:10	821	831
	21.6	65	9.4	56.5	149	153	5:50	869	892
	18.8	55	8.3	50.0	138	142	6:50	943	970
	15.2	42	6.9	41.5	118	126	8:20	982	1049
2400	26.8	75	10.3	61.4	159	161	5:20	847	858
	23.6	65	9.2	55.0	149	153	6:05	906	930
	20.4	55	8.1	48.5	138	142	7:00	966	994
	16.0	41	6.6	39.5	116	125	8:40	1004	1082
2200	25.4	64	8.7	52.4	149	152	6:20	943	962
	22.2	55	7.8	47.0	138	142	7:15	1000	1029
	18.7	45	6.8	40.5	123	130	8:30	1045	1105
	16.5	39	6.1	36.5	112	122	9:30	1064	1159
2000	22.5	50	7.1	42.5	131	136	8:05	1058	1099
	20.5	45	6.5	39.0	123	130	8:50	1086	1148
	17.4	37	5.7	34.0	108	118	10:20	1115	1218

CRUISE & RANGE AT ECONOMY CRUISE
4000 FT, 7°C

MIXTURE SETTING:
Lean mixture in accordance with instructions in Section IV.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR:MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	23.2	75	10.8	64.6	161	164	5:00	805	820
	20.5	65	9.7	58.0	152	155	5:40	861	878
	17.9	55	8.6	51.5	140	144	6:30	910	936
	14.8	43	7.3	43.5	121	128	7:45	937	992
2600	24.4	75	10.5	63.0	161	164	5:10	831	847
	21.5	65	9.4	56.5	152	155	5:52	891	909
	18.7	55	8.3	50.0	140	144	6:43	940	967
	15.0	42	6.9	41.5	120	127	8:30	1020	1079
2400	26.2	74	10.2	60.8	161	163	5:12	837	847
	23.3	65	9.2	55.0	152	155	5:57	904	922
	20.2	55	8.1	48.5	140	144	6:57	973	1000
	15.8	41	6.6	39.5	117	126	8:40	1013	1091
2200	24.4	62	8.5	51.5	148	152	6:25	949	975
	22.0	55	7.8	47.0	140	144	7:10	1003	1032
	18.6	45	6.8	40.5	125	131	8:28	1058	1109
	16.4	39	6.1	36.5	113	121	9:28	1069	1145
2000	22.4	50	7.1	42.5	134	138	8:00	1072	1104
	20.4	45	6.5	39.0	125	131	8:45	1093	1146
	17.2	37	5.7	34.0	108	119	10:14	1105	1217

CRUISE & RANGE AT ECONOMY CRUISE
6000 FT, 3°C

MIXTURE SETTING:
Lean mixture in accordance with instructions in Section IV.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	23.1	75	10.8	64.7	164	167	5:00	820	835
	20.4	65	9.7	58.0	154	157	5:40	871	888
	17.8	55	8.6	51.5	142	148	6:25	911	949
	15.2	45	7.5	45.0	126	134	7:28	940	1000
2600	24.1	75	10.5	63.0	164	167	5:10	847	862
	21.3	65	9.4	56.5	154	157	5:50	898	915
	18.5	55	8.3	50.1	142	148	6:38	941	981
	15.4	44	7.2	43.0	125	13[illegible]	7:50	979	1034
2400	24.4	70	9.7	58.0	160	162	5:40	906	918
	22.8	65	9.2	55.0	154	157	6:00	924	942
	19.8	55	8.1	48.6	142	148	6:50	970	1011
	16.2	43	6.8	40.6	122	131	8:15	1006	1080
2200	23.6	60	8.3	50.0	148	153	6:38	981	1014
	21.8	55	7.8	47.1	142	148	7:10	1017	1060
	20.0	50	7.3	44.1	135	141	7:40	1035	1081
	17.2	42	6.4	38.5	121	130	8:50	1068	1148
2000	21.3	47	6.7	40.2	130	138	8:20	1083	1150
	18.8	41	6.1	36.4	118	128	9:20	1101	1194

CRUISE & RANGE AT ECONOMY CRUISE
8000 FT, -1° C

MIXTURE SETTING:
Lean mixture in accordance with instructions in Section IV.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	23.6	75	10.8	64.7	169	171	5:00	835	850
	21.7	70	10.3	61.6	162	166	5:15	850	871
	20.4	65	9.7	58.0	157	161	5:37	881	904
	19.0	60	9.2	55.1	151	156	6:00	906	936
	17.8	55	8.6	51.5	145	150	6:27	928	961
	14.8	44	7.4	44.4	127	135	7:31	954	1014
2600	23.0	71	10.1	60.6	164	168	5:20	869	890
	21.2	65	9.4	56.6	157	161	5:48	910	933
	19.8	60	8.8	53.3	151	156	6:10	931	962
	18.6	55	8.3	50.1	145	150	6:37	952	985
	17.0	50	7.8	46.8	137	143	7:05	970	1012
	15.2	43	7.6	45.5	125	133	7:55	989	1053
2400	22.8	64	9.1	54.4	157	161	6:04	946	970
	21.3	60	8.6	51.6	151	156	6:21	958	990
	19.8	55	8.1	48.6	145	150	6:50	984	1018
	18.2	50	7.5	45.5	137	143	7:20	1004	1048
	15.5	42	6.7	40.0	122	131	8:20	1016	1091
2200	22.0	55	7.8	47.1	145	150	7:05	1020	1055
	20.0	50	7.3	44.1	137	143	7:40	1050	1096
	16.8	41	6.3	38.0	120	130	8:54	1068	1157
2000	20.3	45	6.5	39.0	129	136	8:35	1102	1167
	18.2	40	6.0	35.7	117	128	9:28	1110	1211

CRUISE & RANGE AT ECONOMY CRUISE
10,000 FT, -5° C

MIXTURE SETTING:
Lean mixture in accordance with instructions in Section IV.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	21.4	70	10.3	61.5	165	169	5:15	851	887
	20.2	65	9.7	58.0	160	164	5:31	877	904
	18.8	60	9.2	55.1	155	159	5:55	907	940
	17.6	55	8.6	51.5	148	153	6:20	927	969
	16.3	50	7.7	46.2	140	147	6:50	944	1004
	15.0	45	7.5	45.0	130	139	7:25	949	1030
2600	21.1	65	9.4	56.5	160	164	5:48	910	951
	19.8	60	8.9	53.3	155	159	6:10	938	980
	18.3	55	8.4	50.1	148	153	6:35	962	1007
	17.0	50	7.8	46.7	140	147	7:03	980	1036
	15.3	44	7.2	43.0	129	138	7:45	988	1069
2400	21.0	60	8.6	51.7	155	159	6:20	961	1006
	19.5	55	8.1	48.5	148	153	6:47	908	1037
	18.0	50	7.6	45.5	140	147	7:18	1076	1073
	16.2	44	7.1	42.5	129	138	8:01	1025	1106
2200	21.0	51	7.4	44.5	142	148	7:28	1051	1105
	17.8	44	6.7	39.9	129	138	8:24	1068	1159
2000									

CRUISE & RANGE AT ECONOMY CRUISE
12,000 FT, -9° C

MIXTURE SETTING:
Lean mixture in accordance with instructions in Section IV.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	19.8	64	9.6	57.5	161	166	5:40	869	882
	18.8	60	9.2	55.1	156	162	5:55	898	947
	17.5	55	8.6	51.5	150	150	6:20	923	977
	16.2	50	7.7	46.2	143	149	6:45	947	1005
	14.6	44	7.4	44.4	130	139	7:28	955	1037
2600	19.6	60	8.9	53.3	156	162	6:10	896	973
	18.2	55	8.4	50.1	150	156	6:34	959	1011
	16.8	50	7.8	46.7	143	149	7:00	983	1043
	15.5	45	7.3	43.5	134	141	7:35	990	1069
	14.8	43	7.1	42.5	129	138	7:50	990	1081
2400	19.6	56	8.2	49.3	151	156	6:40	973	1039
	17.9	50	7.6	45.5	143	149	7:20	1016	1092
	16.4	45	7.0	42.0	134	141	7:54	1030	1113
	15.2	42	6.7	40.0	126	136	8:20	1025	1133
2200	19.4	49	7.2	43.0	141	147	7:40	1059	1126
	18.0	45	6.8	40.5	134	141	8:10	1080	1151
	17.8	42	6.4	38.5	126	136	8:35	1081	1180
2000									

CRUISE & RANGE AT ECONOMY CRUISE
14,000 FT, -13° C

MIXTURE SETTING:
Lean mixture in accordance with instructions in Section IV.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	18.4	58	8.9	53.5	156	162	6:05	912	964
	17.4	55	8.6	51.5	152	158	6:17	929	986
	16.1	50	7.7	46.2	143	152	6:42	946	1012
	14.4	44	7.4	44.4	130	142	7:20	948	1043
2600	18.2	56	8.4	50.6	153	160	6:30	994	1040
	16.7	50	7.8	46.7	143	152	7:00	1001	1064
	14.8	43	7.6	45.5	129	122	7:48	1006	951
2400	18.2	52	7.8	46.6	147	154	7:05	1000	1068
	16.2	45	7.0	42.0	134	143	7:45	1016	1116
	15.3	42	6.7	40.0	126	139	8:10	1016	1138
2200									
2000									

CRUISE & RANGE AT BEST POWER
SEA LEVEL, 15°C

MIXTURE SETTING:
1. Use FULL RICH mixture above 75% power. 2. Lean mixture in accordance with instructions in Section IV at 75% power and below.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	30.2	100	18.4	110.5	175	176	2:35	452	454
	26.2	85	15.8	94.5	163	166	3:15	530	539
	23.5	75	12.5	75.0	156	158	4:12	655	663
	21.0	65	11.3	67.5	147	149	4:45	698	707
	18.0	55	10.0	60.0	136	140	5:30	748	770
	14.9	43	8.7	52.0	118	124	6:30	767	806
2600	30.1	94	14.8	89.0	169	172	2:55	492	501
	27.5	85	13.7	82.0	163	166	3:15	529	539
	24.7	75	12.3	74.0	156	158	4:20	675	684
	21.8	65	10.9	65.5	147	149	4:55	722	732
	19.0	55	9.8	59.0	136	140	5:45	782	805
	15.1	41	8.2	49.0	115	122	6:55	795	843
2400	28.7	80	14.8	88.5	160	162	3:25	546	553
	27.0	75	12.0	72.0	156	158	4:30	702	711
	24.0	65	10.7	64.0	147	149	5:05	747	757
	21.0	55	9.5	57.0	136	140	5:50	793	816
	16.2	41	7.5	45.2	110	119	7:30	825	892
2200	27.1	68	11.3	67.5	150	153	5:05	762	777
	22.5	55	9.2	55.0	136	140	6:05	827	851
	20.8	50	8.6	51.5	130	134	6:30	845	871
	19.0	45	7.8	47.0	122	128	7:05	864	906
	17.2	40	7.5	44.8	113	120	7:40	865	919
2000	24.0	53	8.6	51.5	134	137	6:30	871	890
	23.0	50	8.3	50.0	130	134	6:50	888	915
	21.0	45	7.8	46.5	122	128	7:20	894	938
	17.0	36	6.7	40.0	103	113	8:33	880	966

CRUISE & RANGE AT BEST POWER
2000 FT, 11°C

MIXTURE SETTING:
1. Use FULL RICH mixture above 75% power. 2. Lean mixture in accordance with instructions in Section IV at 75% power and below.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	28.1	93	14.9	89.5	173	175	3:00	500	500
	26.0	85	13.8	83.0	167	169	3:10	534	543
	23.3	75	12.6	75.4	159	161	4:15	669	682
	20.6	65	11.3	67.5	149	153	4:50	714	730
	18.0	55	10.0	60.0	138	142	5:25	754	778
	15.5	45	8.8	53.0	123	130	6:15	766	817
2600	28.1	88	14.1	84.5	169	172	3:05	526	530
	24.4	75	12.3	74.0	159	161	4:20	682	695
	21.6	65	11.0	66.0	149	153	4:55	730	749
	18.8	55	9.8	59.0	138	142	5:35	773	802
	16.0	44	8.5	51.0	123	129	6:35	797	851
2400	28.0	79	12.6	75.5	162	165	3:30	569	575
	26.8	75	12.0	72.0	159	161	4:25	705	721
	23.6	65	10.7	64.0	149	153	5:05	758	782
	20.4	55	9.5	57.0	138	142	5:50	808	837
	16.5	43	8.1	48.5	120	128	7:00	834	895
2200	25.4	64	10.4	62.5	149	152	5:20	791	810
	22.2	55	9.2	55.0	138	142	6:05	834	863
	18.7	45	8.0	48.0	123	130	6:50	827	917
	17.5	42	7.7	46.0	118	109	7:20	864	930
2000	22.5	50	8.6	51.5	131	136	6:30	886	930
	20.5	45	8.0	48.0	123	130	7:20	897	917
	18.5	40	7.3	44.0	115	123	7:55	897	977

CRUISE & RANGE AT BEST POWER
4000 FT, 7°C

MIXTURE SETTING:
1. Use FULL RICH mixture above 75% power. 2. Lean mixture in accordance with instructions in Section IV at 75% power and below.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	26.5	87	14.2	85.0	171	174	3:10	521	539
	25.8	85	13.8	83.0	170	172	3:12	539	546
	23.2	75	12.5	75.0	161	164	4:10	673	692
	20.5	65	11.3	67.5	152	155	4:45	717	738
	17.9	55	10.0	60.0	140	144	5:25	752	782
	15.3	45	8.9	53.5	125	132	6:12	756	818
2600	26.2	82	13.3	79.5	168	170	3:20	556	566
	24.4	75	12.3	74.0	161	164	4:20	691	705
	21.5	65	10.9	65.5	152	155	4:52	734	756
	18.7	55	9.8	59.0	140	144	5:35	773	808
	15.7	44	8.5	51.0	107	113	6:30	799	847
2400	26.2	74	11.8	71.0	161	163	4:35	712	734
	23.3	65	10.7	64.0	152	155	5:05	756	787
	20.2	55	9.5	57.0	140	144	5:50	812	838
	16.7	44	8.2	49.0	124	130	6:50	843	892
2200	24.4	62	10.0	60.0	149	153	5:30	818	830
	22.0	55	9.2	55.0	140	144	6:00	838	871
	18.6	45	7.8	47.0	125	131	7:00	869	923
	17.6	42	7.7	46.0	123	128	7:20	871	934
2000	22.4	50	8.3	50.0	134	138	6:45	895	936
	20.4	45	7.8	46.5	125	131	7:15	908	963
	18.4	40	7.2	43.0	116	124	7:55	914	986

CRUISE & RANGE AT BEST POWER
6000 FT, 3° C

MIXTURE SETTING:
1. Use FULL RICH mixture above 75% power. 2. Lean mixture in accordance with instructions in Section IV at 75% power and below.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	24.7	81	13.3	80.0	169	174	3:20	573	573
	23.1	75	12.5	75.0	164	167	4:15	682	699
	20.4	65	11.3	67.5	155	157	4:45	725	747
	17.8	55	10.0	60.0	142	147	5:25	763	795
	15.2	45	8.9	53.5	126	134	6:15	782	834
2600	24.1	75	12.3	74.0	164	167	4:20	691	708
	21.3	65	10.9	65.5	154	157	4:55	743	765
	18.5	55	9.8	59.0	142	148	5:35	786	812
	15.8	45	8.6	51.5	126	135	6:25	810	864
2400	24.4	70	11.3	68.0	160	162	4:45	743	765
	22.8	65	10.7	64.0	154	157	5:05	769	795
	19.8	55	9.5	57.0	142	148	5:45	821	851
	16.5	44	8.0	48.0	124	133	6:50	847	906
2200	23.6	60	9.8	58.5	148	153	5:35	821	851
	21.8	55	9.2	55.0	142	148	6:00	847	882
	20.0	50	8.6	51.5	135	141	6:20	864	908
	17.6	43	7.8	46.5	123	131	7:10	878	943
2000	21.2	47	8.0	48.0	130	138	6:45	908	924
	19.2	42	7.4	44.5	121	130	7:20	912	986

CRUISE & RANGE AT BEST POWER
8000 FT, -1° C

MIXTURE SETTING:
1. Use FULL RICH mixture above 75% power. 2. Lean mixture in accordance with instructions in Section IV at 75% power and below.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	23.6	75	12.6	75.5	169	171	4:10	686	704
	21.7	70	11.9	71.5	162	166	4:25	708	730
	20.4	65	11.3	67.5	157	161	4:40	730	756
	19.0	60	10.7	64.0	151	156	5:00	752	778
	17.8	55	10.1	60.5	145	150	5:20	769	801
	15.2	45	8.9	53.5	129	136	6:10	786	839
2600	23.0	71	11.8	71.0	164	168	4:20	721	738
	21.2	65	11.1	66.5	157	161	4:50	749	772
	19.8	60	10.4	62.5	151	156	5:10	773	795
	18.6	55	9.8	59.0	145	150	5:30	791	821
	17.0	50	9.3	55.5	137	143	5:50	808	843
	15.6	45	8.7	52.0	129	136	6:25	815	864
2400	22.8	64	10.6	63.5	157	161	5:10	784	808
	21.3	60	10.1	60.5	151	156	5:25	804	830
	19.8	55	9.5	57.0	145	150	5:45	825	856
	18.2	50	8.9	53.5	137	143	6:10	841	882
	16.4	44	8.2	49.0	127	135	6:45	847	908
2200	22.0	55	9.2	55.0	145	150	5:55	851	886
	20.0	50	8.6	51.5	137	143	6:25	873	917
	17.5	43	7.8	46.5	125	133	7:10	880	949
2000	20.3	45	7.8	46.5	129	136	7:10	917	975
	19.0	42	7.4	44.5	122	131	7:30	917	989

CRUISE & RANGE AT BEST POWER
10,000 FT, -5° C

MIXTURE SETTING:
1. Use FULL RICH mixture above 75% power. 2. Lean mixture in accordance with instructions in Section IV at 75% power and below.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	21.4	70	11.9	71.5	165	169	4:25	715	740
	20.2	65	11.3	67.5	160	164	4:40	737	766
	18.8	60	10.7	64.0	155	159	5:00	760	793
	17.6	55	10.0	60.0	148	153	5:20	778	817
	16.3	50	9.5	57.0	140	147	5:40	792	836
	15.3	46	9.0	54.0	133	141	6:00	793	849
2600	21.1	65	11.0	66.0	160	164	4:50	756	782
	19.8	60	10.4	62.5	155	159	5:10	778	811
	18.3	55	9.8	59.0	148	153	5:25	798	838
	17.0	50	9.2	55.0	140	147	5:40	812	858
	15.5	46	8.8	52.5	133	141	6:05	819	876
2400	21.0	60	10.1	60.5	155	159	5:25	810	843
	19.5	55	9.5	57.0	148	153	5:45	832	871
	18.0	50	8.8	53.0	140	147	6:05	850	897
	16.8	46	8.4	50.5	133	141	6:30	858	912
2200	21.0	53	8.9	53.5	144	150	6:08	877	912
	19.8	50	8.6	51.5	141	147	6:12	884	928
	18.4	46	8.2	49.0	133	141	6:40	886	949
2000									

CRUISE & RANGE AT BEST POWER
12,000 FT, -9°C

MIXTURE SETTING:
1. Use FULL RICH mixture above 75% power. 2. Lean mixture in accordance with instructions in Section IV at 75% power and below.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	19.8	64	11.2	67.0	161	166	4:50	738	782
	18.8	60	10.7	64.0	156	162	5:00	756	798
	17.5	55	10.1	60.5	150	156	5:20	778	819
	16.2	50	9.5	57.0	143	149	5:40	791	843
	15.2	46	9.0	54.0	136	143	6:00	801	856
2600	19.6	60	10.4	62.5	156	162	5:10	778	817
	18.2	55	9.8	59.0	150	156	5:30	799	843
	16.8	50	9.3	55.5	143	149	5:50	815	864
	15.7	46	8.8	52.5	136	143	6:10	825	883
2400	19.6	56	9.6	57.5	151	156	5:40	825	899
	17.9	50	8.8	53.0	143	149	6:10	856	905
	16.4	45	8.3	49.5	134	141	6:35	863	926
2200	19.6	50	8.6	51.5	142	149	6:15	879	930
	18.0	45	8.0	48.0	131	141	6:50	893	960
2000									

CRUISE & RANGE AT BEST POWER
14,000 FT, -13°C

MIXTURE SETTING:
1. Use FULL RICH mixture above 75% power. 2. Lean mixture in accordance with instructions in Section IV at 75% power and below.

RPM	MAN PRES (IN. HG)	% BHP	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED KNOTS 2740 LBS	TRUE AIRSPEED KNOTS 2300 LBS	ENDURANCE (HR: MIN)	RANGE (NAUT MI) 2740 LBS	RANGE (NAUT MI) 2300 LBS
2700	18.4	58	11.0	66.0	156	162	5:10	772	812
	17.4	55	10.1	60.5	151	158	5:15	782	825
	16.1	50	9.5	57.0	143	151	5:40	791	850
	15.6	48	9.3	55.5	139	149	5:50	792	860
2600	18.2	56	9.9	59.5	153	160	5:25	799	851
	16.7	50	9.2	55.0	143	151	5:50	812	873
	15.8	47	8.8	53.0	137	147	6:05	817	885
2400	18.2	52	9.1	54.5	147	154	5:55	847	902
	17.3	49	8.8	52.5	142	149	6:10	851	917
	16.4	46	8.4	50.5	136	145	6:30	853	930
2200									
2000									

NORMAL LANDING DISTANCES

ASSOCIATED CONDITIONS:

POWER----------THROTTLE CLOSED
LANDING GEAR-------DOWN
WING FLAPS--------- FULL DOWN (33°)
WEIGHT----------2740 LBS.

RUNWAY - PAVED, LEVEL, DRY SURFACE
APPROACH SPEED AT 50 FT - 71 KIAS

Wind Component Down Runway Knots	OAT °C	PRESSURE ALTITUDE									
		Sea Level		2000 FT.		4000 FT.		6000 FT.		8000 FT.	
		Ground Roll Feet	Total Over 50 Ft. Obstacle Feet	Ground Roll Feet	Total Over 50 Ft. Obstacle Feet	Ground Roll Feet	Total Over 50 Ft. Obstacle Feet	Ground Roll Feet	Total Over 50 Ft. Obstacle Feet	Ground Roll Feet	Total Over 50 Ft. Obstacle Feet
0	-20	773	1805	904	1911	1046	2103	1193	2373	1343	2667
	-10	804	1851	940	1969	1087	2107	1240	2450	1401	2755
	0	834	1906	976	2028	1129	2238	1287	2526	1454	2842
	10	865	1962	1011	2089	1170	2305	1334	2603	1508	2930
	20	896	2018	1047	2149	1211	2372	1382	2680	1561	3017
	30	926	2074	1083	2209	1253	2439	1429	2757	1614	3105
	40	956	2129	1118	2269	1294	2507	1476	2834	1667	3193
10	-20	728	1700	854	1805	990	1990	1131	2250	1281	2534
	-10	758	1746	889	1862	1030	2056	1177	2326	1332	2620
	0	788	1800	924	1920	1070	2122	1223	2400	1384	2706
	10	818	1855	958	1979	1110	2187	1268	2475	1436	2791
	20	848	1910	993	2038	1150	2253	1315	2551	1488	2877
	30	877	1964	1028	2097	1191	2319	1361	2626	1540	2963
	40	906	2018	1062	2155	1231	2386	1407	2702	1592	3036
20	-20	688	1601	808	1703	938	1882	1074	2132	1218	2406
	-10	717	1646	841	1758	977	1946	1119	2206	1269	2491
	0	745	1698	875	1814	1017	2012	1163	2279	1319	2574
	10	774	1751	909	1874	1055	2075	1208	2353	1370	2658
	20	804	1806	943	1931	1094	2139	1253	2426	1421	2742
	30	832	1859	977	1989	1134	2204	1298	2501	1471	2827
	40	860	1911	1010	2046	1173	2269	1343	2575	1522	2884

NOTE: Maximum demonstrated crosswind velocity is 11 Knots.

MAXIMUM PERFORMANCE LANDING DISTANCES

POWER ---------- THROTTLE CLOSED
LANDING GEAR-------- DOWN
WING FLAPS---------- FULL DOWN (33°)
WEIGHT----------2740 LBS.

RUNWAY - PAVED, LEVEL, DRY SURFACE
APPROACH SPEED AT 50 FT. - **65 KIAS**

Wind Component Down Runway Knots	OAT °C	PRESSURE ALTITUDE									
		Sea Level		2000 FT.		4000 FT.		6000 FT.		8000 FT.	
		Ground Roll Feet	Total Over 50 Ft. Obstacle Feet	Ground Roll Feet	Total Over 50 Ft. Obstacle Feet	Ground Roll Feet	Total Over 50 Ft. Obstacle Feet	Ground Roll Feet	Total Over 50 Ft. Obstacle Feet	Ground Roll Feet	Total Over 50 Ft. Obstacle Feet
0	-20	676	1457	735	1585	792	1744	854	1958	911	2219
	-10	703	1501	764	1633	823	1798	888	2019	947	2290
	0	730	1545	793	1681	855	1852	921	2081	983	2361
	10	757	1588	822	1730	886	1906	955	2142	1019	2432
	20	783	1632	851	1778	917	1960	989	2204	1055	2503
	30	810	1675	880	1826	949	2014	1023	2265	1091	2574
	40	837	1719	909	1875	980	2068	1056	2327	1127	2644
10	-20	642	1375	699	1499	755	1653	816	1860	871	2110
	-10	668	1418	727	1546	785	1706	849	1919	907	2181
	0	695	1462	756	1594	816	1758	881	1980	942	2250
	10	721	1504	789	1641	846	1811	914	2040	977	2320
	20	746	1547	813	1689	877	1865	947	2100	1012	2389
	30	773	1590	841	1736	908	1918	981	2161	1048	2460
	40	799	1632	869	1784	939	1971	1013	2221	1083	2528
20	-20	611	1297	667	1417	721	1565	780	1763	835	2005
	-10	636	1338	694	1463	750	1616	812	1822	869	2073
	0	662	1381	722	1509	781	1669	844	1882	903	2141
	10	688	1423	749	1556	810	1720	876	1940	938	2210
	20	713	1466	777	1602	840	1773	909	2000	972	2278
	30	738	1506	805	1649	870	1824	941	2059	1007	2347
	40	764	1549	832	1696	900	1877	973	2119	1041	2414

NOTE: Maximum demonstrated crosswind velocity is 11 Knots.

SECTION VI.

WEIGHT & BALANCE

TABLE OF CONTENTS

TITLE	PAGE
INTRODUCTION	6-2
AIRPLANE WEIGHING PROCEDURE	6-3
OWNERS WEIGHT & BALANCE RECORD	6-5
PILOTS LOADING GUIDE	6-6
LOADING CALCULATION PROCEDURE	6-6
PROBLEM FORM	6-7
LOADING COMPUTATION GRAPH	6-7
CENTER-OF-GRAVITY MOMENT ENVELOPE	6-8
CENTER-OF-GRAVITY LIMITS ENVELOPE	6-8
EQUIPMENT LIST	6-9

NOTE:

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

Model - M20J

Aircraft Serial No. 24-1190

Aircraft Registration No. N1145G

8/24/81

Mooney Aircraft Corp. Approval Signature & Date

INTRODUCTION

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

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

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

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

The maximum certificated gross weight for the Model M20J under all operating conditions is 2740 pounds. 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 skin line above the tailcone access door when leveling the aircraft longitudinally. Level the aircraft by increasing or decreasing air pressure in the nose wheel tire.

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

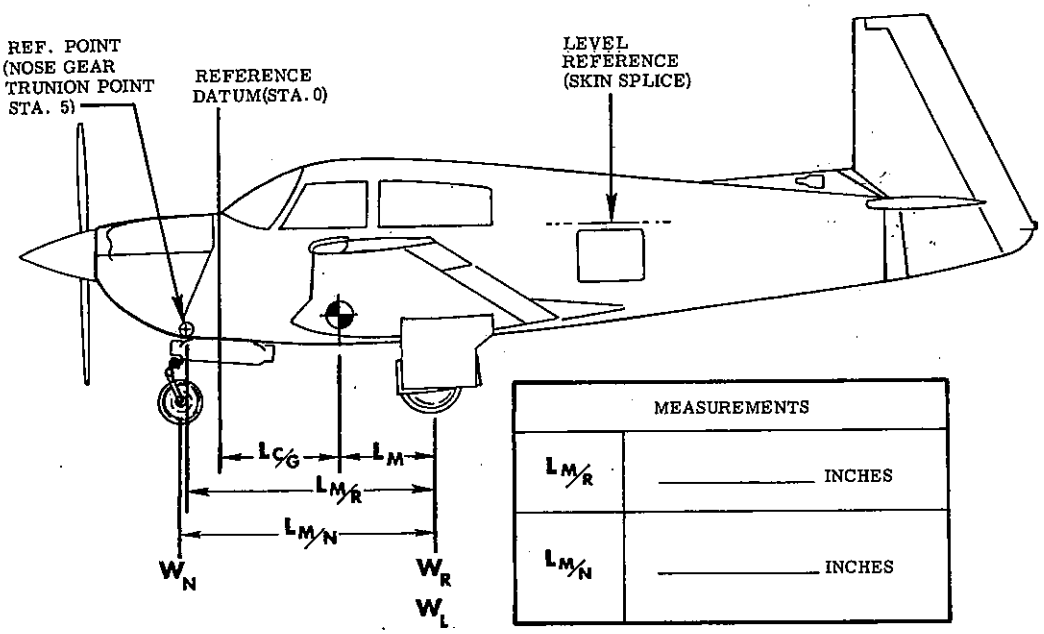
1. Check for installation of all equipment as listed in the Weight & Balance Record Equipment List.
2. Top off both tanks with full fuel. Subtract usable fuel (64.0 gal. @ 6 lb/gal = 384 lbs) from total weight as weighed.

OPTIONAL METHOD Ground aircraft and defuel tanks as follows:

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

3. Fill oil to capacity - 8 qts.
4. Position front seats in full forward position.
5. Position flaps in full up position.
6. Position a 2000-pound capacity scale under each of the three wheels.
7. Level aircraft as previously described making certain nose wheel is centered.
8. Weigh the aircraft and deduct any tare from each reading.
9. Find reference point by dropping a plumb bob from center of nose gear trunnion (retracting pivot axis) to the floor. Mark the point of intersection.
10. Locate center line of nose wheel axle and main wheel axles in the same manner.

11. Measure the horizontal distance from the reference point to main wheel axle center line. Measure horizontal distance from center line of nose wheel axle to center line of main wheel axles.
12. Record weights and measurements, and compute basic weight and CG as follows:



MEASUREMENTS	
$L_{M/R}$	_____ INCHES
$L_{M/N}$	_____ INCHES

SCALE POSITION AND SYMBOL	SCALE READING	TARE	NET WEIGHT
Nose Wheel (W_N)			
Right Main Wheel (W_R)			
Left Main Wheel (W_L)			
Basic Empty Weight, as Weighed (W_T)			

a. CG Forward of Main Wheels:

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

b. CG Aft of Datum (Station 0):

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

OWNERS WEIGHT AND BALANCE RECORD

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

AIRPLANE MODEL - M20J	SERIAL NUMBER 24-1190	FAA REGISTRATION NO. N1145G

DATE	DESCRIPTION OF MODIFICATION	WEIGHT CHANGE				RUNNING EMPTY WEIGHT			
		ADDED (+)		REMOVED (-)					
		Wt. (Pounds)	Arm (Inches)	Wt. (Pounds)	Arm (Inches)	Wt. (Pounds)	Moment /1000	Arm (Inches)	Useful Load
8/24/81	BASIC EMPTY WEIGHT AS DELIVERED (W_T) (INCLUDES FULL OIL - 8 QTS)	—	—	—	—	1838	85.21	46.4	902

PILOT'S LOADING GUIDE

LOADING CALCULATION PROCEDURE

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

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

Step 1. Refer to the latest entry on page 6-5 for the current empty weight and moment.
NOTE: Since the engine oil is normally kept at the full level, the oil weight and moment is included in basic empty weight and is constant in calculating all loading problems.

Step 2. Note the pilot's weight and the position his seat will occupy in flight. Find this weight on the left scale of the Loading Computation Graph (page 6-7) and cross the graph horizontally to the point representing the pilot's seat position between the FWD and AFT position lines on the graph for #1 and #2 seats. When this point is located, drop down to the bottom scale to find the value of the moment/1000 due to the pilot's weight and seat position.

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

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

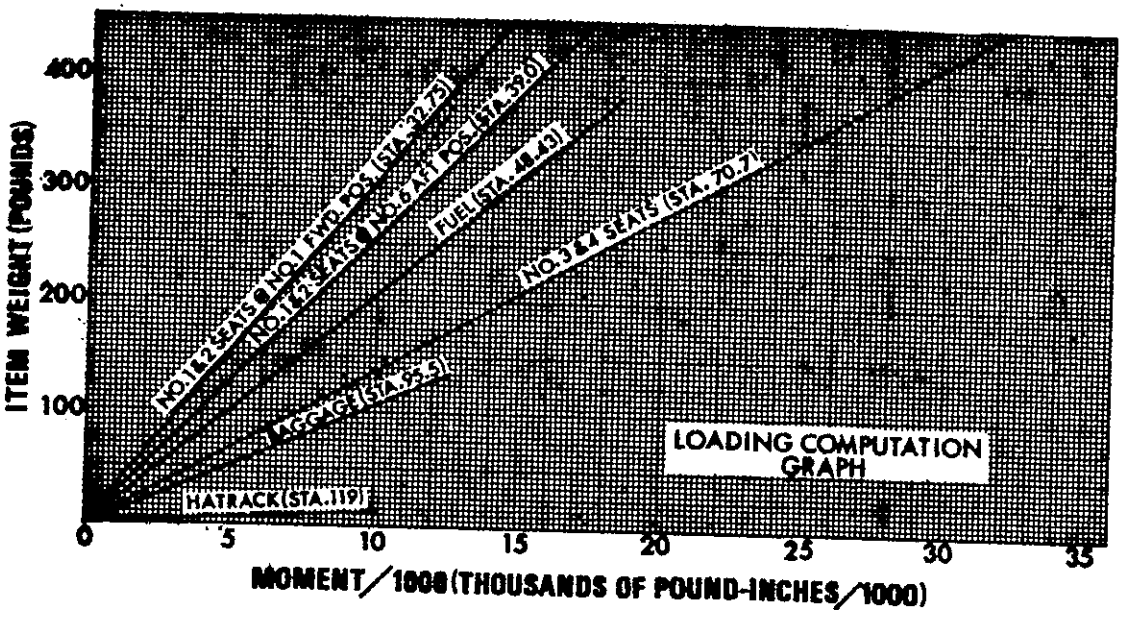
Step 4. Again proceed as in Step 2 to account for the amount of fuel carried, and enter the weight and moment/1000 values in the proper columns.

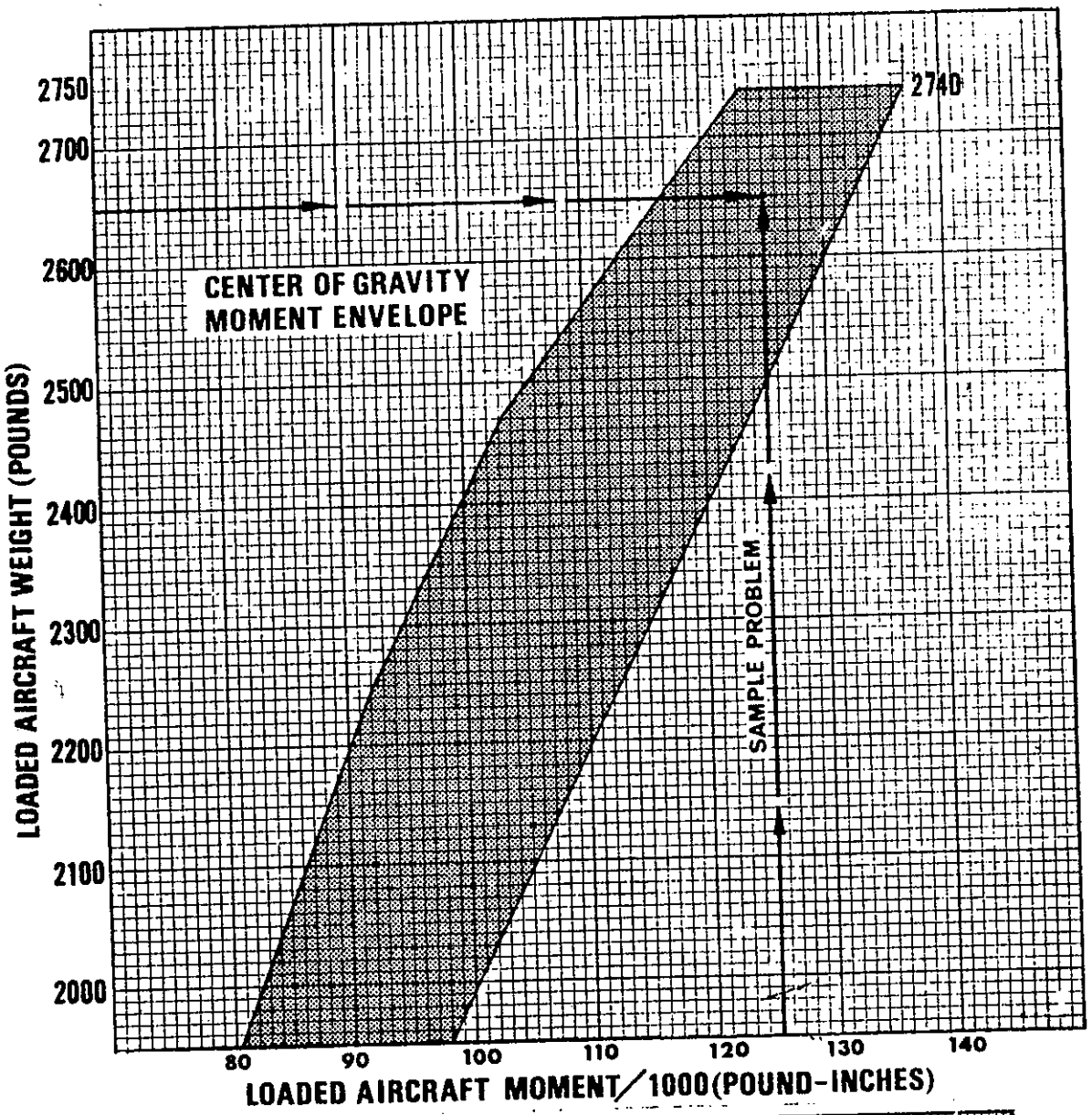
PROBLEM FORM

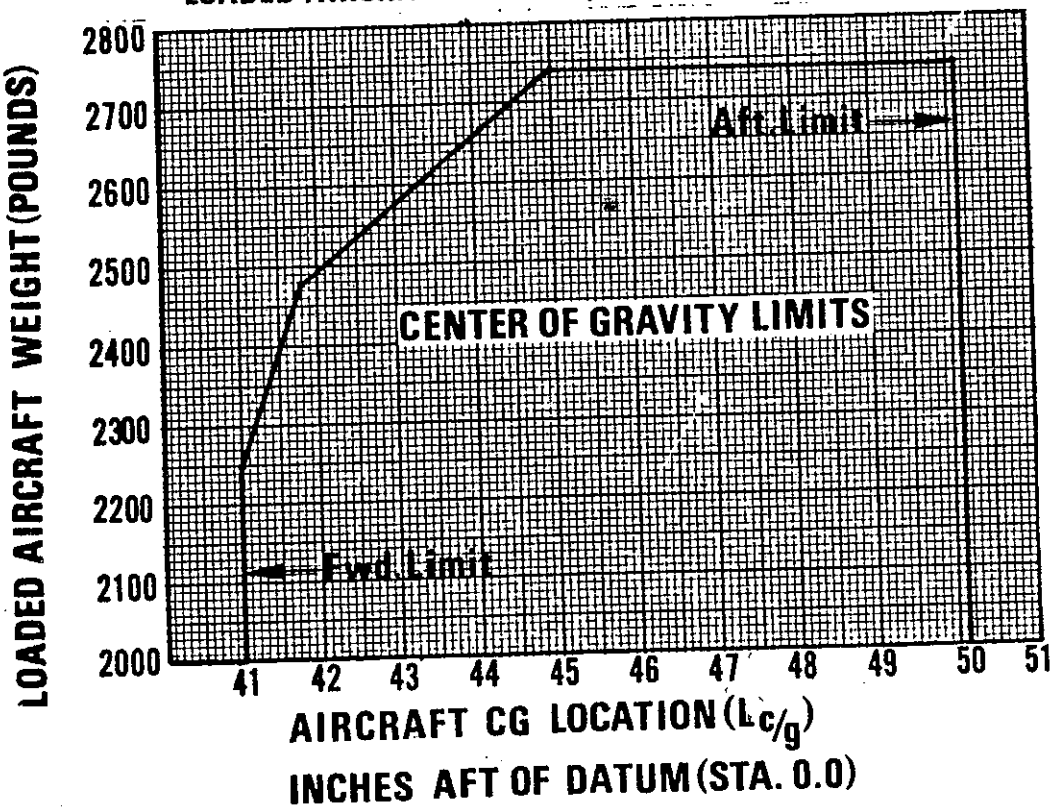
FAA REGISTRATION NO._____ M20J SERIAL NO._____

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

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




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


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

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

Step 6. Total the weight columns. This total must be 2740 pounds or less. Total the Moment/1000 column. Do not forget to subtract negative numbers.

Step 7. Refer to the Center-of-Gravity Moment Envelope (page 6-8). Locate the loaded weight of your airplane on the left scale of the graph and trace a line horizontally to the right. Locate the total moment/1000 value for your airplane on the bottom scale of the graph and trace a line vertically above this point until the horizontal line for weight is intersected. If the point of intersection is within the shaded area, your aircraft loading is acceptable. If the point of intersection falls outside the shaded area, you must rearrange the load before takeoff.

EQUIPMENT LIST

The following Equipment List is a listing of all items approved at the time of publication for the Mooney M20J.

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

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

NOTE

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

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

EQUIPMENT LIST

MO	8			
DAY	24			
YEAR	81			

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

EQUIPMENT LIST

					MO			
					DAY			
					YEAR			
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	A. Powerplant and Accessories cont.							
6A	Spinner Installation	680031-505	4.80	-35.00	X			
7A	Induction Air Filter (Donaldson)	P-13-0234	1.00	-25.50	X			

EQUIPMENT LIST

					MO				
					DAY				
					YEAR				
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED				
	B. Electrical System								
1B	Battery 35 Amp Hr.	800330-000	28.10	+110.80	X				
2B	Regulator	800330-000	1.44	+4.00	X				
3B	Heated Pitot Installation	820252-501	.70	+38.00	X				
4B	Aux. Power Receptacle Instl	950086-509	2.60	+111.00					
5B	Rotating Beacon Installation	800331-000	1.68	+168.00					
6B	Cigarette Lighter	800330-000	.17	+19.50	X				
7B	Fuel Pump	1499-00-19	1.91	+7.50	X				
8B	Stall Warning Indicator (Mallory)	800330-000	1.00	+50.00	X				
9B	Gear Warning Indicator (Mallory)	800330-000	1.00	+50.00	X				
10B	Wingtip Strobe Light Instl	800330-000	1.54	+53.00					

EQUIPMENT LIST

MO.	8	
DAY	24	
YEAR	81	

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED		
	B. ELECTRICAL SYSTEM (cont)						
12B	Landing Lights	650180	.75	-20.5	X		
13B	Actuator, Flap	750097	5.1	103.12	X		
14B	Fuel Qty. Transmitter, Inbd (2 ea)	610256	.45	48.0	X		
15B	Fuel Qty. Transmitter, Outbd (2 ea)	610256	.45	48.5	X		
16B	Actuator, Landing Gear	560254	11.2	39.0	X		
17B	E.L.T.	810081	2.1	121.0	X		

EQUIPMENT LIST

					MO	8		
					DAY	24		
					YEAR	81		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED
	C. WHEELS TIRES & BRAKES				
1C	Two Main Wheel & Brake Assys (6.00X6)	520022	13.72*	64.4	X
	Wheel Assy (2) (CLEVELAND 40-86)	520022	11.00	63.98	
	Brake Assy (2) (CLEVELAND 30-56A)	520022	2.72	65.98	
2C	Nose Wheel Assy (500X5) (CLEVELAND 40-87)	540000	2.60	-5.3	X
3C	Two Main Wheel Tire Assys	520022	17.0	63.98	X
	(6-Ply Rating Tires, 6.00X6 ,				
	Type III, with regular tubes)				
4C	Nose Wheel Tire Assy	540000	7.00	-5.3	X
	(6-ply rating tire, 5.00 X 5 Type III, with regular tube)				

EQUIPMENT LIST

MO.	9	
DAY	24	
YEAR	81	

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

EQUIPMENT LIST

MO	8			
DAY	24			
YEAR	81			

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

EQUIPMENT LIST

					MO	8		
					DAY	24		
					YEAR	81		
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	D. Instruments (cont.)							
12D	Tachometer Mechanical	820309	.63	18.95	X			
13D	Alternate Static Air Source	820252	.25	18.5	X			
14D	Annunciator Panel	820309	.70	17.5	X			

EQUIPMENT LIST

					MO	8		
					DAY	24		
					YEAR	81		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	E. Vacuum System							
1E	Vacuum System Instl	860052	6.30*	10.19	X			
	Vacuum Pump (211cc)	860052	2.5	-5.00				

Mooney M20J

EQUIPMENT LIST

					MO	9			
					DAY	24			
					YEAR	81			
ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED				
	F. Cabin Accommodations								
1F	Sun Visors	130291	1.0	33.00	X				
2F	Shoulder Harness, Front & Back (Set of four)	140205	8.4	76.48	X				
3F	Belt Assy, Rear Occupant Lap (2)	130291	2.0	71.00	X				
4F	Belt Assy, Front Occupant Lap(2)	130291	2.0	35.00	X				

EQUIPMENT LIST

					MO	8		
					DAY	24		
					YEAR	81		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	G. Avionics & Autopilots							
1G	Weather Radar Instl, Color	810409	38.3	34.3				
2G	Weather Radar Instl, Monochromatic	810409	26.8	34.7				
3G	King KMA 24	810081	1.7	+19.0	X			
4G	King KT-76A	810081	3.8	+19.36	X			
5G	King KR-87 W/KI 227	810081	6.9	+39.1	X			
6G	King KY 197	810081	3.7	+14.1	X			
7G	King KY 197	810081	3.7	+14.1	X			
8G	King KNS-80	810081	6.0	+15.0	X			
9G	King KN-53 W/KI 204	810081	4.8	+15.0	X			
10G	Encoder-United Inst., Inc.	810081	1.9	+14.0	X			

EQUIPMENT LIST

MO	8		
DAY	24		
YEAR	81		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED
	G. Avionics & Autopilots (cont...)				
	Autopilot KFC 200	830125	37.5	+94.8	X
11G					
12G					
13G					
14G					
15G					
16G					

EQUIPMENT LIST

					MO	8		
					DAY	24		
					YEAR	81		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	H. Auxiliary Equipment							
1H	Tow Bar (Stowed)	010001	1.25	95.5	X			
2H	Jack Points (Stowed)	010000	.10	119.0	X			
3H	Wing Tie Down Rings (Stowed)	010002	.10	119.0	X			
4H	Fuel Sampler Cup (Stowed)	610010	.05	119.0	X			

EQUIPMENT LIST

					MO	8		
					DAY	24		
					YEAR	81		

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	I. Optional Equipment							
1I	Oxygen System Installation	870007	37.2	125.0				
2I	**Curtains**	**950193**	**2.9**	**64.00**				
3I	**Headrest Assy**	130276	**1.22***	**45.00***	X			
4I	**Headrest Mount Bar**	950192	**.70**	**45.00**	X			
5I	Aux. Power Receptacle Instl	950086	2.60	111.00	X			
6I	Belly Strobe Light Instl	950196	3.57	113.30				
7I	Rotating Beacon Installation	800331	1.68	168.00				
8I	Brake Instl, Dual	950239	3.00	15.0				
9I	Fire Extinguisher Instl	950231	5.25	21.51	X			
10I	Fixed Step Assy	840071	2.16	108.0	X			

EQUIPMENT LIST

MO.	8			
DAY	24			
YEAR	81			

ITEM NO.	ITEM DESCRIPTION	REF. DRAWING	WEIGHT (POUNDS)	ARM (INCHES)	MARK IF INSTALLED			
	I. Optional Equipment (cont.)							
11I	Fuel Flow System (M20J)	950233	.88	1.95				
12I	Hour Meter Instl (M20J)	950229	.29	18.50				
13I	Trim Actuator, Electric (King)	830125	5.14	134.85				
14I	Electric Tachometer	880002	.8	18.0				

SECTION VII.

AIRPLANE & SYSTEMS DESCRIPTION

TABLE OF CONTENTS

TITLE	PAGE
INTRODUCTION	7-3
AIRFRAME	7-3
POWER PLANT	7-4
ENGINE CONTROLS	7-4
IGNITION SYSTEM	7-5
FUEL SYSTEM	7-6
OIL SYSTEM	7-8
ENGINE COOLING	7-8
VACUUM SYSTEM	7-8
PROPELLER	7-8
FLIGHT PANEL & CONTROLS FAMILIARIZATION	7-9
FLIGHT INSTRUMENTS & CONTROLS	7-9
ENGINE INSTRUMENTS & CONTROLS	7-15
MISCELLANEOUS INSTRUMENTS, CONTROLS & INDICATORS	7-19
ANNUNCIATOR AND SWITCH PANEL	7-22
FLIGHT CONTROLS	7-24
PRIMARY FLIGHT CONTROLS	7-24
TRIM CONTROLS	7-24
WING FLAP CONTROLS	7-24
PITOT-STATIC SYSTEM	7-25
STALL WARNING SYSTEM	7-25
EMERGENCY LOCATOR TRANSMITTER	7-25

LANDING GEAR 7-27

ELECTRIC GEAR RETRACTION SYSTEM . . 7-27
EMERGENCY GEAR EXTENSION SYSTEM . . 7-28
BRAKE & STEERING SYSTEMS 7-28

ELECTRICAL POWER 7-28

ALTERNATOR & BATTERY 7-28
CIRCUIT BREAKERS 7-30
ANNUNCIATOR LIGHTS 7-31
INSTRUMENT & PLACARD LIGHTS 7-31
CABIN LIGHTING 7-31
EXTERIOR LIGHTING 7-32

CABIN ENVIRONMENT 7-32

HEATING & VENTILATING SYSTEMS 7-32
WINDSHIELD DEFROSTING SYSTEM 7-33

CABIN 7-33

SEATS & SAFETY BELTS 7-33
SAFETY HARNESS 7-34
BAGGAGE & CARGO AREAS 7-35
DOORS, WINDOWS & EXITS 7-35

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

AIRFRAME

The airframe has a welded, tubular-steel cabin structure enclosed in sheet-aluminum skins. Stressed skins rivet to main and auxiliary spars in the wing, stabilizer, and vertical fin. The laminar-flow wing has full wrap-around skins with flush riveting over the forward top and bottom two thirds of the wing area.

For pitch trim control, the empennage pivots on the aft fuselage. A torque-tube-driven jack screw, bolted to the rear tailcone bulkhead, sets the stabilizer angle.

The forward-opening cabin door provides access to both front and rear seats. The baggage compartment door is located above the right wing trailing edge to permit baggage loading from the ground.

The tricycle landing gear allows maximum taxi vision and ground maneuvering. Hydraulic disc brakes and a steerable nose wheel aid in positive directional control during taxiing and crosswind landings.

The landing gear is electrically retracted and extended. A gear warning horn, a gear position indicator on the floorboard and a green "gear down" light help prevent inadvertent gear-up landings. A manual emergency gear extension system is provided for use in the event of an electrical failure.

ENGINE CONTROLS

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

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

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

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

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

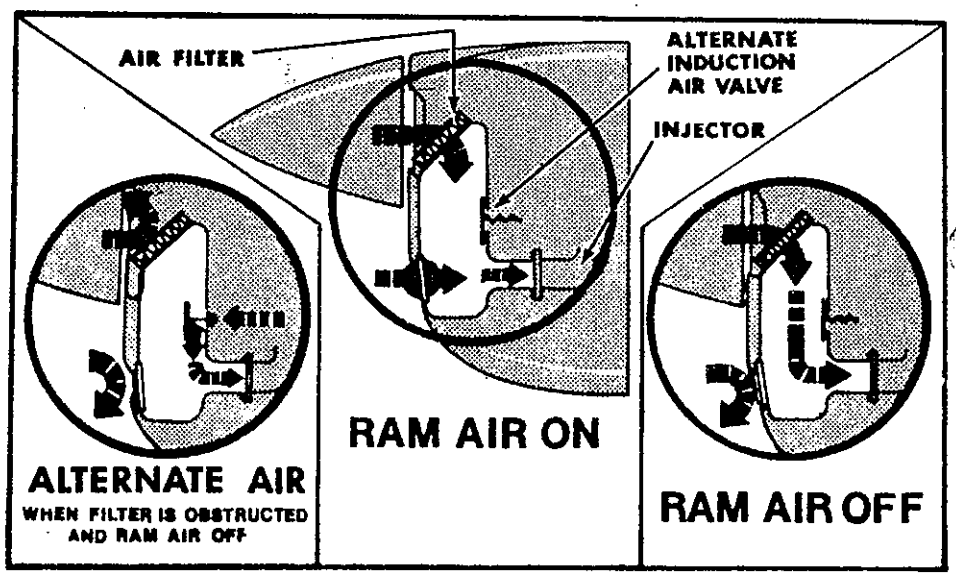


FIGURE 7-1 ENGINE AIR INDUCTION SYSTEM

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

IGNITION SYSTEM

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

to fire the engine. After the engine starts, the impulse coupling flyweights do not engage due to centrifugal action. The coupling then acts as a straight drive and the magneto fires at the normal firing position of the engine. The magneto/starter switch is spring loaded to return from START to the BOTH position when released.

CAUTION

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

WARNING

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

FUEL SYSTEM

Fuel is carried in two integral sealed sections of the forward inboard area of the wings. Total usable fuel capacity is 64 gallons. Both tanks have fuel level indicators visible through the filler ports. These indicators show the 25-gallon level in each tank. There are sump drains at the lowest point in each tank for taking fuel samples to check for sediment contamination and condensed water accumulation.

The recessed three-position fuel selector handle aft of the console on the floor allows the pilot to set the selector valve to LEFT tank, RIGHT tank, or OFF position. The gascolator, located to the left of the selector valve in the floorboard, is for draining condensed water and sediment from the lowest point in the fuel lines before the first flight of the day and after each refueling.

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

Electric fuel-level transmitters in the tanks operate the fuel gages. The master switch actuates the fuel quan-

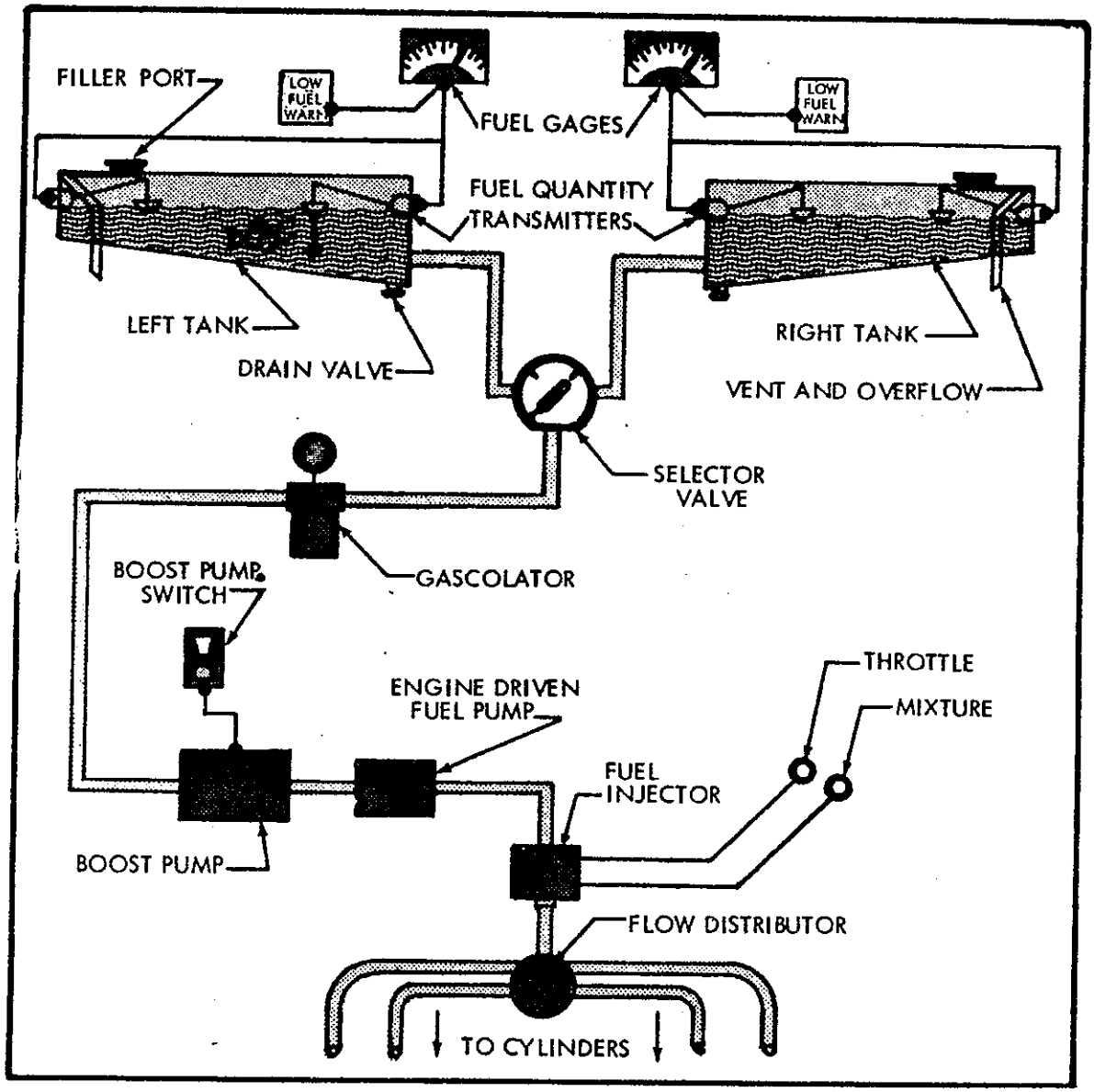


FIGURE 7-2 FUEL SYSTEM SCHEMATIC

tity indicator system to maintain an indication of fuel remaining in each tank. The fuel pressure gage registers fuel pressure in the line to the injector. Vents in each fuel tank allow for overflow and ventilation.

The optional visual fuel quantity indicators located on top of each wing tank are to be used for partial fuel loading only and not for preflight inspection purposes.

OIL SYSTEM

The engine has a full-pressure wet-sump oil system with an 8-quart capacity. An automatic bypass control valve routes oil flow around the oil cooler when operating temperatures are below normal or when the cooling radiator is blocked.

ENGINE COOLING

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

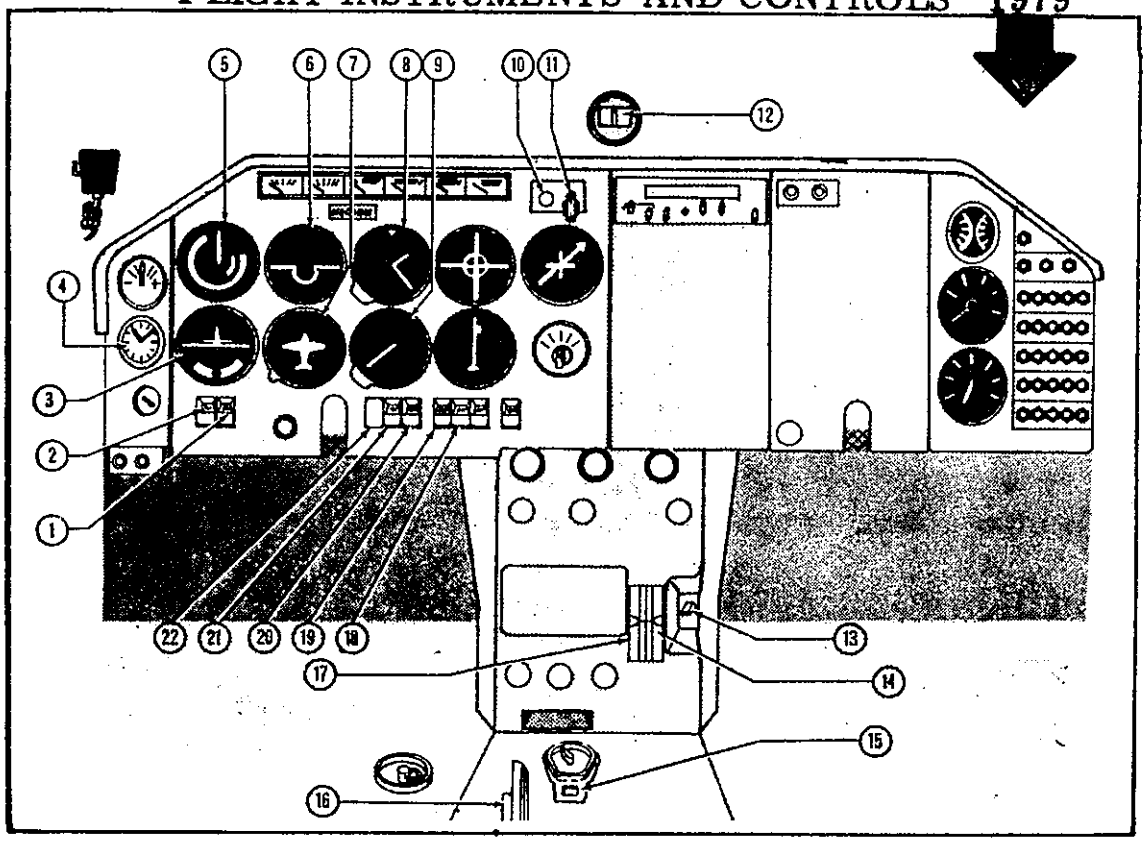
VACUUM SYSTEM

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

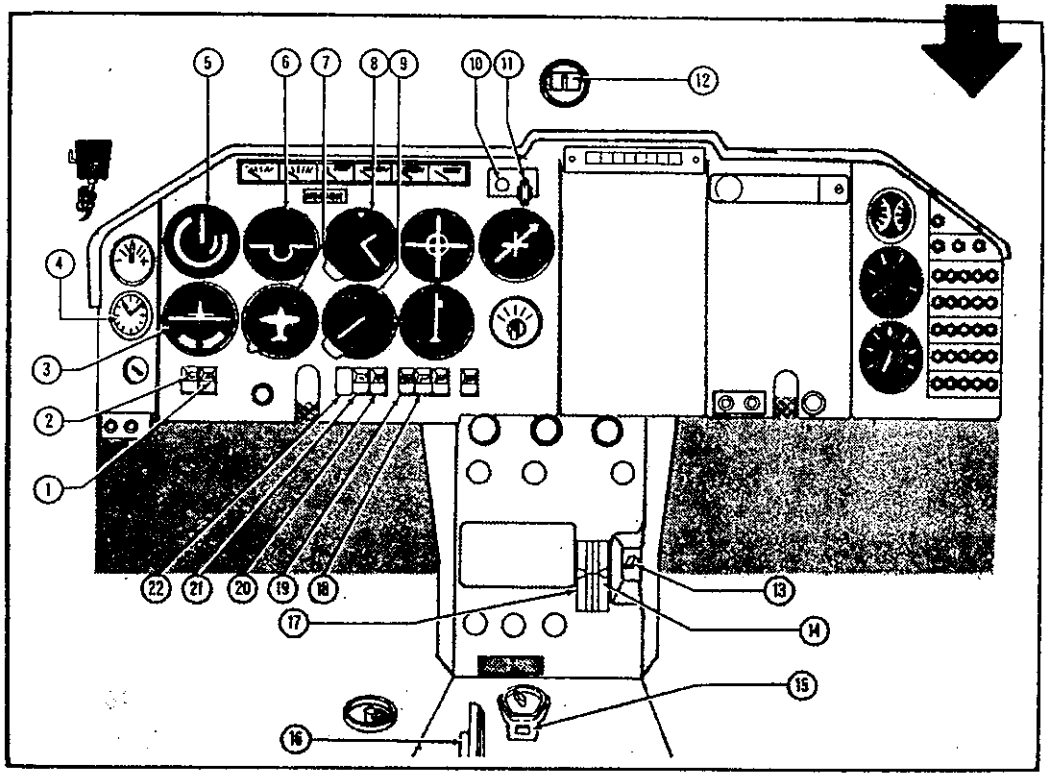
PROPELLER

The propeller, of the constant speed type, is a single-acting unit in which hydraulic pressure opposes the natural, centrifugal twisting moment of the rotating blades, and the force of a spring, to obtain the correct pitch for the engine load. Engine lubricating oil is supplied to the power piston in the propeller hub through the propeller shaft. The amount and pressure of the oil supplied is controlled by an engine-driven governor. Increasing engine speed will cause oil to be admitted to the piston, thereby increasing the pitch. Conversely, decreasing engine speed will result in oil leaving the piston, thus decreasing the pitch.

FLIGHT INSTRUMENTS AND CONTROLS 1979



FLIGHT INSTRUMENTS AND CONTROLS - 1980



(1) RADIO MASTER

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

(2) MASTER SWITCH

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

(3) TURN COORDINATOR (if installed)

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

(4) CLOCK (if installed)

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

(5) AIRSPEED INDICATOR

The standard airspeed indicator is marked in knots and miles per hour. Limitation markings are CAS and include the white arc (61 to 125 MPH, 52 to 108 KTS) green arc (68 to 200 MPH, 59 to 173 KTS), yellow arc (200 to 225 MPH, 173 to 195 KTS), and a red line (225 MPH, 195 KTS).

(6) ATTITUDE GYRO (if installed)

The attitude gyro gives a visual indication of flight attitude. Bank attitude is presented by a pointer at the top of the indicator relative to the bank scale which is marked in increments of 10^{o}, 20^{o}, 30^{o}, 45^{o}, 60^{o}, and

90° either side of the center mark. Pitch attitude is presented by an airplane silhouette in relation to the horizon bar. A knob at the bottom of the instrument is provided for in-flight adjustment of the silhouette to the horizon bar for a more accurate flight attitude indication.

(7) DIRECTIONAL GYRO (if installed)

The directional gyro displays airplane heading on a compass card in relation to a fixed simulated airplane image and index. The directional indicator will precess slightly over a period of time. Therefore, the compass card should be set in accordance with the magnetic compass just prior to takeoff, and occasionally re-adjusted on extended flights. A knob on the lower left edge of the instrument is used to adjust the compass card to correct for any precession.

(8) ALTIMETER

Airplane altitude is depicted by a barometric type altimeter. A knob near the lower left portion of the indicator provides adjustment of the instrument's barometric scale to the proper barometric pressure reading.

(9) VERTICAL SPEED INDICATOR (if installed)

The vertical speed indicator depicts airplane rate of climb or descent in feet per minute. The pointer is actuated by an atmospheric pressure change supplied by the static source.

(10) GEAR SAFETY OVERRIDE SWITCH

The gear safety override switch is a mechanical means of electrically bypassing the airspeed safety switch. In the event the gear control switch is inadvertently placed in the gear-up position, the gear airspeed safety switch prevents the gear being retracted before approximately 75 MPH (65 KTS) airspeed is reached. Should it be necessary to retract at lower airspeed the gear safety override

switch may be pressed allowing the gear to retract.

CAUTION

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

(11) GEAR SWITCH

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

NOTE

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

(12) MAGNETIC COMPASS

The magnetic compass is liquid-filled, with expansion provisions to compensate for temperature changes. It is equipped with compensating magnets adjustable from the front of the case. Access to the compass light and the compensating magnets is provided by pivoted covers. No maintenance is required on the compass except an occasional check on a compass rose with adjustment of the compensation card, if necessary, and replacement of the lamp.

(13) FLAP SWITCH

The flap switch in a recess on the right of the console operates the electrically-actuated wide span wing drag flaps. Holding the spring-loaded switch in the down position lowers the flaps to the desired angle of deflection. A pointer in the center console indicates flap position. Simply releasing downward pressure on

the switch allows it to return to the OFF position stopping the flaps at any desired intermediate position during extension. When flap-up position is selected, flaps will retract to full up position unless the switch is returned to the neutral position for a desired intermediate setting. Pushing the switch to the UP position retracts the flaps.

(14) FLAP POSITION INDICATOR

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

(15) GEAR POSITION INDICATOR

The illuminated gear-down position indicator in the back of the fuel selector, trim pan aft of the center console has two marks that align when the gear is down and illuminates when the green gear down light is on.

(16) TRIM CONTROL WHEEL

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

(17) TRIM POSITION INDICATOR

Stabilizer trim position is mechanically indicated thru a cable attached to the trim wheel mechanism. Position indications are shown on the console.

(18) PITOT HEAT SWITCH/CIRCUIT BREAKER

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

(19) LANDING LIGHT SWITCH/CIRCUIT BREAKER

Pushing ON the landing light combination rocker switch/circuit breaker turns ON the landing light.

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

(20) NAVIGATION LIGHT SWITCH/CIRCUIT BREAKER

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

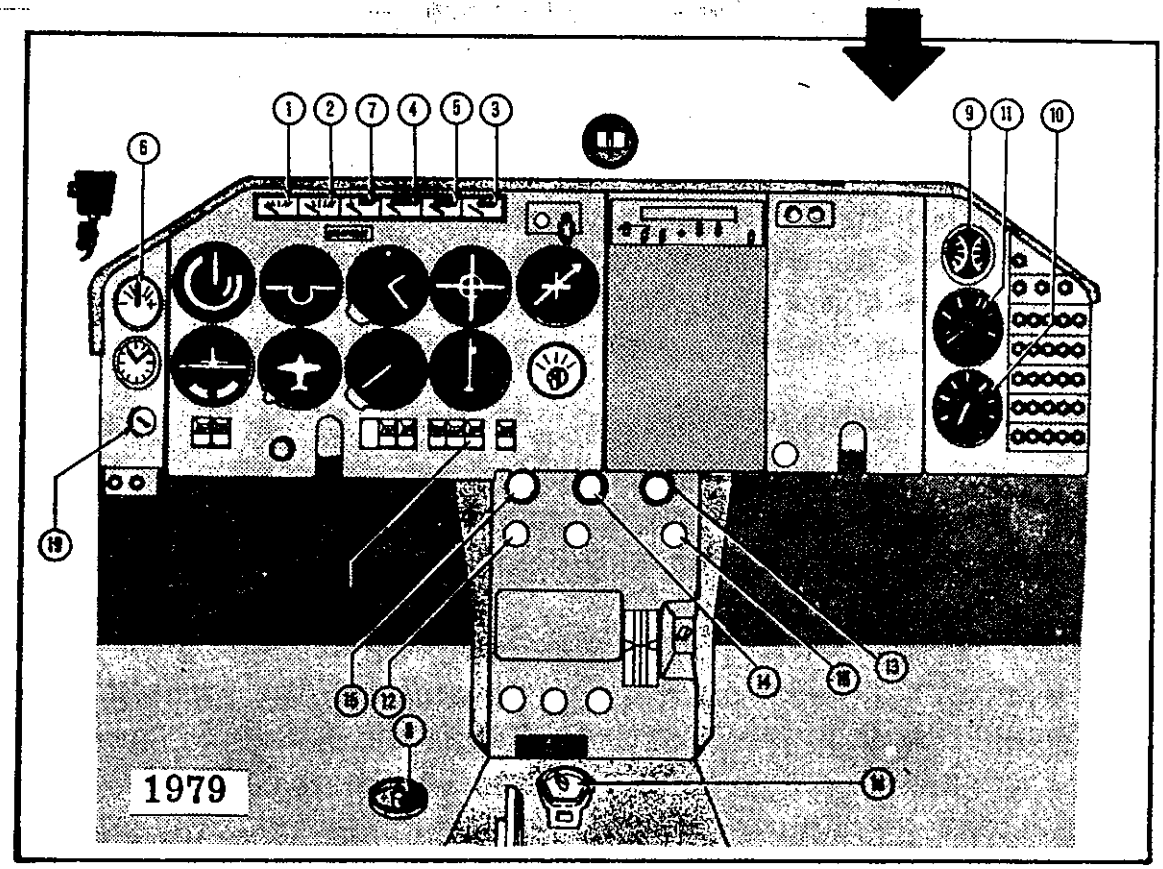
(21) STROBE LIGHT SWITCH/CIRCUIT BREAKER (if installed)

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

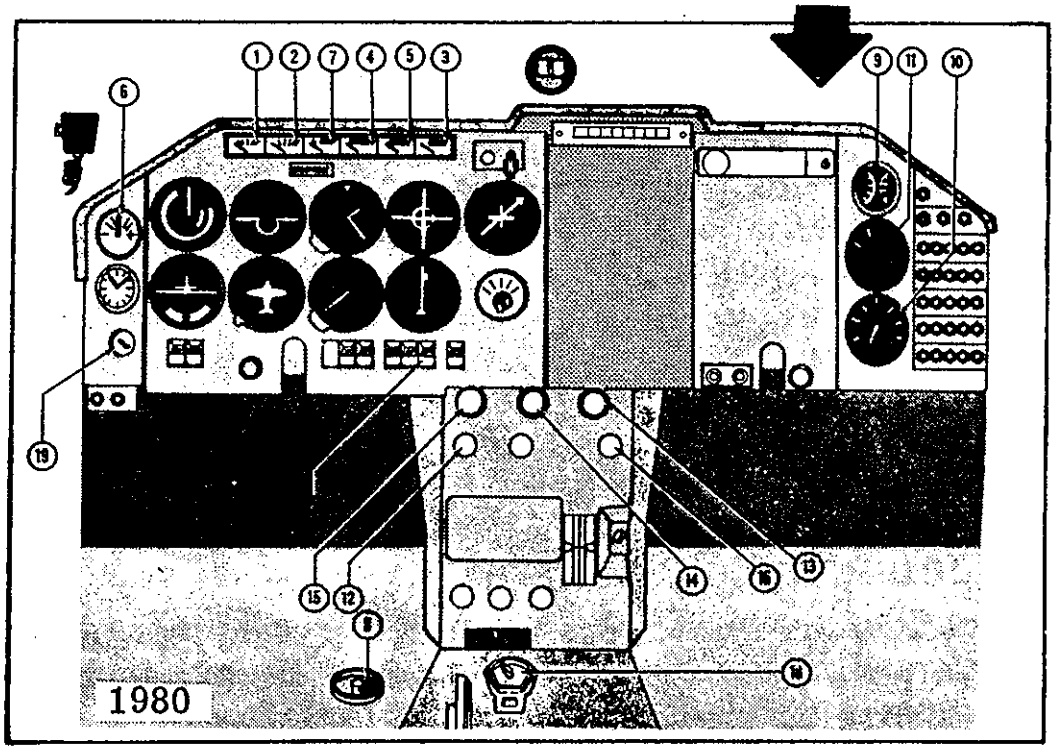
(22) ROTATING BEACON SWITCH/CIRCUIT BREAKER (if installed)

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

ENGINE INSTRUMENTS AND CONTROLS - 1979



ENGINE INSTRUMENTS AND CONTROLS - 1980



(1.) and (2.) FUEL QUANTITY INDICATORS

The fuel quantity indicators are used in conjunction with a float-operated variable-resistance transmitter

in each fuel tank. The tank-full position of the transmitter float produces a maximum resistance through the transmitter, permitting minimum current flow through fuel quantity indicator and maximum pointer deflection.

(3.) CYLINDER HEAD TEMPERATURE

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

(4.) OIL PRESSURE GAGE

The electric transducer type oil pressure gage is a direct-reading gage, operated by a pressure pickup line connected to the engine main oil gallery.

(5.) OIL TEMPERATURE GAGE

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

(6.) AMMETER

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

(7.) FUEL PRESSURE GAGE

The fuel pressure gage is of the electric transducer type and is calibrated in pounds per square inch and indicates the pressure to the fuel injector.

(8.) GASCOLATOR

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

(9.) EGT/OAT GAGE

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

(10) TACHOMETER

The tachometer is a mechanical indicator driven at half crankshaft speed by a flexible shaft. Most tachometer difficulties will be found in the driveshaft. To function properly, the shaft housing must be free of kinks, dents and sharp bends.

(11) MANIFOLD PRESSURE

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

(12) RAM AIR CONTROL

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

(13) MIXTURE CONTROL

The mixture control allows the pilot to adjust the fuel-air ratio (mixture) of the engine. Pushing the control forward richens the mixture. Pulling the control aft leans the mixture and pulling the control full aft closes the idle cutoff valve shutting down the engine. The control is of the vernier type and fine adjustments of the mixture can be obtained by turning the knob, clockwise richens the mixture, counter-clockwise leans.

(14) PROPELLER CONTROL

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

(15) THROTTLE CONTROL

Pushing the throttle control forward increases the manifold pressure thereby increasing the engine power. Pulling the control aft decreases the manifold pressure thereby decreasing the engine power.

(16) COWL FLAP CONTROL

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

(17) FUEL BOOST PUMP SWITCH/CIRCUIT BREAKER

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

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

to permit the engine to develop maximum rated power.

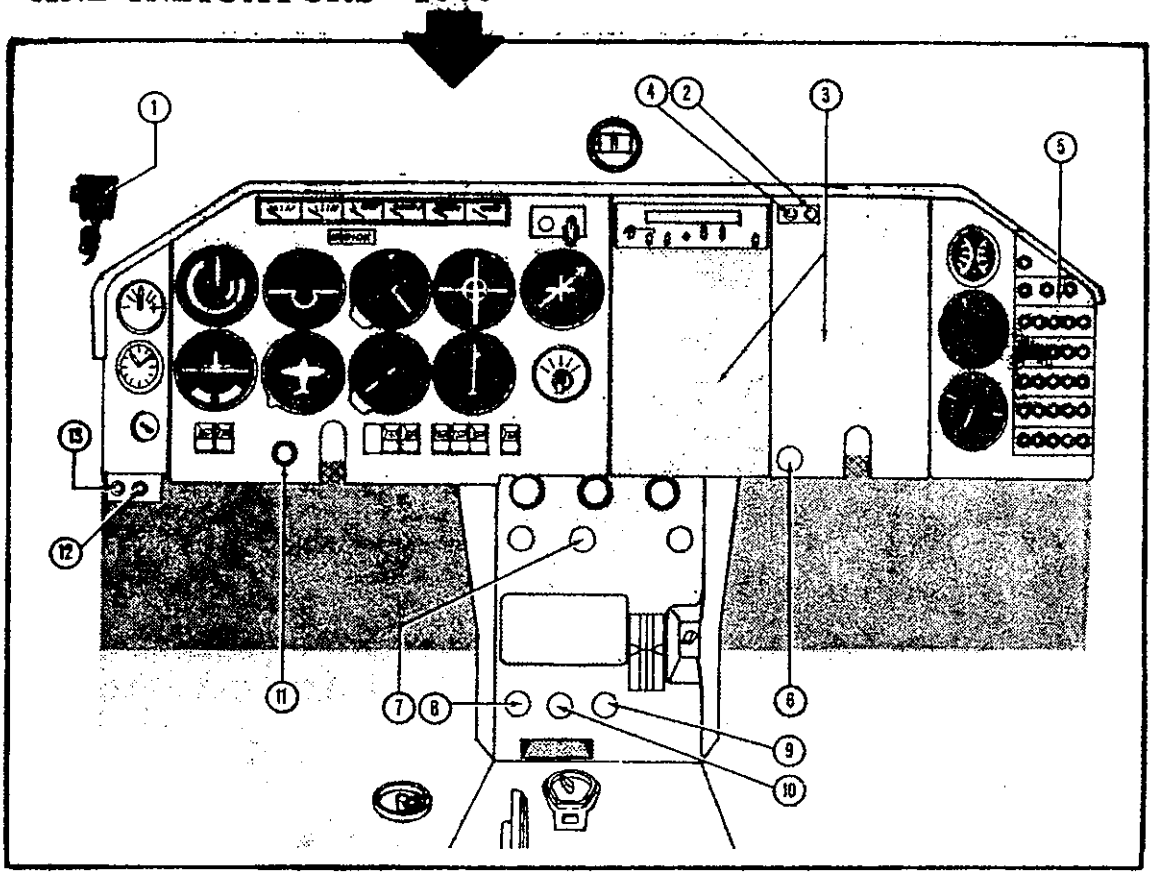
(18) FUEL SELECTOR VALVE

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

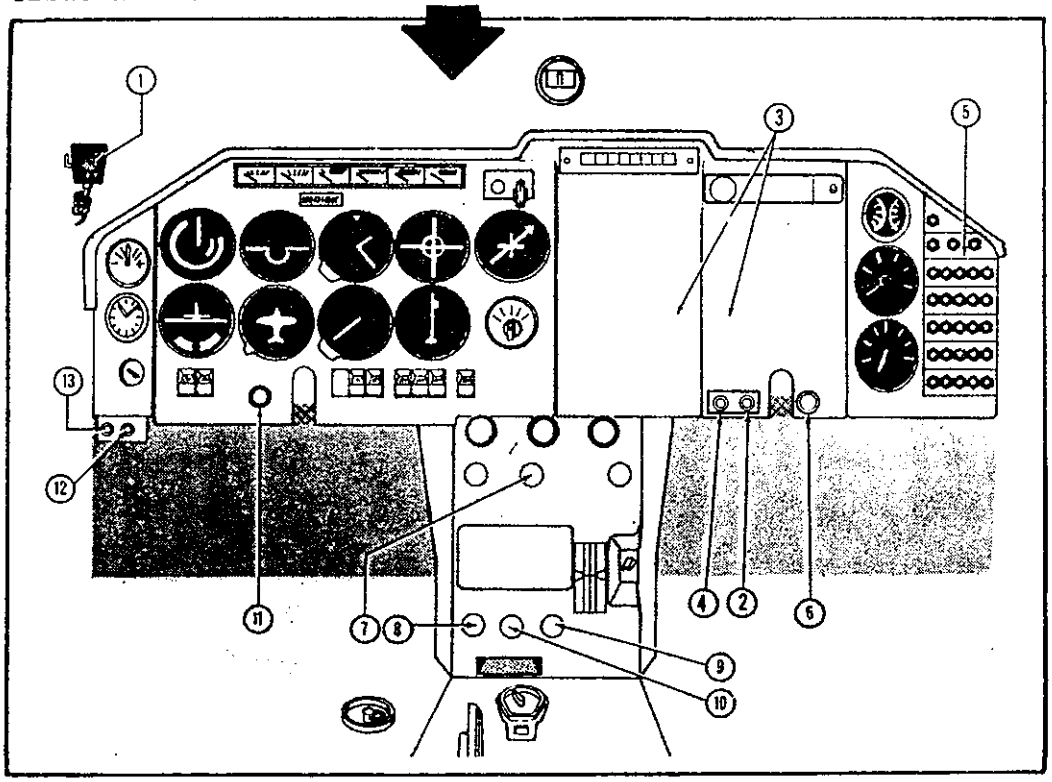
(19) MAGNETO/STARTER SWITCH

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

MISCELLANEOUS INSTRUMENTS, CONTROLS AND INDICATORS -1979



MISCELLANEOUS INSTRUMENTS, CONTROLS AND INDICATORS - 1980



1. RADIO MICROPHONE (If Installed)

2. RADIO LIGHT SWITCH AND DIMMER

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

3. RADIO PANELS

Adequate space is provided for installation of optional avionics.

4. PANEL LIGHT SWITCH AND DIMMER

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

5 CIRCUIT BREAKER PANEL

Push-to-reset and push-pull circuit breakers automatically break the electrical current flow if the systems receive an overload.

6 CIGAR LIGHTER

(7.) PARKING BRAKE CONTROL
Pulling the parking brake control and depressing the brake pedals sets the parking brake. Pushing in the parking brake control releases the parking brake.

(8.) CABIN VENT CONTROL
Pulling the cabin vent control aft opens the cabin vent, located on the right side of the airplane. Optimum use of the cabin vent control is described in the Cabin Environment Section.

(9.) CABIN HEAT CONTROL
Pulling the cabin heat control turns on cabin heat. To lower cabin temperature the cabin heat control is pushed forward toward the OFF position. Optimum use of the cabin heat control is described in the Cabin Environment Section.

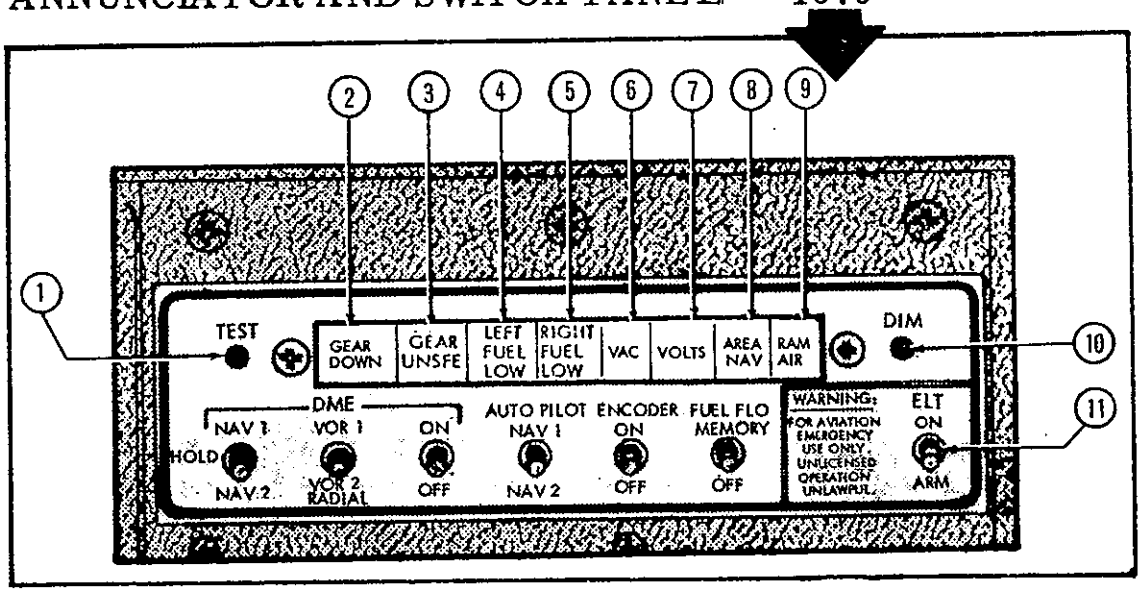
(10.) DEFROST CONTROL
Pulling the defrost control decreases air flow to cabin and increases air flow over the windshield in the front of the glareshield area. Optimum use of the defrost control is described in the Cabin Environment Section.

(11) ALTERNATE STATIC SOURCE VALVE
Pulling the alternate static source valve to the full aft position (alternate) changes the source of static air for the altimeter, airspeed indicator and rate-of-climb indicator from the outside of the aircraft to the cabin interior.

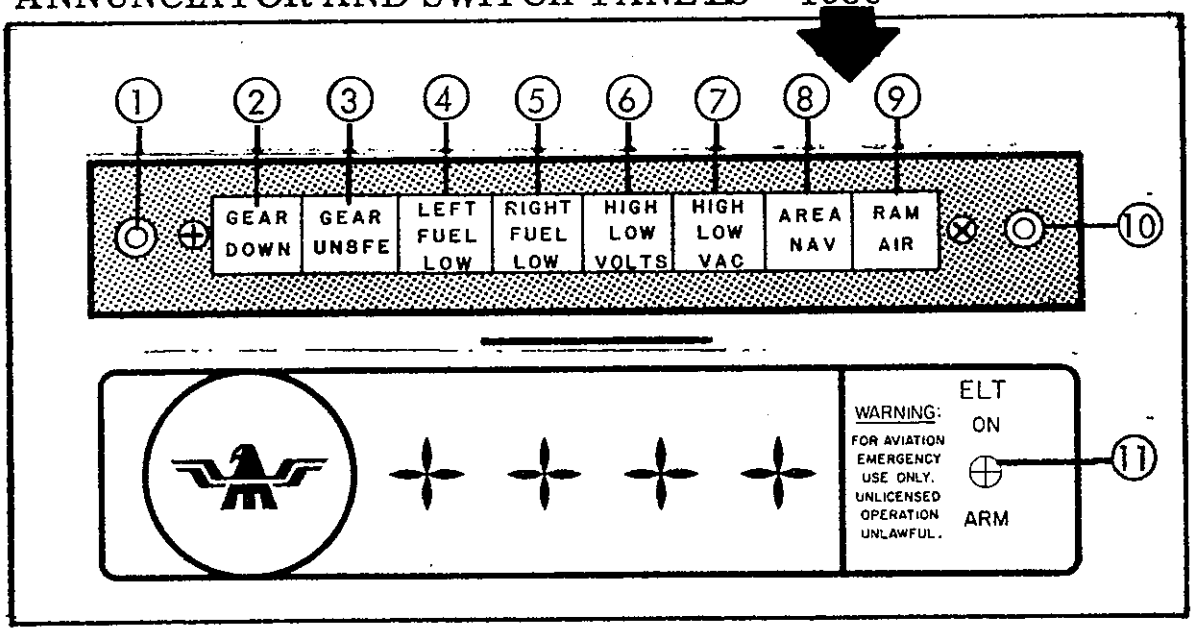
(12.) HEADSET JACK

(13.) MICROPHONE JACK

ANNUNCIATOR AND SWITCH PANEL - 1979



ANNUNCIATOR AND SWITCH PANELS - 1980



(1) PRESS-TO-TEST SWITCH
Pressing the red press-to-test switch with the master switch ON will illuminate all annunciator light bulbs. Defective bulbs should be replaced prior to the next flight.

(2) and (3) GEAR SAFETY INDICATOR
The green GEAR DN light and a red GEAR UNSFE light provide visual gear position signals. The green light (GEAR DN) shows continuously when the gear is fully extended. With the navigation lights on, the GEAR DN light is dim for night operation. All gear lights are out when the gear is fully retracted. Gear unsafe light is on between

gear fully extended and gear fully retracted position.

④ and ⑤ FUEL LOW INDICATORS
Left and/or right, red, fuel low annunciator light comes on when there is 2-1/2 to 3 gallons of useable fuel remaining in the respective tanks.

⑥ VACUUM MALFUNCTION INDICATOR
The red VAC annunciator light indicates a malfunction or improper adjustment of air suction system. Air suction is available for operation of the attitude gyro, and also the directional gyro, and will be shown in inches of mercury. The designated suction range is 4.0 to 5.5 inches of mercury. The vac light will blink when suction is below 4.0 inches of mercury and gives a steady light when suction is above 5.5 inches of mercury. In either case the gyros should not be considered reliable during this warning time.

⑦ VOLTAGE IRREGULARITY INDICATOR
The red VOLTS annunciator light comes on designating improper voltage supply. A red blinking light designates low, or no voltage from the alternator; a steady red light indicates over voltage or a trippage of the voltage relay.

⑧ AREA NAV FUNCTION INDICATOR
The blue AREA NAV light refers only to the ON or OFF position of specific navigation equipment.

⑨ RAM AIR POSITION INDICATOR
The amber RAM AIR annunciator light is a reminder that ram air system is in operation when the gear comes down and should be turned off to reroute air through air filter.

⑩ DIM SWITCH
The DIM switch is activated when the low fuel lights come on bright. The switch will dim both low fuel

lights but will not turn them off. To restore the display to bright, press the test switch.

(11) EMERGENCY LOCATOR TRANSMITTER SWITCH
The ELT switch manually activates the emergency locator transmitter located in the forward portion of the tailcone. To activate the system pull the switch out and raise. Failure to pull out can result in a breakage of the switch. Reference should be made to the Emergency Locator Transmitter section for proper and lawful usage of the ELT.

FLIGHT CONTROLS

PRIMARY FLIGHT CONTROLS

Push-pull tubes with self-aligning rod end bearings actuate the primary flight control surfaces. A spring-loaded interconnect device indirectly joins the aileron and rudder control systems to assist in lateral stability during flight maneuvers. Control surface gap seals minimize airflow through the hinge slots and reduce drag.

TRIM CONTROLS

For pitch trim control, the entire empennage pivots on the tail cone attachment points to increase or decrease the horizontal stabilizer angle. This design allows flight trim establishment with minimum control surface deflection. A trim indicator on the console indicates stabilizer trim position. In flight, forward rotation of the trim wheel lowers the nose; rearward rotation raises the nose.

WING FLAP CONTROLS

The flap control is located in a recess on the right side of the engine control console and operates the electrically-actuated wide-span wing flaps. Moving the control to the UP position, retracts the flaps. The position of the flaps can be noted from the flap position indicator located adjacent to the trim indicator. Holding the

control in the down position moves the flaps down until the desired position is reached, releasing the control stops flap movement. Limit switches prevent flap travel above or below travel limits.

PITOT STATIC SYSTEM

A pitot tube, mounted on the lower surface of the left wing, picks up airspeed indicator ram air. A heated pitot prevents pitot tube icing when flying in moisture-laden air. A pitot system drain valve is located on the forward bottom skin of the left wing just outboard of the wing fillet. Static ports on each side of the tail cone supply static air pressure for the altimeter, the airspeed indicator, and the vertical speed indicator. A static system drain valve is located on the fuselage bottom skin below the tail cone access door. An alternate static pressure source valve is installed under the left flight panel above the pilot's left knee.

STALL WARNING SYSTEM

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

EMERGENCY LOCATOR TRANSMITTER

The Emergency Locator Transmitter (ELT) is located in the forward portion of the tailcone and is accessible by removing the radio access panel on the left side of the fuselage. The emergency locator transmitter meets the requirements of FAR 91.52 and is automatically activated by a longitudinal force of 5 to 7 g's. The ELT transmits a distress signal on both 121.5 MHz and 243.0 MHz for a period of from 48 hours in low temperature areas and up to 100 hours in high temperature areas. The unit operates on a self-contained battery.

The battery has a useful life of four years. However, to comply with FAA regulations it must be replaced after

two years of shelf life. The battery should also be replaced if the transmitter has been used in an emergency situation or if accumulated test time exceeds one hour. The replacement date is marked on the transmitter label.

On the unit itself is a three position selector switch placarded "OFF", "ARM", "ON". The "ARM" position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until the battery is drained to depletion or until the switch is manually moved to the "OFF" position. The "ARM" position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane. The "ON" position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter.

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

NOTE

If the switch on the unit 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.

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

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

NOTE

If for any reason a test transmission is necessary, the operator must first obtain permission from a local FAA/FCC representative (or other applicable Authority) or in accordance with current regulations. Test transmission should be kept to a minimal duration.

LANDING GEAR

ELECTRIC GEAR RETRACTION SYSTEM

The two-position electric gear control switch, identified by its wheel-shaped knob, is located near the top of the instrument panel above the throttle.

There are two ways to check that the electrically-actuated gear is down:

(1) The green gear-down annunciator light is on.
(2) The indicator marks align as seen on the floorboard visual gear-position indicator.

A green GEAR DN light, a red UNSAFE light, and a warning horn provide visual and audible gear position signals. The green light (GEAR DN) shows continuously when the gear is fully extended. With the navigation lights on, the GEAR DN light is dim for night operation. All gear lights are off when the gear is fully retracted.

NOTE

Retarding the throttle below 12 inches manifold pressure causes the gear warning horn to emit an intermittent tone if the gear is not down.

To prevent inadvertent retraction of the landing gear system an airspeed actuated safety switch is installed in the pitot system. The switch is not intended to substitute for the gear switch in keeping the gear extended while taxiing, taking-off, or landing.

CAUTION

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

The aircraft is also equipped with a landing gear safety bypass switch override should the gear fail to retract after take-off. Section III discusses the procedure to be used should the landing gear safety switch fail to de-activate after take-off.

EMERGENCY GEAR - MANUAL EXTENSION SYSTEM

The emergency gear extension pull cable located between and aft of the seats if for manually driving the electric gear actuator to extend the gear if the electric system malfunctions. Section III discusses the emergency gear extension procedure.

BRAKE & STEERING SYSTEMS

The main gear wheels incorporate self-adjusting disc-type hydraulic brakes. The pilot's rudder pedals have individual toe-actuated brake cylinders linked to the rudder pedals. Depressing the toe pedals and pulling out the parking brake control on the console sets the brakes. Pushing the parking brake control forward releases the brakes.

It is not advisable to set the parking brake when the brakes are overheated, after heavy braking or when outside temperatures are unusually high. Trapped hydraulic fluid may expand with heat and damage the system. Wheel chocks and tiedowns should be used for long-term parking.

Rudder pedal action steers the nose wheel. Gear retraction relieves the rudder control system of its nose wheel steering and centers the wheel to permit retraction into the nose wheel well. The minimum turning radius on the ground is 41 feet.

ELECTRICAL POWER

ALTERNATOR & BATTERY

A 12-volt 35-ampere-hour storage battery in the tailcone and a 60-ampere self-rectifying alternator supply electrical power for equipment operation. The ammeter in the engine instrument display indicates battery charge/discharge rate.

A power loss in the alternator or voltage regulator will be shown as a discharge reading on the ammeter; a discharged battery will be indicated as a high-charge reading.

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

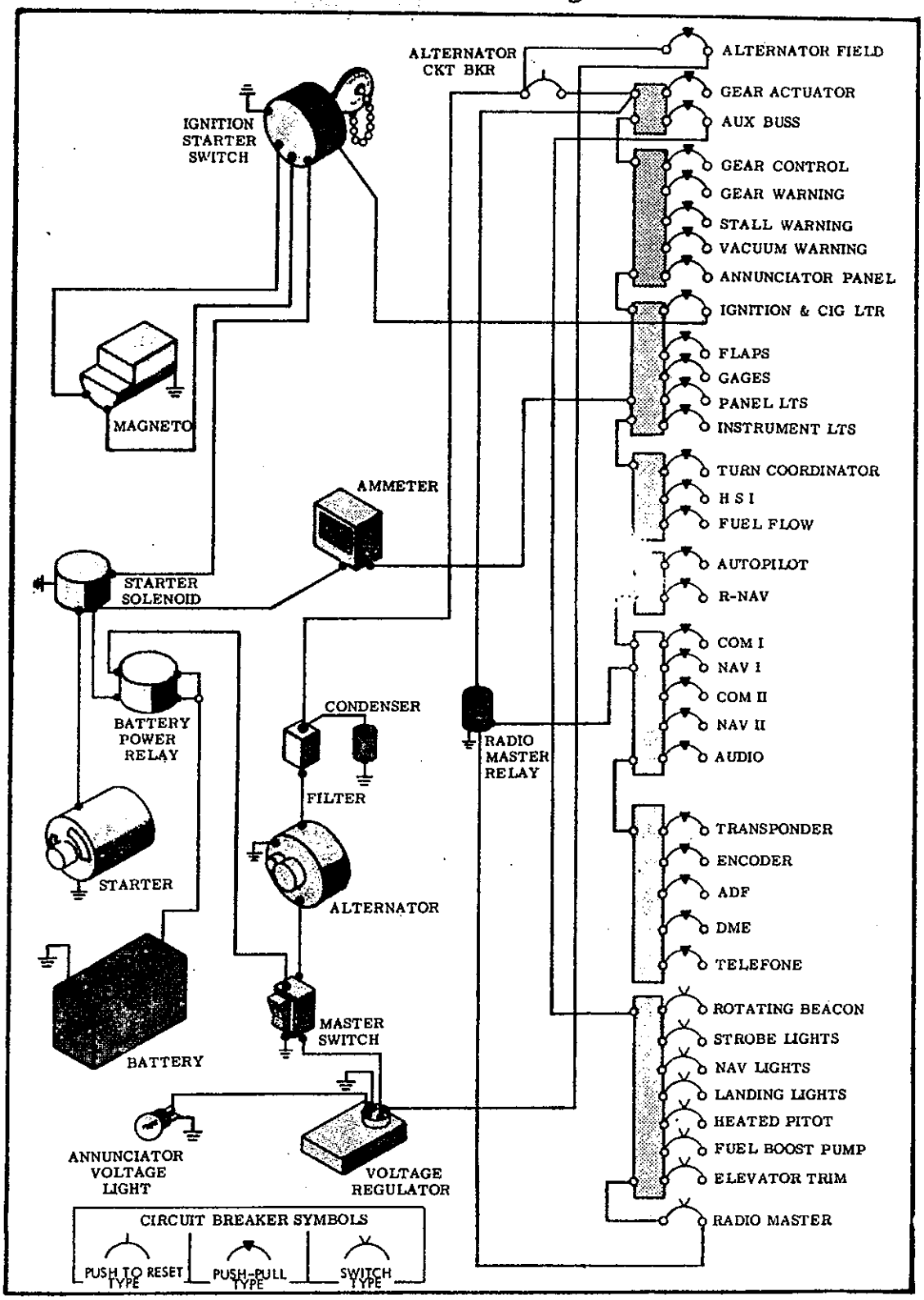


FIGURE 7-3 ELECTRICAL SYSTEM SCHEMATIC

CIRCUIT BREAKERS

Push-to-reset, push-pull, or rocker-switch circuit breakers automatically break the electrical current flow if the systems receive an overload, thus preventing damage to electrical wiring.

The main circuit breaker panel is in the extreme right panel. Figure 7-4 illustrates the main circuit breaker panel with its push-pull standard equipment circuit breakers. All rocker-switch circuit breakers are at the bottom of the flight panel.

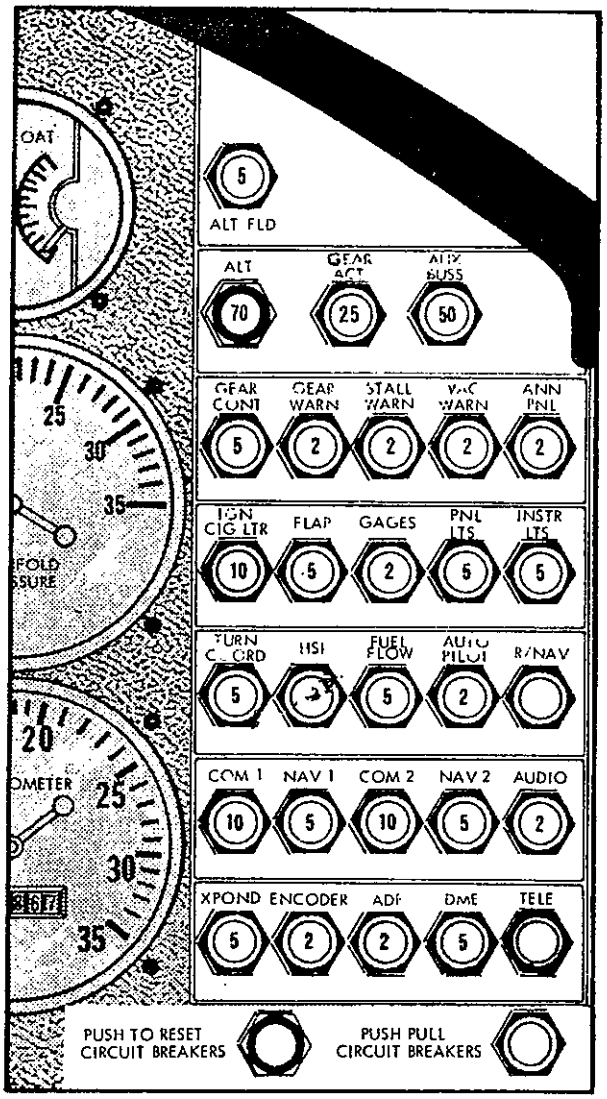


FIGURE 7-4
Main
Circuit Breaker Panel

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

The alternator-field is a push-pull circuit breaker and furnishes an emergency break in the alternator field excitation circuit in the event of alternator or voltage regulator malfunction. If the regulator output voltage

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

ANNUNCIATOR PANEL – 1979

The landing gear lights, low fuel light, voltage lights, and ram air lights are grouped in the annunciator and switch panel. A test switch, dim switch, and ELT switch are also found in the panel and each of the lights and switches are discussed elsewhere in this section.

ANNUNCIATOR PANEL – 1980

The landing gear lights, low fuel light, voltage lights, and ram air lights are grouped in the annunciator panel. A test switch and dim switch are found in the panel and each of the lights and switches are discussed elsewhere in this section.

ELT PANEL – 1980

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

INSTRUMENT & PLACARD LIGHTS

All instrument faces and placards are floodlighted by light bulbs in the glareshield. There are two rheostat knobs on the right hand radio panel, the left control regulates the intensity of the instruments and placard lighting. The right control provides avionic lighting. Rotating the knobs clockwise turns on and increases light intensity.

CABIN LIGHTING

A dome light illuminates the cabin. Its BRIGHT-OFF-DIM switch is slightly forward and to the right of the dome light.

EXTERIOR LIGHTING

Conventional navigation and high intensity strobe lights are installed on the wing tips. A landing and taxi light is installed on the right side of the lower engine cowling. All exterior lights are controlled by rocker type switches on the lower left portion of the instrument panel.

When high intensity wing tip strobe lights are installed. they should be turned off when taxiing near other aircraft, in fog or clouds. The conventional navigation lights must be used for all night operations.

CABIN ENVIRONMENT

HEATING & VENTILATION SYSTEMS

Three ventilating systems provide cabin environmental control suited to individual pilot and passenger preferences. Fresh air heated by the engine exhaust muffler, and cool air from an airscoop on the co-pilot side, can be individually controlled and mixed to the desired

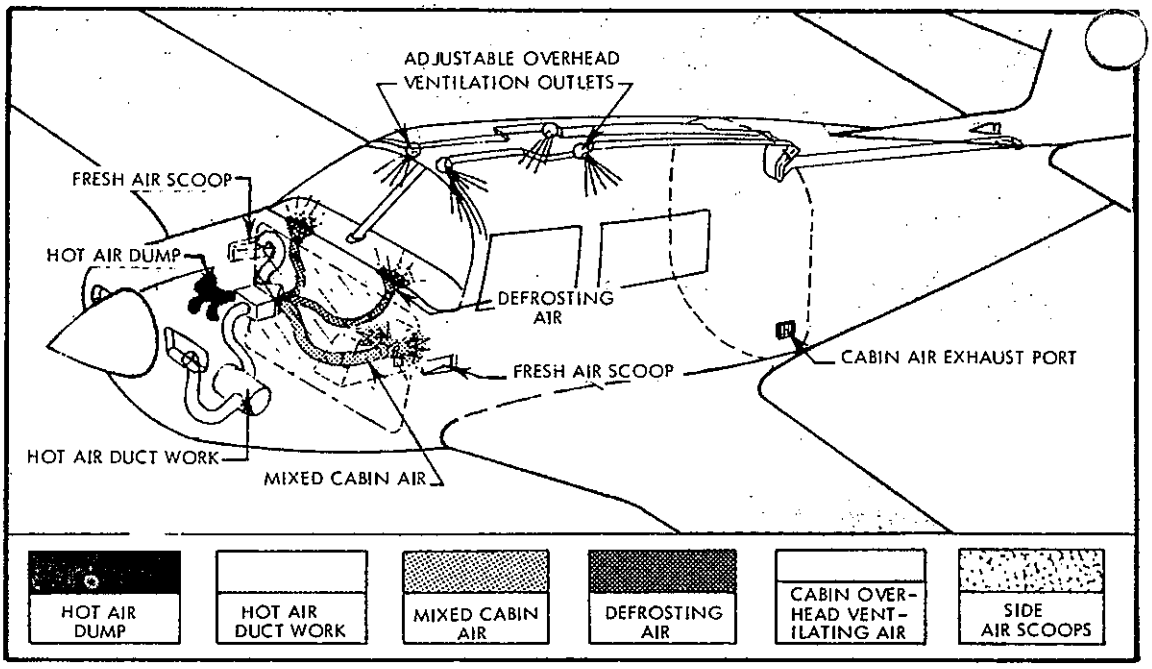


FIGURE 7-5. CABIN HEATING & VENTILATING.

temperature. The left side fresh-air scoop has an adjustable eyeball outlet near the pilot's knee.

The cabin overhead ventilating system works independently of the cabin heating and ventilating system. Fresh air enters an intake on the dorsal fin and is controlled by individual eyeball outlets above each seat. The 1980 models have a master air vent control to regulate flow of air through the individual overhead outlets. This control is located above the pilots seat back on the overhead panel.

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

WINDSHIELD DEFROSTING SYSTEM.

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

CABIN

SEATS & SAFETY BELTS

The front seats are individually mounted and may be adjusted fore and aft to fit individual comfort preferences. Resetting a seat back is accomplished by pulling the seat back forward, rotating the large cam selector knob at the lower back juncture, and allowing the back to return to the new position.

SAFETY HARNESS

The single diagonal type harness is designed so the chest strap crosses diagonally from the outboard shoulder to an attachment point as low on the inboard hip as possible. Care should be taken to conform with this location in adjusting the chest strap and inboard belt length. This diagonal configuration places the body center-of-gravity inside the triangle formed by the chest strap and lap belt. The lap belt should be adjusted comfortably tight. As a result the body is restricted from rolling out toward the unrestricted shoulder, or "open" side of the harness, upon forward impact.

BAGGAGE & CARGO AREAS

The baggage compartment has 17 cubic feet of baggage or cargo space and two pairs of floor tiedown straps. The loose equipment, consists of wing jackpoints and tiedown rings, a fuel sampling cup, and towbar. These are stowed in the baggage compartment. The rear seat back may be removed for additional cargo space by removing attaching bolts at top and bottom of seat back.

DOORS, WINDOWS & EXITS

CABIN DOOR

Access to the cabin is provided by a door located on the right side of the fuselage. This door has inside and outside operating handles. The outside door handle can be locked with a key specifically provided for it. The door has two latching mechanisms, one located at the top of the door and one at the aft, center of the door.

Should the door come open inflight the flying qualities of the aircraft will not be affected. Procedures for closing the door in flight are contained in Section 3.

PILOT'S WINDOW

A fresh air pilot's window is located in the left main cabin window. This window is generally used for fresh air for prolonged ground operations. The window should not be opened in flight above 150 MPH.

EMERGENCY EXITS

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

The baggage compartment access door can be used as a means of auxiliary exit. The door can be opened from the inside even though locked. To open, pull off the cover, pull the white knob and lift up the red handle. To re-engage outside latch; open outside latch fully, close inside latch and push in on white button until latched. Operate outside latch in normal method.

SECTION VIII.

HANDLING, SERVICING & MAINTENANCE

TABLE OF CONTENTS

TITLE	PAGE
INTRODUCTION	8-2
GROUND HANDLING	8-3
TOWING	8-3
TIEDOWN	8-4
JACKING	8-4
SERVICING	8-5
REFUELING	8-5
ENGINE LUBRICATION	8-6
INDUCTION AIR FILTER	8-8
GEAR AND TIRE	8-9
BATTERY	8-9
HYDRAULIC BRAKE RESERVOIR	8-10
MAINTENANCE	8-10
PROPELLER CARE	8-10
EXTERIOR CARE	8-11
INTERIOR CARE	8-12
AIRPLANE FILE	8-13/8-14 Blank

INTRODUCTION

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

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

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

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

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

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

Keep in touch with your Mooney Service Center and take advantage of his knowledge and experience. He knows your airplane and how to maintain it.

Should an extraordinary or difficult problem arise concerning the repair or upkeep of your Mooney, consult the Customer Service Department, Mooney Aircraft Corporation, P.O. Box 72, Kerrville, TX 78028. Phone Area Code 512-896-6000.

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

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

GROUND HANDLING

TOWING

For maneuvering the aircraft in close quarters, in the hangar, or on the ramp, use the tow bar furnished with the aircraft loose equipment. The towbar attaches to the nose gear crossbar. One man can move the aircraft providing the ground surface is relatively smooth and the tires are properly inflated.

When no towbar is available, or when assistance in moving the aircraft is required, push by hand: (1) on the wing leading edges, (2) on the wing tips, and (3) on the inboard portion of propeller blades adjacent to the propeller hub. Towing by tractor or other powered equipment is not recommended.

CAUTION

Exercise care not to turn the nose wheel past its normal swivel angle of 14° either side of center. Exceeding the turn limits shown on the turn indicator may cause structural damage.

TIEDOWN

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

To tie down the aircraft:

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

JACKING

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

a. Install jack points in tiedown mounting holes outboard of each main gear.
b. Use standard aircraft jacks at both wing hoist points (wing tiedown eyebolt receptacles) outboard of the main gears. While holding jack point in place, raise jack to firmly contact jack point.
c. Raise aircraft, keeping wings as nearly level as possible.
d. Secure safety locks on each jack.
e. Use a yoke-frame jack under propeller to lift the nose.

CAUTION

Do not raise the aircraft on jacks out of doors when wind velocity is over 10 MPH (8 KTS). When lowering aircraft on jacks, bleed off pressure on all jacks simultaneously and evenly to keep aircraft level as it is lowered.

NOTE

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

SERVICING

REFUELING

Integral sealed tanks in the forward inboard sections of the wings carry the fuel. With the aircraft standing on level ground, service each fuel tank after flight with 100 or 100 LL octane aviation-grade gasoline. Both tanks have fuel level indicators that are visible through the filler ports. These indicators show the 25-gallon fuel level in each tank.

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

CAUTION

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

Sample fuel from the sump drain in each tank before the first flight of the day and after each refueling to check for water or sediment contamination.

WARNING

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

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

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

ENGINE LUBRICATION

The new Lycoming engine has been carefully run-in and tested at the factory. Operate the new engine at full power within the limitations given in Section II. Before every flight, check the engine oil level and replenish as necessary.

Check engine oil level after engine has been stopped long enough for oil to drain back into sump. The oil filler cap access door is located in the top cowling. Any lubricating oil, either straight mineral or compounded, must conform with Lycoming Specification No. 301F to be acceptable for use in Lycoming engines. New or newly overhauled engines should be operated on aviation grade straight mineral oil during the first 25 hours of operation or until oil consumption has stabilized. The aircraft is delivered from Mooney with straight mineral oil of the correct viscosity.

The engine is equipped with an external oil filter and the engine oil change intervals may be extended to 100-hour intervals providing the external filter element is changed AT 50-HOUR INTERVALS. If an engine has been operating on straight mineral oil for several hundred

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

a. Do not mix additive oil and straight mineral oil. Drain straight mineral oil from engine, change filter and fill with additive oil.
b. Do not operate engine longer than five hours before again changing oil.
c. Check oil filter for evidence of sludge or plugging. Change oil and replace oil filter element every 10 hours if sludge is evident. Resume normal oil drain periods after sludge conditions improve.

Your Mooney Service Center will change the engine oil in addition to performing all other service and inspection procedures needed when you bring your airplane in for its 50-hour, 100-hour, or annual inspections. Excessive oil sludge buildup indicates that the oil system needs servicing at less than 50-hour intervals.

When changing or adding oil Lycoming specifies the following grades of oil to use for various ambient air temperatures.

Average Ambient Air	*Recommended Grade Oil	
	Single Viscosity	Multi Viscosity
Above 60°F	SAE 50	40 or 50
30° to 90°F	SAE 40	40
0° to 70°F	SAE 30	40 or 20W-30
Below 10°F	SAE 20	20W-30

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

Your Mooney Service Center has approved brands of lubricating oil and all consumable materials necessary to service your airplane.

INDUCTION AIR FILTER SERVICING

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

1. To clean the dry-type induction air filter:
   a. Remove the top engine cowling.
   b. Remove filter element.
   c. Direct a jet of air against down or clean side of filter (opposite to normal airflow). Keep air nozzle at least two inches from filter element. Cover entire filter area with air jet.

CAUTION

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

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

NOTE

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

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

NOTE

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

f. Rinse filter element with a stream of clear water until rinse water is clear.
g. Dry filter thoroughly. Do not use a light bulb or air heated above 180°F (82°C) for filter drying.
h. Inspect for damage and ruptures by holding filter before a light bulb. If damage is evident, replace filter with a new one.

GEAR & TIRE SERVICE

The aircraft is equipped with 6-ply standard-brand tires and tubes. Keep the main gear tires inflated at 30 PSI and the nose tire at 49 PSI for maximum service life. Proper inflation will minimize tire wear and impact damage. Visually inspect the tires at preflight for cracks and ruptures, and avoid taxi speeds that require heavy braking or fast turns. Keep the gear and exposed gear retraction system components free of mud and ice to avert retraction interference and binding.

The gear warning horn may be checked in flight by retarding the throttle with the gear up. The gear horn should sound with an intermittent note at about 12 inches manifold pressure.

BATTERY SERVICE

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

To service the battery, remove the battery box cover and check the terminals and connectors for corrosion. Add distilled water to each battery cell as necessary; keep the fluid at one-quarter inch over the separator tops. Check the fluid specific gravity for a reading of 1.265 to

1.275. A recharge is necessary when the specific gravity is 1.240 or lower. Start charging at four amperes and finish at two amperes; do not allow battery temperature to rise above 120°F during recharging. Keep the battery at full charge to prevent freezing in cold weather and to prolong service life.

CAUTION

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

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

HYDRAULIC BRAKE RESERVOIR SERVICE

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

MAINTENANCE

PROPELLER CARE

The high stresses to which propeller blades are subjected makes their careful inspection and maintenance vitally important. Check the blades for nicks, cracks, or indications of other damage before each flight. Nicks tend to cause high-stress concentrations in the blades which, if ignored, may result in cracks. It is very important that all nicks and scratches be polished out prior to next flight.

It is not unusual for the propeller blades to have some end play or fore and aft movement as a result of manufacturing

tolerances in the parts. This has no adverse affect on propeller performance or operation and is no cause for concern if the total movement at the blade tip does not exceed .12 inches. With the first turn, centrifugal force firmly seats the blades, rigidly and positively against the retention bearing in the propeller hub.

Preflight inspection of the propeller blades should include in addition to the foregoing an occasional wiping with an oily cloth to clean off grass and bug stains. Never use an alkaline cleaner on the blades; remove grease and dirt with tetrachloride or Stoddard solvent. McCauley recommends the propeller be removed and overhauled every 1200 hours of operation.

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

EXTERIOR CARE

As with any paint applied to a metal surface, an initial curing period is necessary for developing the desired qualities of durability and appearance. Therefore, do not apply wax or polish to the new aircraft exterior until two or three months after delivery. Wax substances will seal paint from the air and prevent curing. Do wash the exterior to prevent dirt from working into the curing paint, but hold buffing to a minimum until curing is complete and there is no danger of disturbing the undercoat.

Before washing the exterior, be certain the brake discs are covered, a pitot cover is in place, and all static-air buttons are masked off. Remove grease or oil from the exterior by wiping with a cotton cloth saturated in kerosene. Flush away loose dirt and mud deposits before washing the exterior with an aircraft-type washing compound mixed in warm water. Use soft cleaning cloths or a chamois, and avoid harsh or abrasive detergents that might scratch or corrode the surface. It is essential that all cleaning compounds and application cloths be free of abrasives, grit, or other foreign matter. Use a prewax cleaner to remove a heavy oxidation film. For nonoxidized or precleaned surfaces, apply a good exterior finish wax recommended for protection of urethane enamel finishes. Carefully follow the manufacturer's instructions. A heavier coating of wax

on the leading edge of the wings, empennage and nose section will help reduce drag and abrasion in these areas.

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

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

INTERIOR CARE

Normal household cleaning practices are recommended for routine interior care. Frequently vacuum clean the seats, rugs, upholstery panels, and headliner to remove as much surface dust and dirt as possible. Occasionally wash the leather or vinyl upholstery and kick panels with a mild soap solution to prevent dirt from working into the surface. Wipe clean with a slightly damp cloth and dry with a soft cloth. Never apply furniture polishes. Foam-type shampoos and cleaners for vinyl, leather, textiles, and plastic materials are good for removing stains and reconditioning the entire interior. Spray dry cleaners are also recommended. Grease spots on fabric should be removed with a jelly-type spot lifter.

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

Do not saturate fabrics with a solvent which could damage the backing and padding materials. To minimize carpet wetting, keep foam as dry as possible and gently rub in circles. Use a vacuum cleaner to remove foam and to dry the materials. Use a damp cloth or a mild soap solution to clean interior garnish plastic, vinyl trim, and metal surfaces.

AIRPLANE FILE

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

1. To be displayed in the airplane at all times:

   (a) Aircraft Airworthiness Certificate (FAA Form 8100-2)
   (b) Aircraft Registration Certificate (FAA Form 8050-3)
   (c) Aircraft Radio Station License, if transmitter installed (FCC Form 556).

2. To be carried in the airplane during all flight operations:

   (a) Pilot's Operating Handbook (including FAA Approved Flight Manual)
   (b) Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
   (c) Equipment List.

NOTE

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

3. To be made available upon request:

   (a) Airplane Log Book
   (b) Engine Log Book

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

MOONEY M20J LANDPLANES

SUPPLEMENTAL DATA

for

CERTIFICATION IN THE UNITED KINGDOM

The following information in this document is supplied to Meet CAA requirements, for Mooney M20J Landplane certification in the United Kingdom in the Transport Category (Passenger). Performance Group E.

This supplement is applicable to the following Mooney Model M20J landplanes.

Year of Manufacture	Airplane Serial Numbers	Applicable Owners Manual Issue Date
1979	24-0084, 24-0764 & ON	12-28-78

Published by the Manuals Group
MOONEY AIRCRAFT CORPORATION
KERRVILLE, TEXAS 78028

MANUAL NUMBER
79-20J-OM-S

CATEGORY

The Mooney M20J is eligible for certification in the United Kingdom in the Transport Category (Passenger). This aeroplane may, however, be restricted to another category and to a particular use and this will be stated in the certificate of airworthiness.

PERFORMANCE GROUP

The aeroplane is classified in performance group E.

MINIMUM CREW

The minimum crew is one pilot.

MAXIMUM NUMBER OF OCCUPANTS

The maximum number of occupants shall not exceed four and shall not exceed the number of approved seats fitted.

Children under the age of three years carried in the arms of passengers may be left out of this count.

NIGHT AND IFR FLIGHT

The aeroplane may be flown at night or in IFR conditions when permitted by the air navigation legislation and when the equipment required by the legislation is carried.

FLIGHT OVER WATER SPEED

The true airspeed to be used for the purpose of compliance with the legislation governing flight over water is 150 MPH.

SUPPLEMENTAL DATA

for

CERTIFICATION IN THE UNITED KINGDOM

The following information in this document is supplied to Meet CAA requirements, for Mooney M20J Landplane certification in the United Kingdom in the Transport Category (Passenger). Performance Group E.

This supplement is applicable to the following Mooney Model M20J landplanes.

Year of Manufacture	Airplane Serial Numbers	Applicable Owners Manual Issue Date
1981 & later	24-1038 & ON	August, 1980 or subsequent model years (until revoked)

Published by Technical Publications
MOONEY AIRCRAFT CORPORATION
KERRVILLE, TEXAS 78028

Issued June 1982

MANUAL NUMBER
81-20J-OM-S

TEGORY

The Mooney M20J is eligible for certification in the United Kingdom in the Transport Category (Passenger). This aeroplane may, however, be restricted to another category and to a particular use and this will be stated in the certificate of airworthiness.

PERFORMANCE GROUP

The aeroplane is classified in performance group E.

MINIMUM CREW

The minimum crew is one pilot.

MAXIMUM NUMBER OF OCCUPANTS

The maximum number of occupants shall not exceed four and shall not exceed the number of approved seats fitted.

Children under the age of three years carried in the arms of passengers may be left out of this count.

NIGHT AND IFR FLIGHT

The aeroplane may be flown at night or in IFR conditions when permitted by the air navigation legislation and when the equipment required by the legislation is carried.

FLIGHT OVER WATER SPEED

The true airspeed to be used for the purpose of compliance with the legislation governing flight over water is 130 KIAS - (150 MPH).

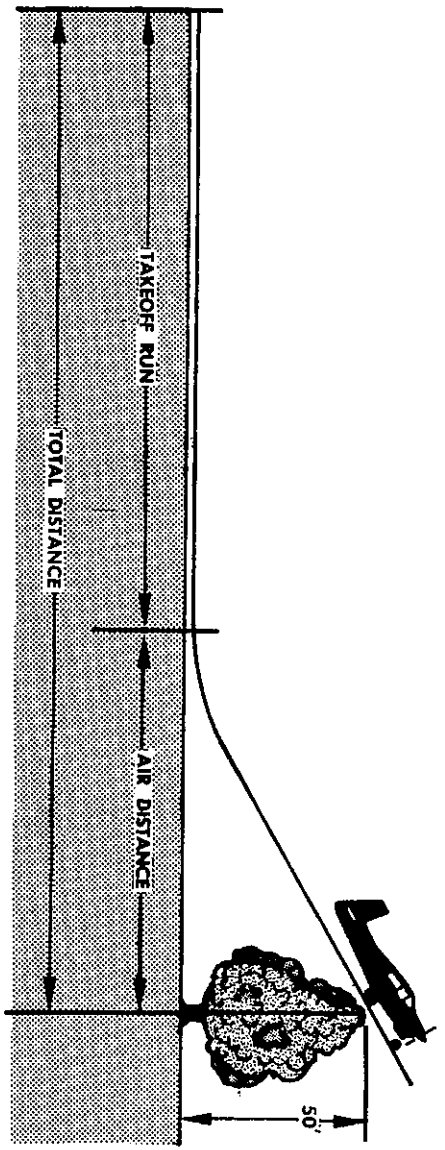
TAKEOFF DISTANCES

ASSOCIATED CONDITIONS:

POWER------ FULL THROTTLE, 2700 RPM (Before Brake Release)
MIXTURE --- LEAN FOR SMOOTH OPERATION
FLAPS ------ 15°
LDG. GEAR-- EXTENDED UNTIL OBSTACLE CLEARED

RUNWAY---------- PAVED, LEVEL, DRY SURFACE
WEIGHT---------- 2740 LBS.
TAKEOFF SPEED------73 MPH/63 KTS IAS
CLIMB OUT---------- 82 MPH/71 KTS IAS
COWL FLAPS---------- FULL OPEN

Wind Component Down Runway Knots	OAT °C	PRESSURE ALTITUDE: Sea Level Ground Roll Feet	Sea Level Total Over 50 Ft. Obstacle Feet	2000 FT. Ground Roll Feet	2000 FT. Total Over 50 Ft. Obstacle Feet	4000 FT. Ground Roll Feet	4000 FT. Total Over 50 Ft. Obstacle Feet	6000 FT. Ground Roll Feet	6000 FT. Total Over 50 Ft. Obstacle Feet	8000 FT. Ground Roll Feet	8000 FT. Total Over 50 Ft. Obstacle Feet
0	-20	704	1374	854	1646	1049	2074	1392	2808	1778	3820
	-10	765	1482	928	1776	1140	2237	1513	3028	1933	4118
	0	829	1594	1005	1910	1235	2406	1639	3256	2094	4426
	10	896	1711	1086	2050	1334	2581	1771	3494	2262	4746
	20	965	1831	1170	2194	1438	2764	1908	3738	2437	5077
	30	1037	1955	1258	2344	1545	2951	2051	3992	----	----
	40	1112	2084	1349	2498	1657	3145	2199	4253	----	----
10	-20	632	1255	769	1507	948	1906	1263	2490	1619	3537
	-10	688	1356	837	1629	1032	2059	1375	2797	1763	3818
	0	747	1460	908	1754	1120	2217	1492	3011	1913	4109
	10	814	1575	983	1885	1212	2382	1615	3236	2070	4412
	20	872	1681	1061	2021	1309	2555	1743	3466	2233	4725
	30	939	1798	1143	2162	1408	2730	1876	3705	----	----
	40	1008	1919	1227	2306	1513	2914	2014	3952	----	----
20	-20	570	1446	696	1381	862	1753	1151	2389	1480	3275
	-10	622	1240	760	1495	940	1897	1255	2583	1615	3541
	0	676	1338	826	1613	1021	2045	1365	2786	1755	3815
	10	738	1445	895	1736	1107	2200	1479	2997	1901	4101
	20	793	1546	967	1862	1197	2362	1598	3214	2054	4397
	30	854	1654	1043	1995	1290	2528	1723	3441	----	----
	40	919	1768	1122	2131	1387	2700	1852	3674	----	----



NOTE: 1) Maximum demonstrated crosswind velocity is 12 MPH (11 Knots). 2) Where distance value has been deleted, climb performance after lift off is less than 150 ft./min. 3) Conditions of high humidity can result in an increase of up to 10% to the above take-off distances.

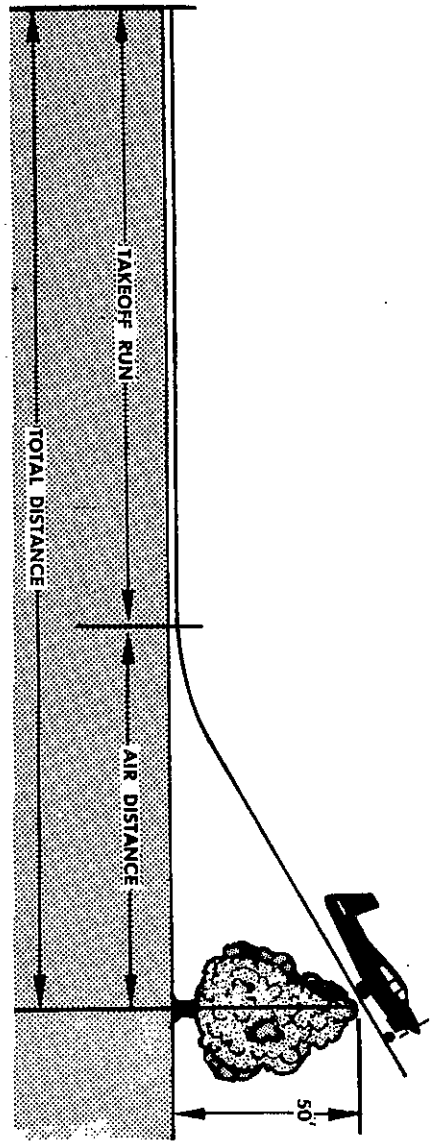
TAKEOFF DISTANCES

ASSOCIATED CONDITIONS:

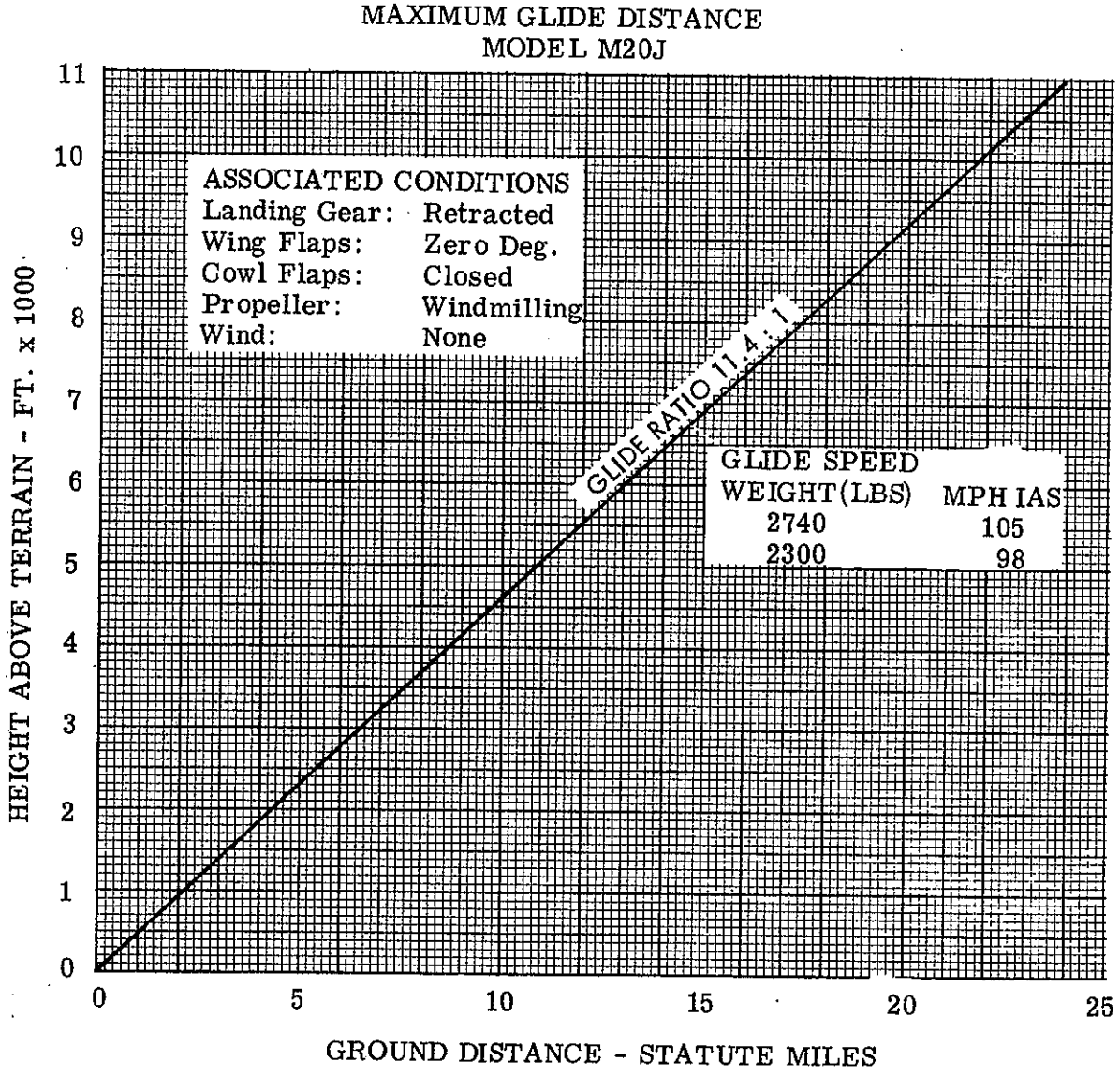
POWER - - - FULL THROTTLE, 2700 RPM (Before Brake Release)
MIXTURE - - LEAN FOR SMOOTH OPERATION
FLAPS - - - 15°
LDG GEAR - EXTENDED UNTIL OBSTACLE CLEARED

RUNWAY - - SHORT DRY GRASS SURFACE
WEIGHT - - - 2740' LBS.
TAKEOFF SPEED - - 73 MPH/63 KTS IAS
CLIMB OUT - - 82 MPH/71 KTS IAS
COWL FLAPS - - FULL OPEN

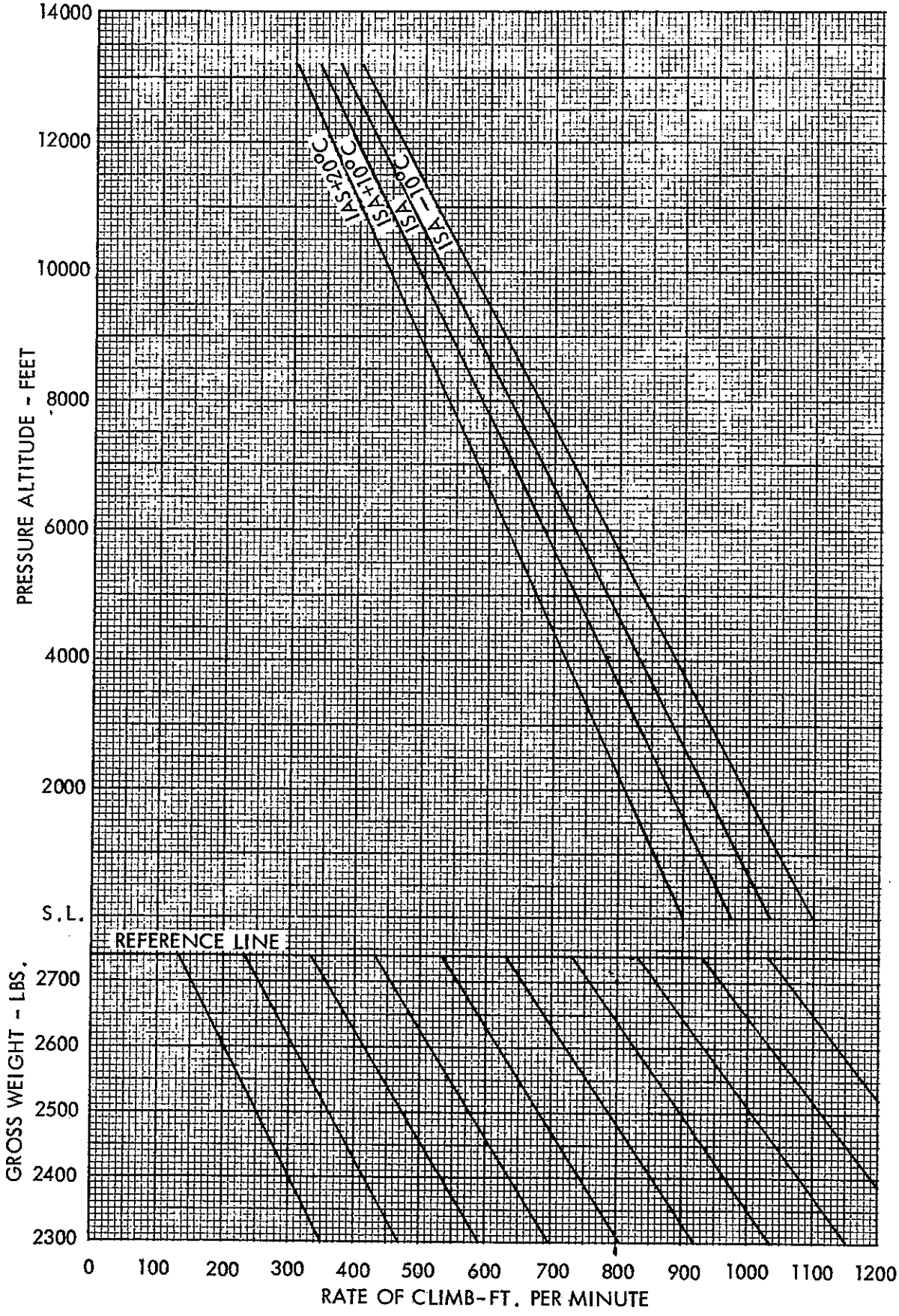
Headwind Component Down Runway Knots	OAT °C	PRESSURE ALTITUDE									
		Sea Level		2000		4000		6000		8000	
		Ground Roll Feet	Total Over 50' Obstacle Feet	Ground Roll Feet	Total Over 50' Obstacle Feet	Ground Roll Feet	Total Over 50' Obstacle Feet	Ground Roll Feet	Total Over 50' Obstacle Feet	Ground Roll Feet	Total Over 50' Obstacle Feet
0	-20	812	1482	1004	1796	1265	2290	1762	3178	2367	4409
	-10	888	1605	1100	1948	1388	2362	1939	3454	2613	4798
	0	969	1734	1201	2106	1518	2689	2127	3744	2875	5207
	10	1055	1870	1309	2273	1655	2902	2327	4050	3154	5638
	20	1145	2011	1422	2446	1802	3128	2540	4370	3454	6094
	30	1211	2129	1542	2628	1955	3361	2766	4707	----	----
	40	1339	2311	1667	2816	2119	3607	3005	5059	----	----
10	-20	724	1351	899	1637	1137	2095	1590	2917	2145	4063
	-10	793	1466	987	1779	1250	2277	1754	3176	2372	4427
	0	868	1581	1080	1926	1370	2467	1927	3446	2615	4811
	10	947	1708	1179	2081	1497	2667	2112	3733	2874	5216
	20	1029	1838	1283	2243	1632	2878	2309	4032	3152	5644
	30	1114	1973	1394	2413	1774	3096	2519	4348	----	----
	40	1208	2119	1509	2588	1926	3327	2741	4679	----	----
20	-20	640	1216	799	1484	1015	1906	1427	2665	1932	3727
	-10	704	1322	879	1614	1119	2076	1577	2905	2142	4068
	0	771	1433	964	1751	1229	2253	1737	3158	2366	4426
	10	843	1550	1055	1896	1345	2438	1907	3425	2605	4805
	20	919	1672	1151	2046	1471	2636	2089	3705	2863	5206
	30	997	1797	1253	2205	1601	2839	2283	4001	----	----
	40	1083	1932	1359	2368	1741	2477	2488	4310	----	----



NOTE: 1) Maximum demonstrated crosswind velocity is 12 MPH (11 Knots). 2) Where distance value has been deleted, climb performance after lift off is less than 150 ft./min. 3) Conditions of high humidity can result in an increase of up to 10% to the above take-off distances.


MAXIMUM GLIDE DISTANCE
MODEL M20J
HEIGHT ABOVE TERRAIN - FT. x 1000
GROUND DISTANCE - STATUTE MILES
0
1
2
3
4
5
6
7
8
9
10
11
0
5
10
15
20
25
ASSOCIATED CONDITIONS
Landing Gear: Retracted
Wing Flaps: Zero Deg.
Cowl Flaps: Closed
Propeller: Windmilling
Wind: None
GLIDE RATIO 11.4 : 1
GLIDE SPEED
WEIGHT(LBS) MPH IAS
2740 105
2300 98

EFFECT OF AMBIENT TEMPERATURE ON CLIMB PERFORMANCE
MODEL M20J- 2740 LBS.

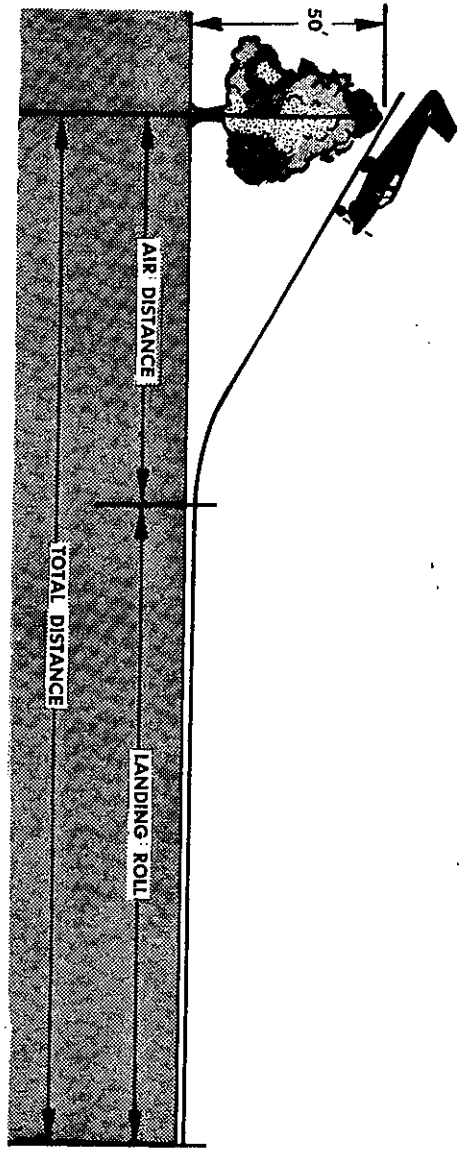


NORMAL LANDING DISTANCES

ASSOCIATED CONDITIONS:
POWER..... THROTTLE CLOSED
LANDING GEAR.....DOWN
WING FLAPS.....FULL DOWN (33°)
WEIGHT .....2740 LBS.

RUNWAY.....PAVED, LEVEL DRY SURFACE
APPROACH SPEED AT 50 FT.....81 MPH (71 KTS.) IAS
BRAKING.....MAXIMUM EFFORT

Wind Component Down Runway Knots	OAT °C	Pressure Altitude: Sea Level Ground Roll Feet	Sea Level Total Over 50 Ft. Obstacle Feet	2000 FT. Ground Roll Feet	2000 FT. Total Over 50 Ft. Obstacle Feet	4000 FT. Ground Roll Feet	4000 FT. Total Over 50 Ft. Obstacle Feet	6000 FT. Ground Roll Feet	6000 FT. Total Over 50 Ft. Obstacle Feet	8000 FT. Ground Roll Feet	8000 FT. Total Over 50 Ft. Obstacle Feet
0	-20	773	1805	904	1911	1046	2103	1193	2373	1348	2667
	-10	804	1851	940	1969	1087	2170	1240	2450	1401	2755
	0	834	1906	976	2028	1129	2238	1287	2526	1454	2842
	10	865	1962	1011	2089	1170	2305	1334	2603	1508	2930
	20	896	2018	1047	2149	1211	2372	1382	2680	1561	3017
	30	926	2074	1083	2209	1253	2439	1429	2757	1614	3105
	40	956	2129	1118	2269	1294	2507	1476	2834	1667	3193
10	-20	728	1700	854	1805	990	1990	1131	2250	1281	2534
	-10	758	1746	889	1862	1030	2056	1177	2326	1332	2620
	0	788	1800	924	1920	1070	2122	1223	2400	1384	2706
	10	818	1855	958	1979	1110	2187	1268	2475	1436	2791
	20	848	1910	993	2038	1150	2253	1315	2551	1488	2877
	30	877	1964	1028	2097	1191	2319	1361	2626	1540	2963
	40	906	2018	1062	2155	1231	2386	1407	2702	1592	3036
20	-20	688	1601	808	1703	938	1882	1074	2132	1218	2406
	-10	717	1646	841	1758	977	1946	1119	2206	1269	2491
	0	745	1698	875	1814	1017	2012	1163	2279	1319	2574
	10	774	1751	909	1874	1055	2075	1208	2353	1370	2658
	20	804	1806	943	1931	1094	2139	1253	2426	1421	2742
	30	832	1859	977	1989	1134	2204	1278	2501	1471	2827
	40	860	1911	1010	2046	1173	2269	1343	2575	1522	2884



NOTE: Maximum demonstrated crosswind velocity is 12 MPH (11 Knots)

For operation with wing flaps retracted, increase ground roll by 25%. Increase total distance by 60%.
Approach speed at 50 ft.: 91 MPH (79 KTS) IAS.

LANDING DISTANCES

ASSOCIATED CONDITIONS:

POWER - - - - - THROTTLE CLOSED

LANDING GEAR- DOWN

WING FLAPS - - FULL DOWN (33°)

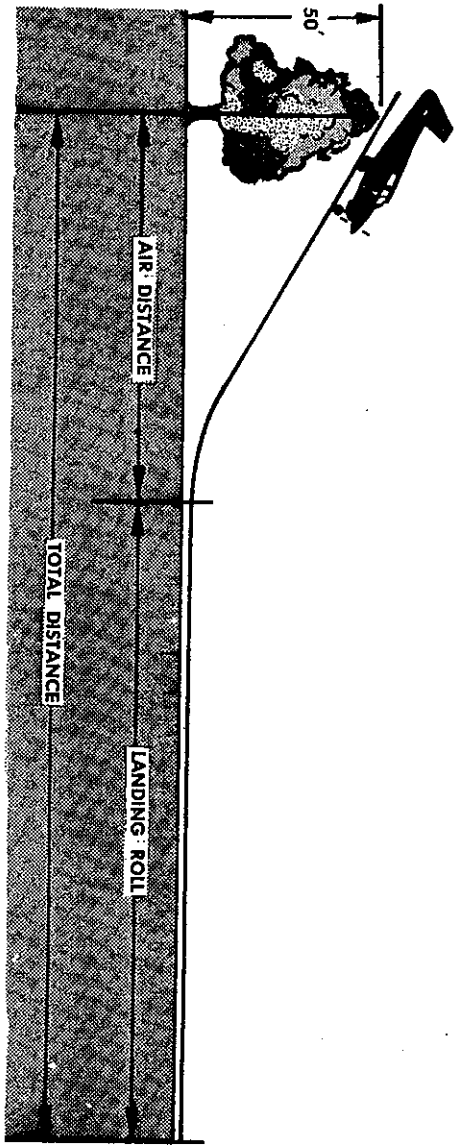
WEIGHT- - - - - 2740 LBS.

RUNWAY - - - - SHORT DRY GRASS SURFACE

APPROACH SPEED AT 50 FT 81 MPH (71 KTS)IAS

BRAKING - - - - MAXIMUM

Headwind Component Down Runway Knots	OAT °C	PRESSURE ALTITUDE									
		Sea Level		2000		4000		6000		8000	
		Ground Roll Feet	Total Over 50' Obstacle Ft.	Ground Roll Feet	Total Over 50' Obstacle Ft.	Ground Roll Feet	Total Over 50' Obstacle Ft.	Ground Roll Feet	Total Over 50' Obstacle Ft.	Ground Roll Feet	Total Over 50' Obstacle Ft
0	-20	1171	2203	1370	2377	1585	2642	1808	2988	2042	3361
	-10	1218	2265	1424	2453	1647	2730	1879	3089	2123	3477
	0	1264	2336	1479	2526	1711	2820	1950	3189	2203	3591
	10	1311	2408	1532	2560	1773	2908	2021	3290	2285	3707
	20	1358	2480	1586	2688	1835	2996	2094	3392	2365	3821
	30	1403	2551	1641	2767	1898	3084	2165	3493	2445	3936
	40	1448	2621	1694	2845	1961	3174	2236	3594	2526	4052
10	-20	1034	2006	1216	2167	1413	2413	1618	2737	1836	3089
	-10	1078	2066	1267	2240	1471	2497	1686	2835	1913	3201
	0	1122	2134	1318	2314	1532	2584	1753	2930	1989	3311
	10	1166	2203	1368	2389	1590	2667	1820	3027	2066	3421
	20	1210	2272	1420	2465	1649	2752	1890	3126	2143	3532
	30	1253	2340	1472	2541	1709	2837	1957	3222	2219	3642
	40	1296	2408	1522	2615	1769	2924	2025	3320	2296	3740
20	-20	909	1818	1070	1965	1249	2193	1439	2497	1640	2828
	-10	947	1876	1118	2035	1305	2274	1502	2589	1712	2934
	0	987	1940	1166	2105	1362	2357	1566	2682	1784	3039
		1029	2006	1214	2179	1417	2437	1629	2774	1858	3146
		1071	2073	1262	2250	1473	2518	1695	2868	1930	3251
	30	1111	2138	1311	2323	1529	2599	1759	2962	2003	3359
	40	1151	2202	1358	2394	1586	2682	1823	3055	2076	3438



NOTE: Maximum demonstrated crosswind velocity is 12 MPH (11 Knots).

For operation with wing flaps retracted, increase ground roll by 25%. Increase total distance by 60%. Approach speed at 50 ft.: 91 MPH (79 KTS) IAS.

30 NOV 1992

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

FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
FOR
MOONEY M20J - (S/N 24-0773, 24-0939, 24-1094 AND UP)

WITH

KING KFC 200 AUTOMATIC FLIGHT CONTROL SYSTEM
WITH FLIGHT DIRECTOR

Model No. M20J

Reg. No. G-BJNB

Ser. No. 24-1190

This supplement must be used in conjunction with the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the King KFC 200 Automatic Flight Control System is installed in accordance with Mooney dwg. 830125. The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic airplane flight manual.

FAA APPROVED: D.A. Tull
for Don P. Watson, Chief
Engineering & Mfg. Branch
FEDERAL AVIATION ADMINISTRATION
Southwest Region, Fort Worth, T

REVISION A
DATE SEP 6 1983

DATE: JUL 16 1980

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

LOG OF REVISIONS

Revision Number	Revised Pages	Description of Revision	FAA Approved*	Date
A	4	DELETION OF RE-DUNDANT PLACARD	C L Stone	9-6-83

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

*Don P. Watson, Manager, Airplane Certification Division

KFC 200
AP + FD

SECTION I

GENERAL

This manual is to acquaint the pilot with the operation of the KFC 200 Automatic Flight Control System with Flight Director as installed in the M20J airplane. The airplane must be operated within the limitations herein specified.

The KFC 200 System with Flight Director may be operated as a Flight Director alone with the pilot steering the airplane to satisfy the Flight Director command presentation or the autopilot may be engaged to automatically steer the airplane to satisfy the Flight Director commands.

The KFC 200 System autopilot is certified in this airplane with 2 axis control, pitch and roll or 3 axis control if optional Yaw Axis is installed. The optional 3rd axis (Yaw) when installed gives 3 axis damping and control whenever the autopilot mode is engaged. With the installation of an optional KC 291 Yaw Damper Mode Controller, Yaw Damping and turn coordination is available with or without the basic autopilot mode being engaged. Both the 2 axis and 3 axis version of the system are described in this manual.

The airplane is equipped with an electric pitch trim system which is controlled by pilot operation of the trim switch. When autopilot coupled, the autopilot uses the electric trim system to accomplish automatic trimming to unload the autopilot elevator servo so that autopilot disengagement does not result in transient airplane motion. An autotrim/electric pitch trim monitor is provided in the autopilot. Autotrim and/or electric pitch trim faults are visually annunciated on the Mode Annunciator and accompanied by an audible warning.

This airplane is equipped with a manual electric trim system designed to withstand any type inflight single malfunction, provided that the system is fully functional during the preflight operational check.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

AFCS	Automatic Flight Control System
ALT	Altitude or Altitude Hold
AP	Autopilot
APPR	Approach
ARM	System Arm for Capture

Symbols, Abbreviations and Terminology cont...

BC	Back Course
CDI	Course Deviation Indicator or Control
CPLD	Coupled
CWS	Control Wheel Steering
DISC	Disconnect
FCS	Flight Control System
FD	Flight Director System
GA	Go Around
GS	Glideslope
HDG	Heading Select
NAV	Navigation
PAH	Pitch Attitude Hold
PNI	Pictorial Navigation Indicator
FDI	Flight Director Indicator
LOC	Localizer

SECTION II

LIMITATIONS

A. During autopilot operation, the pilot must be seated at the controls with seat belt fastened. Operation is limited to the left side pilot position.

B. Maximum speed for autopilot operation is 207 mph/180 kts indicated airspeed. Minimum speed for Autopilot operation is 92 mph/80 kts indicated airspeed.

C. During autopilot operation, the wing flaps must not be extended beyond 15° (Take-off position).

D. The autopilot must be disengaged during take-off and landing.

E. System approved for Category I operation only (APPR Mode selected).

Autopilot attitude command limits:

Pitch	±15°
Roll	±20°
Yaw	NA

Placards:

1) AP DISC Location - Pilot's control wheel, left horn.

2) TRIM INTERRUPT — Location - Pilot's control wheel, right horn.

3) CWS — Location - Pilot's control wheel, right horn.

4) TRIM DN / UP — Location - Pilot's control wheel, left horn.

5) GO AROUND — Location - Instrument panel, directly above the throttle.

6) 3 AXIS AP CONTROL — Location - Immediately adjacent to KC 290 (If equipped with a 3rd axis without KC 291).

7) CONDUCT TRIM CHECK PRIOR TO FLIGHT, SEE PILOT'S OPERATING HANDBOOK. — Location - On console below engine controls.

NOTE

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

SECTION III

EMERGENCY PROCEDURES

A. Autopilot/Yaw Damp Malfunction:

1. AP DISC Switch - Hold the Control Wheel firmly and press the AP DISC Switch.

B. Electric Trim Malfunction (either manual electric or autotrim)

1. TRIM INTERRUPT SWITCH - Press and hold down until recovery can be made.

2. ELEV TRIM switch - OFF.

3. AIRPLANE - Manually retrim.

C. Autopilot/Yaw Damp Manual Disengagement.

1. The autopilot and/or Yaw Damp can be manually disengaged by the following methods:

a) Press the AP DISC switch on the Pilot's control wheel.

b) Move the Autopilot ON-OFF handle to the OFF position. (Dumps AP only with KC291 Yaw Controller installed).

c) Turn off the Radio Master switch.

d) Operate manual electric trim switch UP or DN.

e) Depressing the GA switch on panel near engine throttle. (Dumps AP only with KC291 Yaw Controller).

f) Cycle the Yaw Damp Switch. (with KC291 Yaw Controller. Dumps Yaw Damp only).

D. The following conditions will cause the Autopilot/Yaw Damp to automatically disengage:

1. Power failure.

2. Internal Flight Computer Power supply failure.

3. With the KCS 55A compass system, a loss of compass valid (displaying HDG flag) disengages the AP and FD when a mode using heading information is engaged. With the HDG flag present only vertical modes can be selected.

E. Manual electric pitch trim can be disengaged by:

Press TRIM INTERRUPT switch and hold down until recovery can be made, then turn off ELEV TRIM switch and manually retrim the airplane using the manual trim control wheel.

NOTE

IF "ELEV TRIM" SWITCH IS TURNED OFF, THE AIRPLANE ELECTRIC TRIM SYSTEM WILL BE DISABLED ("TRIM" WARNING ANNUNCIATOR FLASHES). IN THIS EVENT THE AUTOPILOT SHOULD BE DISENGAGED AND NOT USED.

F. Maximum altitude losses due to autopilot malfunctions.

Configuration	Alt Loss
Cruise, Climb, Descent	360'
Maneuvering	80'
APPR	80'

CAUTION

WHEN THE AUTOPILOT IS ENGAGED, MANUAL APPLICATION OF A FORCE TO THE PITCH AXIS OF THE CONTROL WHEEL FOR A PERIOD OF THREE SECONDS OR MORE WILL RESULT IN THE AUTO TRIM SYSTEM OPERATING IN THE DIRECTION TO CREATE A FORCE OPPOSING THE PILOT. THIS OPPOSING MISTRIM FORCE WILL CONTINUE TO INCREASE AS LONG AS THE PILOT APPLIES A FORCE TO THE CONTROL WHEEL AND WILL ULTIMATELY OVERPOWER THE AUTOPILOT. IF THE AUTOPILOT IS DISENGAGED UNDER THESE CONDITIONS, THE PILOT MAY BE REQUIRED TO EXERT CONTROL FORCES IN EXCESS OF 50 POUNDS TO MAINTAIN THE DESIRED AIRPLANE ATTITUDE. THE PILOT WILL HAVE TO MAINTAIN THIS CONTROL FORCE WHILE HE MANUALLY RETRIMS THE AIRPLANE.

SECTION IV

NORMAL PROCEDURES

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

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

C. The KFC 200 is controlled by the following circuit breakers:

Autopilot (AUTOPILOT)	This supplies power to the FCS KC 295 Computer, KC 290 Mode Controller, KA 285 Annunciator Panel, KI 256, and AP Pitch and Roll Servos. When optional yaw damper system is installed, this breaker also supplies power to the KC 296 Yaw Computer, the Yaw Servo, and the KC 291 if so equipped.
RADIO MASTER	This switch/circuit breaker supplies power to the avionics buss.
ELEV TRIM	This switch/circuit breaker supplies power to the FCS autotrim and manual electric pitch trim systems.
COMP. SYSTEM (HSI)	This supplies power to the KCS 55A Compass System.

D. Pilot's control wheel switch functions:

TRIM INTERRUPT	This is a single detent switch that will interrupt the power to the electric trim system when depressed and disconnect the FD, and AP if engaged. In the event of electric trim failure the switch can be held down which removes all power from both the electric and autotrim system to allow the pilot time to turn off the Elev Trim switch.
AP DISC	The left hand portion of the manual electric trim switch provides the AP and yaw damp disconnect functions. Momentarily moving the switch forward or backwards will interrupt the power going to the servo engage clutches and cause both AP and Yaw Damp engage switches to disengage.
CWS	This switch, when depressed and held, will allow the pilot to manually fly the airplane in pitch and roll without disengaging the AP. When the switch is released the AP will resume control (within the pitch and roll attitude limits The CWS switch will resync the FD and PAH, or ALT hold mode and will transfer th GA mode to PAH.
TRIM DN UP	Manual electric pitch trim is activated by a dual action type switch that requires both portions to be moved simultaneously for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller and switch the YAW DAMP mode off.

CAUTION

UNDER SOME CONDITIONS IT IS POSSIBLE THAT WHEN THE MANUAL ELECTRIC TRIM RUNS THE LONGITUDINAL TRIM TO THE LIMIT STOP, THERE MAY NOT BE SUFFICIENT TORQUE TO RUN THE TRIM IN THE OPPOSITE DIRECTION (AWAY FROM THE STOP). IF THIS OCCURS, MANUAL REPOSITION OF THE TRIM AWAY FROM THE LIMIT STOP MAY BE REQUIRED.

D. (continued)

GA — The GA switch is located on the airplane panel adjacent to the throttle and the operation of the switch will indicate a fixed angle of climb of 6° on the FDI. Selection of the GA Mode when in the APPR or NAV CPLD Mode will disengage the mode and revert to the FD Mode (wings level) for lateral steering. The AP, if engaged, will disengage. The AP, however, can be engaged or re-engaged with GA mode selected and will follow the pitch command to climb at the fixed angle.

E. FCS Warning Flags and Annunciators Designation and Operation:

The KI 256 Flight Director Indicator does not have a warning flag. However, the command bars will be biased out of view whenever the system is invalid or a FD mode is not engaged.

HDG — This warning flag, mounted in the Pictoria Navigation Indicator, will be in view whenever the Directional Gyro information is invalid. If a HDG invalid occurs with either NAV, APPR, or HDG modes selected, the AP and/or FD is disengaged. Basic FD mode may then be re-engaged along with any vertical mode and the AP re-engaged.

TRIM — The TRIM Warning light, located in the lower right corner of the annunciator panel, will flash and be accompanied by an audible warning whenever autotrim and/or manual electric pitch trim failures occur. The Trim servo running without a command is monitored for both manual electric trim and Autotrim. The Trim servo motor not running when commanded to run, and the trim servo motor running in the wrong direction are monitored on Autotrim only. The TRIM warning light will flash at least 4 times but not more than 6 times and the audible warning sound when the test switch on the mode controller is depressed.

E. (continued)

GS	The Glideslope valid, (GS pointer being in view on PNI) has to be present before GS may couple. If, after GS CPLD, the valid is lost, the system will flash the GS Annunciator and revert from GS CPLD back to PAH with the FDI pitch steering bar providing pitch attitude steering information. If the GS valid returns the system will revert back to GS CPLD.
NAV	The NAV or APPR Modes (ARM or CPLD) may be selected and will function with or without a NAV warning flag present. The FDI bank steering will continue to provide steering information with or without a valid NAV signal.
AP Disconnect Alert	A two second solid audio warning will sound whenever the Autopilot engage lever c the mode controller is disengaged.

F. Before Engaging Flight Control System:

1. Check that all circuit breakers for the system are in.

2. Allow sufficient time for gyros to come up to speed and system warm-up. (3 to 4 minutes).

G. Preflight Check: Perform prior to each flight.

1. With no modes engaged and power applied to all systems, depress the Test Button on the KC 290 Mode Controller. The Yaw Damp ON light will illuminate (if KC291 yaw controller is installed) and all modes will be indicated on the KA 285 Mode Annunciator including the three marker lights. Also, the red TRIM failure light will flash. At least four but not more than six flashes must be observed to indicate proper operation of the autotrim/manual electric pitch trim monitor and the audible warning should sound.

2. Engage the FD. Then engage the AP and Yaw Damp, depress the CWS switch, center the flight controls and then release the CWS switch. Apply force to the controls to determine if the AP and Yaw Damp can be overpowered.

3. With the FD, AP and Yaw Damp engaged press the AP DISC switch to see that it disengages the Autopilot and Yaw Damp.

4. Perform the following manual electric pitch trim checks:

   a. Verify that the Elev TRIM Switch is on.

   b. Actuate the left-side switch to the fore and aft positions. The trim solenoid should engage, but the trim servo should not run.

   c. Actuate the right-side switch to the fore and aft positions. The trim solenoid should not engage and the trim should not run.

   d. Run the trim from full nose up to full nose down: The time required is 37 ± 6 seconds.

   e. Grasping the manual trim wheel, run the electric trim in both the up and down directions and check the overpower capability.

   f. Press the TRIM INTERRUPT switch down and hold. The manual electric pitch trim will not operate either up or down.

5. Disengage AP and set airplane manual pitch trim to take off position.

CAUTION

IF THE AUTOPILOT OR ELECTRIC TRIM FAILS PREFLIGHT TEST, THE AUTOPILOT CIRCUIT BREAKER SHOULD BE PULLED AND ELEV TRIM SWITCH SHOULD BE TURNED OFF AND NEITHER AUTOPILOT NOR ELECTRIC TRIM SHOULD BE USED.

H. Preflight check: Perform prior to first flight of the day.

1. Check operation of pilot's control wheel switch functions.

2. Engage the FD and AP and put in a pitch (UP) command using the vertical trim switch on the Mode Controller. Hold the control column to keep it from moving and observe the autotrim run in the nose-up direction after approximately three seconds delay. Press the CWS Switch and resync the autopilot. Use the vertical trim switch and put in a pitch (DN) command. Hold the control column and observe the autotrim run in the nose-down direction after approximately 3 seconds.

H. (continued)

3. Engage the HDG mode and the AP. Set the HDG bug to command a right turn. The control wheel will rotate clockwise. Set the HDG bug to command a left turn. The control wheel will rotate counterclockwise.

CAUTION

DISENGAGE THE AP AND CHECK THAT THE AIRPLANE MANUAL PITCH TRIM IS IN THE TAKEOFF POSITION PRIOR TO TAKEOFF.

NOTE

IF THE AUTOPILOT CIRCUIT BREAKER IS PULLED, THE RED "TRIM" FAILURE LIGHT ON THE ANNUNCIATOR PANEL WILL BE DISABLED AND THE AUDIBLE WARNING WILL CONTINUOUSLY SOUND INDICATING THAT THE FAILURE LIGHT IS DISABLED. IN THIS EVENT THE "ELEV TRIM" SWITCH SHOULD BE TURNED OFF AND INFLIGHT TRIM ACCOMPLISHED BY USING THE MANUAL PITCH TRIM WHEEL.

I. In-Flight Operation

1. Engage Procedure:

After takeoff, clean up airplane and establish climb. Engage the FD mode first, monitor flight controls and engage AP. The AP will lock on any pitch attitude up to ±15°.

NOTE

DO NOT ENGAGE AUTOPILOT IN ATTITUDES BEYOND AUTOPILOT LIMITS.

Engaging and holding the CWS switch allows the pilot to momentarily revert to manual control while retaining his previous modes, except GA, and conveniently resume the profile at his discretion.

2. Disengage Procedure:

Check the airplane trim by monitoring the command bars before disengaging the AP. While holding the flight controls firmly, disengage the system by one of the following methods: depressing the pilot's AP DISC switch or by the operation of the engage lever on the Mode Controller. The AP light on the annunciator panel will flash at least four times and remain off and an audible warning will be heard to indicate that the AP is disengaged. To deactivate the flight director system, depress the FD switch on the Mode Controller or press the TRIM INTERRUPT switch on the pilot's control wheel.

NOTE

IF THE AIRPLANE IS EQUIPPED WITH KC 291, THE OPTIONAL YAW DAMPER MODE WILL DISENGAGE WITH THE USE OF THE PILOT'S CONTROL WHEEL "AP DISC" SWITCH, BUT WILL NOT DISENGAGE AUTOMATICALLY WHEN THE MODE CONTROLLER "AP" SWITCH IS DISENGAGED. THE YAW DAMPER CAN BE DISENGAGED AT ANY TIME BY DEPRESSING THE YAW CONTROLLER "YAW DAMP" SWITCH.

3. Flight Director Mode (FD):

The FD mode must be engaged before the AP can be engaged. The FD alone indicates PAH and wings level. The pilot may choose to fly the FDI commands manually, without the AP engaged, by depressing the FD mode switch on the Mode Controller and selecting any of the other modes he wishes to follow. When the AP is engaged, the airplane will automatically follow the FDI commands.

The FD may be disengaged by depressing the FD mode switch on the Mode Controller at any time the AP is not engaged or by pressing the TRIM INTERRUPT switch on the pilot's control wheel with or without the AP engaged. FD mode engagement is displayed on the annunciator.

NOTE

THE "VERTICAL TRIM" SWITCH, LOCATED ON THE MODE CONTROLLER, MAY BE USED TO TRIM THE COMMAND PITCH ATTITUDE AT A RATE OF ONE DEGREE PER SECOND (THE PITCH ATTITUDE DEGREES LEGEND ON THE AIRPLANE ATTITUDE INDICATOR WILL NOT SERVE TO INDICATE ACCURATE FDI PITCH STEERING BAR PITCH ATTITUDES IN DEGREES).

4. Altitude Hold Mode (ALT):

When the ALT switch on the Mode Controller is pressed, the FDI will provide commands for maintaining the pressure altitude existing at the time the switch is depressed. For smooth operation, engage the ALT at no greater than 500 ft. per minute climb or descent. ALT will automatically disengage when glideslope couples or the GA switch is depressed. ALT hold may be turned off at any time by depressing the ALT switch. ALT engagement is displayed on the annunciator panel.

NOTE

THE "VERTICAL TRIM" SWITCH, LOCATED ON THE MODE CONTROLLER, MAY BE USED TO CHANGE OR TRIM THE COMMAND ALTITUDE UP OR DOWN AT 500 TO 700 FPM WITHOUT DISENGAGING THE MODE. THE NEW PRESSURE ALTITUDE THAT EXISTS WHEN THE SWITCH IS RELEASED WILL THEN BE HELD.

5. Heading Mode (HDG)

Set the heading bug to desired heading on the PNI, depress the HDG switch on the Mode Controller and HDG will be displayed on the annunciator panel. The airplane FDI and/or AP will command a turn to the heading selected and hold. The pilot may then choose any new heading by merely setting the bug on a new heading. The airplane FDI and/or AP will automatically command a turn in the direction of the new setting. To disengage the HDG Mode, depress the HDG switch on the Mode Controller and observe the HDG light go out on the annunciator. The HDG mode will automatically disengage when APPR or NAV CPLD is achieved.

6. Navigation Mode (NAV):

The Navigation mode may be selected by tuning the NAV receiver to the desired frequency, setting the CDI to the desired radial and depressing the NAV switch on the Mode Controller. The annunciator will indicate NAV ARM until intercepting the selected course, unless the NAV switch is engaged with wings level and a centered needle on the CDI. Then the mode will go directly to NAV CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. If a condition requiring a capture exists at mode engagement, the pilot is required to set up an intercept angle using either HDG or FD mode. NAV may be disengaged by depressing the NAV switch or by engaging HDG when in NAV CPLD or APPR when in NAV CPLD/ARM.

CAUTION

THE "NAV" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE COMMAND AND/OR CONTROL WITHOUT A VALID VOR/LOC SIGNAL (NAV FLAG IN VIEW). ALSO ERRONEOUS NAVIGATION INFORMATION MAY RESULT FROM COMM RADIO INTERFERENCE WITH NAV RADIO. THIS ERRONEOUS INFORMATION MAY CAUSE PREMATURE NAV CAPTURES AS WELL AS ERRONEOUS STEERING INFORMATION. SHOULD THIS OCCUR RE-SELECT "HDG" MODE AND THEN RE-SELECT "NAV" MODE.

7. Approach Mode (APPR):

The Approach mode may be selected by tuning the NAV receiver to the desired VOR or LOC frequency, setting the CDI to the desired radial or inbound heading and depressing the APPR switch on the Mode Controller. The annunciator will indicate APPR ARM until the course is intercepted unless the APPR switch is engaged with the wings level and there is a centered needle on the CDI. In that situation, the mode will go directly to APPR CPLD as displayed on the annunciator panel. The

7. Approach Mode (APPR) (continued)

system can intercept at any angle up to 90° and will always turn toward the course pointer. See approach procedure for more detail. APPR mode can be disengaged by depressing the GA switch on the control panel or by engaging HDG or NAV when in APPR CPLD. The annunciator panel indicates the status of the approach mode.

CAUTION

THE "APPR" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE COMMANDS AND/OR CONTROL WITHOUT A VALID VOR/LOC SIGNAL (NAV FLAG IN VIEW). ALSO ERRONEOUS NAVIGATION INFORMATION MAY RESULT FROM COMM RADIO INTERFERENCE WITH NAV RADIO. THIS ERRONEOUS INFORMATION MAY CAUSE PREMATURE APPR CAPTURES AS WELL AS ERRONEOUS STEERING INFORMATION. SHOULD THIS OCCUR RE-SELECT "HDG" MODE AND THEN RE-SELECT APPR MODE.

8. Back Course Mode (BC):

For BC operation proceed as for normal approach mode, but engage BC after selecting APPR. The BC switch reverses the signals in the computer and cannot be engaged without a LOC frequency selected. BC status is indicated on the annunciator panel. BC mode can be disengaged by depressing either the BC, APPR or GA switches, or by selecting other than a LOC frequency on the NAV receiver.

9. Trim Up/DN:

Operation of the vertical trim switch on the Mode Controller provides a convenient means of adjusting the ALT hold or PAH angle function without disengaging the mode.

10. Go Around Mode (GA):

The GA mode may be engaged at any time by depressing the GA switch on the airplane panel. GA will illuminate on the annunciator panel indicating mode status. The GA mode provides a fixed pitch up angle of 6° degrees for climbout. The AP, if engaged will disengage. GA will cancel all other vertical modes as well as APPR or NAV CPLD.

11. Yaw Damper Mode (YAW DAMP):

The optional Yaw Damper mode engages automatically when the AP is engaged or may be engaged or disengaged separately by the use of the YAW DAMP switch on the optional Yaw Controller. The Yaw Damper provides lateral damping plus turn coordination

11. Yaw Damper Mode (YAW DAMP) (continued)

as a third axis with AP engaged or as a stand alone system with only the YAW DAMP on. If no KC 291 is used, the Yaw Damper will disengage with AP disengagement.

J. VOR Procedures:

1. Tune NAV receiver to the appropriate frequency.

2. Set the desired heading with the HDG bug to intercept the radial and engage HDG and AP (Maximum recommended intercept angle is 90°).

3. Select the desired radial and engage NAV. The FCS will remain on HDG as indicated on the annunciator panel and in ARM on the NAV mode. When the airplane intercepts the beam, the system will automatically couple and track in NAV mode and indicate CPLD on the annunciator.

4. A new course may be selected over the VOR station when operating in the NAV mode, by selecting a new radial when the To-From indication changes.

5. For VOR approach, see approach procedure.

K. Approach Procedures:

1. Tune ILS or VOR.

2. Set CDI to front course.

3. Set Heading Bug and engage HDG to intercept beam. (Maximum recommended intercept angle is 90°).

4. Engage APPR and note APPR ARM on the annunciator panel.

5. When the airplane approaches the beam, APPR will couple, HDG will decouple, the FDI and/or AP will give commands to track LOC or VOR, and CPLD will illuminate on the annunciator panel. If a satisfactory capture is not achieved, reselect HDG, select a new intercept heading, and then engage APPR. This places the system back in APPR Arm and a new capture cycle is commanded.

6. Flaps not to exceed 15° (Take off) position.

7. When the glideslope beam is intercepted, the glideslope will couple automatically and indicate GS on the annunciator panel. If ALT was engaged prior to intercepting the glideslope, it will automatically disengage when GS couples. Airplane FDI and/or AP will now provide command to track LOC and GS. Adjust throttle to control speed

7. (continued)

on descent. Set HDG bug for missed approach but do not engage HDG.

NOTE

SHOULD THE "GA" MODE BE INADVERTENTLY SELECTED DURING "APPR" MODE OPERATION, CANCEL THE "GA" MODE (PRESS CWS) PRIOR TO RE-SELECTION OF THE "APPR" MODE. IT MAY BE NECESSARY TO USE SOME COMBINATION OF VERTICAL TRIM AND POWER TO RE-CENTER THE GLIDESLOPE FOR "GS" COUPLING. FAILURE TO FOLLOW THIS PROCEDURE WILL RESULT IN THE "GS" MODE BEING INHIBITED.

8. When middle marker signal is received, system will automatically switch to a more stable track mode.

NOTE

OPERATION OF THE MARKER TEST FUNCTION AFTER APPROACH COUPLED WILL REDUCE THE FLIGHT CONTROL SYSTEM GAINS. IF THIS SHOULD OCCUR THE APPROACH MODE SHOULD BE RECYCLED.

9. Landing or missed approach.

a) Disengage AP and land.

b) Go around by depressing the GO AROUND switch on the airplane panel. The AP will disengage if engaged and the FDI will command a 6° climb attitude. APPR may be engaged for a straight away missed approach or HDG may be engaged to turn to the missed approach heading.

L. Back Course Procedure:

Same as front course except that BC is engaged after APPR is engaged and the airplane must be set for descent manually by holding the vertical trim switch DN on the MODE CONTROLLER if in ALT hold or by establishing the desired PAH using CWS or Vertical Trim Switch.

SECTION V.

PERFORMANCE

No change.

30 NOV 1992

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

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

MOONEY MODELS

M20C, M20J, M20K, M20L, M20M

WITH

KING KNS-80 RNAV SYSTEM

Reg. No. G-BJHB

Ser. No. 24-1190

This supplement must be attached to the applicable Airplane Flight Manual when the King KNS-80 RNAV System has been installed by Mooney Aircraft Corporation. The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures and performance information not contained in the supplement, consult the basic Airplane Flight Manual.

FAA APPROVED: _____

Don P. Watson, Chief
Engineering & Mfg. Branch
FEDERAL AVIATION ADMINISTRATION
Southwest Region, Fort Worth, TX

Original Issue Date: 12 - 21 - 78

Revision D: 7 - 29 - 89

MOONEY AIRCRAFT CORPORATION

P. O. BOX 72

Kerrville, Texas 78029-0072

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date
D	ALL PAGES	1) Add M20M Model	A A Pomeroy	7-28-89

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

SECTION I - GENERAL

The KNS-80 system contains one VOR/DME receiver combination when in the RNAV mode and has the capability for autopilot coupled operations. KNS-80 Area Navigation Computer includes a four waypoint memory for data storage and annunciation of conventional operating modes when selected. The system will retain its waypoint storage memory from its own battery power with the aircraft battery switch off.

1.1 HORIZONTAL SITUATION OR COURSE DEVIATION INDICATOR

1. COURSE SELECTOR Control - Used to set the magnetic course to the waypoint in either RNAV ENR or APR mode.

Sets the magnetic course to the VOR ground station in VOR and VOR PAR mode.

2. VERTICAL DEVIATION BAR - Represents deviation from the selected magnetic course. Pointer moves left or right of the center line as airplane deviates from the selected magnetic course. Course width is 20 degrees in VOR mode, 10 nautical miles in RNAV ENR mode and 2-1/2 nautical miles in RNAV APR mode.

3. HORIZONTAL DEVIATION BAR * - When the KNS 80 is tuned to an ILS frequency the horizontal deviation bar represents the deviation from the suggested glidepath. If the airplane is above the glidepath, the horizontal bar is displaced downward. If below the glidepath the horizontal bar is displaced upward.

4. TO/FROM POINTER - Indicates whether the selected magnetic course is TO or FROM the destination. The pointer reverses direction as the destination is passed.

5. WARNING FLAG - Shows if the Course Deviation data is unreliable. A black background appears if the Course Deviation data is reliable. If the data is not reliable, the TO/FROM flag disappears from view, and a red NAV flag appears.

6. LIGHTING - The CDI lighting is controlled by an instrument lighting rheostat which controls all instrument panel lighting.

* Not applicable to systems without a glideslope.

SECTION II - LIMITATIONS

1. The KNS 80 in the RNAV mode is limited to VFR operations only unless accuracy certified per AC 90-45A for IFR operations. (Placard installed below right end of instrument cluster if not IFR approved) IFR approaches must be conducted in accordance with approved instrument approach procedures.

2. IFR approaches must be conducted in accordance with FAA approved instrument approach procedures.

3. IFR Enroute use of the RNAV must be conducted in accordance with FAA approved RNAV routes or with a flight plan filed with and accepted by the applicable A.T.C. facility.

4. A/P coupled R/N approaches are prohibited. (Placard installed just above artificial horizon.) Limitation applies to KNS 80 S/N 3865 and prior only.

Coupled approaches are permissible with approved autopilot installations.

5. VOR PAR mode prohibited during approach operation.

6. VOR/DME stations used for RNAV and VOR PAR operations must be co-located.

SECTION III - EMERGENCY PROCEDURES

NO CHANGE

SECTION IV - NORMAL PROCEDURES

4.1 KNS 80 OPERATION

4.1.1 GENERAL

The KNS 80 can be operated in any of 3 basic modes:

(a) VOR, (b) RNAV or (c) ILS.

To change from one mode to another, the appropriate pushbutton switch is pressed, except that the ILS mode is entered automatically whenever an ILS frequency is channeled in the USE waypoint. The display will annunciate the mode lighting a message above the pushbutton. In addition to the standard VOR and RNAV enroute (RNV ENR) modes, the KNS 80 has a constant course width or parallel VOR mode (VOR PAR) and an RNAV approach mode (RNV APR). To place the unit in either of these secondary modes the VOR pushbutton or the RNAV pushbutton, as the case may be, is pushed a second time. Repetitive pushing of the VOR button will cause the system to alternate between the VOR and VOR PAR modes, while repetitive pushing of RNAV button causes the system to alternate between RNV ENR and RNV APR modes.

A description of the RNAV and VOR modes is as follows:

1. VOR

This is the conventional VOR/DME mode. The NM, KT- and MIN displays are DME outputs and the CDI is displaying conventional cross track deviation information (i.e., +/-10 degrees full scale).

2. VOR PAR

This is like the above mode except that the CDI is now displaying constant course width information with a full scale deflection of +/- 5 NM. In this mode, a DME "unlock" will cause a CDI flag. Rechanneling the VOR with the HOLD button depressed will also cause a CDI flag. It is recommended that the VOR mode be used instead of VOR PAR for approaches since in this mode the course indication is more accurate at distances less than 28 nautical miles.

WARNING
VOR PAR information can be displayed during ILS or RNAV approaches but use is prohibited.

3. RNV ENR

This RNAV mode has a CDI sensitivity of +/- 5 NM full scale. The NM, KT and MIN displays as well as the CDI are now with respect to the waypoint as defined by the data stored in the USE waypoint location.

4. RNV APR

This is like the above except that the CDI sensitivity is +/- 1.25 NM full scale.

CAUTION
Autopilot approach steering is too sensitive for coupled approach operation and is prohibited.

All waypoint information, station frequency, waypoint distance, and waypoint radial is entered with the increment/decrement rotary switch on the right side of the panel

and displayed in the right hand readout. The small knob affects the lower significant digits while the large knob changes the most significant digits. The tenth's position of waypoint radial and distance can be changed by pulling the small knob to the out position. The type of data being displayed is indicated by the illuminated messages (FRQ, RAD, DST) located directly below the displayed data.

Frequency, radial, or distance information for a waypoint can be displayed sequentially by pressing the "DATA" pushbutton. The increment/decrement switch changes only the information being displayed.

The KNS 80 can store frequency, radial, and distance information for up to 4 waypoints. The waypoint number of the data being displayed is located above the message DPS. The DSP waypoint number is changed by pressing DSP button. The number of the waypoint being used for navigation is indicated by the displayed waypoint, the DSP waypoint number blinks. Pressing the USE button causes the waypoint in use to match the displayed waypoint.

Normally, the DME is tuned to the station paired with the VOR frequency. The tuning of the DME may be frozen by depressing the HOLD button. Subsequent rechanneling of the NAV receiver will cause the HLD light to come on. The DME will "hold" the frequency it was tuned to at the time the button was depressed.

4.2 DETAILED FUNCTION DESCRIPTION

4.2.1 SYSTEM MODES

VOR, VOR PAR, RNV ENR and RNV APR are selected modes and have equal precedence. If an ILS frequency is placed in the active data, the system will automatically go to the ILS mode. When switched out of an ILS frequency the system will revert back to the mode in which it was at the time the ILS frequency was selected.

4.2.2 DISPLAYS

4.2.2.1 - NM DISPLAY

1. VOR and VOR PAR modes

Displays DME distance.
0 to 99.9 NM in 0.1 NM steps, 100 to 200 NM in 1 NM steps.
Displays dashes whenever DME goes into search.

2. RNV APR and RNV ENR Modes

Displays RNAV distance to waypoint.
0 to 99.9 NM is 0.1 NM steps, 100 to 400 NM in 1 NM steps.
Displays dashes if DME is in search, if VOR flags, or if the VOR is rechanneled with the HOLD button depressed.

4.2.2.2 - KT DISPLAY

1. VOR and VOR PAR modes

Displays ground speed to the DME ground station.
0 to 999 knots in 1 knot steps.
Update rate is once per second.
Displays dashes whenever DME goes into search.

2. RNV APR and RNV ENR Modes

Displays ground speed to the active waypoint.
0 to 999 knots in 1 knot steps.
Update rate is once per second.

Displays dashes whenever DME goes into search, if VOR flags or if the VOR is rechanneled with the HOLD button depressed.

4.2.2.3 - MIN DISPLAY

1. VOR and VOR PAR Modes

Displays time to DME ground station.
0 to 99 minutes in 1 minute steps.
Displays dashes whenever DME goes into search or when calculated value exceeds 99 minutes.

2. RNV APR and RNV ENR Modes

Displays time to the active waypoint.
0 to 99 minutes in 1 minute steps.
Displays dashes if DME is in search, if VOR flags, if the VOR is rechanneled with the HOLD button depressed, or if calculated value exceeds 99 minutes.

4.2.2.4 - FRQ. RAD. DST DISPLAY

1. FRQ Mode

Displays frequency from 108.00 to 117.95 MHz.
1 MHz digit overflows into (or underflows from) 10 MHz digit.
Roll over from 117 to 108 or vice versa.
Least significant digit displays only zero or five.

2. RAD Mode

Displays ground station radial on which the waypoint is located from 0.0 to 359.9 degrees.
10 degree digit overflows into (or underflows from) 100 degree digit.

3. DST Mode

Displays the distance offset of the waypoint from the ground station over range of 0.0 to 199.9 NM.
10 NM digit overflows into (or underflows from) 100 NM digit.
The two most significant digits roll over from 190 to 0 NM and vice versa.

4.2.2.5 - USE DISPLAY

Displays waypoint number of data actually being used by system.
In VOR MODES only the frequency has meaning.
Range 1 to 4.
When changed always takes on new value equal to DSP value.

4.2.2.6 - DSP DISPLAY

Displays waypoint number of data being displayed.
Range 1 to 4.
When changed, increments by 1.
Rolls over from 4 to 1 and blinks when not equal to USE value.

4.2.2.7 - PAR, VOR, ENR, APR, RNV DISPLAYS

System status lights.

4.2.2.8 - HLD DISPLAY

Indicates when the station to which the DME is actually tuned is different than the station to which the VOR is tuned.

4.2.2.9 - DATA DISPLAY

Displays waypoint data.
The messages FRQ, DST, and RAD tell what is being displayed at any one time.

4.2.2.10 - ILS DISPLAY

Indicates that the frequency in use is an ILS frequency.

4.2.2.11 - COURSE DEVIATION INDICATOR

1. VOR Mode

Full scale sensitivity equals +/- 10 degrees.

2. VOR PAR Mode

Full scale sensitivity equals +/- 5 NM.
Flagged if VOR or DME data is invalid.
Flagged if the VOR is rechanneled with the DME HOLD button depressed.

3. RNV ENR Mode

Full scale sensitivity equals +/- 5 NM.
Flagged if VOR or DME data is invalid.
Flagged if the VOR is rechanneled with the DME HOLD button depressed.

4. RNV APR Mode

Full scale sensitivity equals +/- 1.25 NM.
Flagged if VOR or DME data is invalid.
Flagged if the VOR is rechanneled with the DME HOLD button depressed.

5. ILS Mode

Full scale sensitivity equals 3 to 6 degrees (depending upon ground facility).
Flagged if localizer or glideslope data is invalid.

4.2.3 CONTROLS

4.2.3.1 - VOR BUTTON

Momentary pushbutton.
When pushed while system is in either RNV mode causes system to go to VOR mode. Otherwise the button causes system to toggle between VOR and VOR PAR modes.

4.2.3.2 - RNAV BUTTON

Momentary pushbutton.
When pushed while system is in either VOR mode causes system to go to RNV ENR mode. Otherwise the button causes system to toggle between RNV ENR and RNV APR modes.

4.2.3.3 - HOLD BUTTON

Two position pushbutton.

When in depressed position, inhibits DME from channeling to a new station when the VOR frequency is changed. Pushing the button again releases the button and channels the DME to the station paired with the VOR station.

4.2.3.4 - USE BUTTON

Momentary pushbutton.
Causes active waypoint to take on same value as displayed waypoint and data display to go to FRQ mode.

4.2.3.5 - DSP BUTTON

Momentary pushbutton.
Causes displayed waypoint to increment by 1 and data display to go to frequency mode.

4.2.3.6 - DATA BUTTON

Momentary pushbutton.
Causes waypoint data display to change from FRQ to RAD to DST and back to FRQ.

4.2.3.7 - OFF/PULL ID CONTROL

1. Rotate counterclockwise to switch off power to the KNS 80.

2. Rotate clockwise to increase audio level.

3. Pull switch out to hear VOR Ident.

4.2.3.8 - DATA INPUT CONTROL

Dual concentric knobs. Center knob has "in" and "out" positions.

1. Frequency Data

Outer knob varies 1 MHz digit.
A carryover occurs from the tens to hundreds place.
Rollover occurs from 117 to 108.
Center knob varies frequency in .05 MHz steps regardless of whether the switch is in its in or out position.

2. Radial Data

Outer knob varies 10 degree digit.
A carryover occurs from units to tens to hundreds position.
A rollover to zero occurs at 360 degrees.
Center knob "in" position varies 1 degree digit.
Center knob "out" position varies 0.1 NM digit.

3. Distance Data

Outer knob varies 10 NM digit.
A carryover occurs from the tens to hundreds place.
A rollover to zero occurs at 200 NM.
Center knob "in" position varies 1 NM digit.
Center knob "out" position varies 0.1 NM digit.

4.2.3.9 - COURSE SELECT KNOB

Located in CDI unit.
Selects desired course through the VOR ground station or waypoint.

4.2.4 LIGHTING

Display lighting is automatically controlled by ambient light conditions. Button backlighting is controlled by an instrument lighting rheostat which controls all instrument panel lighting.

4.3 BATTERY REPLACEMENT

The waypoint memory is kept alive by two silver oxide watch cells located in the lower left hand corner of the front panel. Typical life of the cell is two years although high temperature and humidity conditions can shorten this period. If the battery should become weak, waypoint storage will be lost and the radio will "wake up" tuned to 100.00 MHz in the VOR mode. The cells can be replaced by opening the battery pocket with a thin blade screwdriver. The holder was designed so that the cells can only be inserted with the correct polarity.

4.4 SYSTEM PERFORMANCE GROUND CHECK

The following test can be used to determine if the system is operating properly.

1. Tune the KNS 80 to a VORTAC (VOR/DME) within 25 NM of the airplane.

2. Place the KNS 80 in VOR mode and rotate the OBS until the course deviation needle centers with the TO/FROM flag giving a "from" indication.

3. Place the KNS 80 in RNAV ENR mode.

The system is operating properly if the distance to station is within 1.0 NM and the course deviation needle is within a dot of being centered.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

MOONEY MODELS M20J OR M20K

WITH INCORPORATION OF

MOONEY SERVICE BULLETIN M20-239
BAGGAGE DOOR, INSIDE LATCH MODIFICATION

REG. NO. G-BJHB

SERIAL NO. 24-1190

This Supplement must be attached to the applicable FAA Approved Airplane Flight Manual when the aircraft is modified per Mooney Service Bulletin M20-239. The information contained herein supersedes the basic manual only in those areas listed. For limitations, procedures and performance information not contained in this Supplement, consult the basic POH/AFM.

FAA APPROVED: _____

for L.B. ANDRIESEN
Rotorcraft Directorate
Aircraft Certification Service
FEDERAL AVIATION ADMINISTRATION
Fort Worth, Tx. 76193-0100

Date: 9-30-88

.MOONEY AIRCRAFT CORPORATION
P. O. BOX 72
Kerrville, Texas 78029-0072

LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date

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

The following POH/AFM's are affected for M20J and M20K aircraft that are to be modified per this Service Bulletin. The POH/AFM number(and Revision if applicable) is shown along with the pages of the various sections of the POH/AFM that a portion of will be made obsolete when SB M20-239 is incorporated into an aircraft that uses the POH/AFM:

M20J

POH/AFM NO.	SECTION II PAGE NO.	SECTION III PAGE NO.	SECTION VII PAGE NO.
1221 D	2-12	3-9	7-32
1223 F	2-12	3-9	7-35/7-36BLANK
1225 D	2-12	3-9	7-33/7-34BLANK
1227 C	2-12	3-10, 3-11	7-34
1229 A	2-12	3-10, 3-11	7-24
1231 A	2-15	3-14, 3-15	7-31
1233 A	2-13	3-17, 3-19	7-29
1233 B	2-12	3-14, 3-15	7-21

M20K

1224 F	2-12	3-17	7-26
1226 E	2-12	3-16	7-26
1228 D	2-12	3-17, 3-18	7-27
1230 B	2-12	3-16, 3-17	7-27
1232	2-16	3-18, 3-19	7-30
1234 C	2-13	3-21, 3-24	7-32
1236	2-13	3-24, 3-27	7-32
1236 A	2-12	3-20, 3-22	7-25

SECTION I - GENERAL

NO CHANGE

SECTION II - LIMITATIONS

New Placard required: 150080-834; Located above inside baggage door handle.

AUXILIARY EXIT
DO NOT OPEN IN FLIGHT
TO OPEN

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

TO CLOSE

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

SECTION III - EMERGENCY PROCEDURES

UNLATCHED DOORS IN FLIGHT

CABIN DOOR

NO CHANGE TO THESE WORDS FROM BASIC POH/AFM

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

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

EMERGENCY EXIT OF AIRCRAFT

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

BAGGAGE DOOR
Fold rear seat backs forward (if applicable),CLIMB OVER. PULL off plastic cover. PULL latch pin from hole in clip assembly. LIFT red handle UP. OPEN door and exit aircraft.

TO VERIFY RE-ENGAGEMENT OF BAGGAGE DOOR LATCH MECHANISM:
OPEN outside handle fully. CLOSE inside red handle to engage pin into cam slide of latch mechanism. PLACE latch pin in hole of clip assembly to hold red handle down. REPLACE cover. CHECK and operate outside handle in normal manner.

SECTION IV THRU VI

NO CHANGE

SECTION VII - AIRPLANE AND SYSTEMS DESCRIPTION

EMERGENCY EXITS

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

BAGGAGE DOOR
The baggage compartment access door can be used as a means of auxiliary exit. The door can be opened from the inside even though locked. To open, pull off the small ABS cover, PULL out the latch pin and lift UP red handle.

FAA APPROVED
DATE: 9-30-88

To verify re-engagement of latching mechanism: insert latching pin into hole of clip assembly to hold red handle down. Replace ABS cover. Operate outside handle in normal manner.

SECTION VIII THRU X

NO CHANGE

SECTION X

SAFETY INFORMATION

TABLE OF CONTENTS

INTRODUCTION 10-1
GENERAL 10-2
GENERAL SOURCES OF INFORMATION 10-4
RULES AND REGULATIONS 10-4
FAR, PART 39, AIRWORTHINESS DIRECTIVES. . 10-5
AIRMAN INFORMATION, ADVISORIES, AND NOTICES, FAA AIRMAN'S INFORMATION MANUAL. 10-5
ADVISORY INFORMATION 10-6
GENERAL INFORMATION ON SPECIFIC TOPICS. . . 10-6
FLIGHT PLANNING 10-6
INSPECTIONS - MAINTENANCE 10-7
WALK AROUND INSPECTIONS 10-8
COCKPIT CHECKS. 10-8
FLIGHT OPERATIONS 10-9
GENERAL 10-9
TURBULENT WEATHER 10-9
FLIGHT IN TURBULENT AIR. 10-10
MOUNTAIN FLYING. 10-11
VFR - LOW CEILINGS. 10-11
VFR AT NIGHT 10-12
VERTIGO - DISORIENTATION 10-12
STALLS, SPINS AND SLOW FLIGHT 10-13
STANDARD PROCEDURE FOR SPIN RECOVERY . 10-14
VORTICES - WAKE TURBULENCE. 10-14
TAKE-OFF AND LANDING CONDITIONS 10-15
MEDICAL FACTS FOR PILOTS 10-15
GENERAL 10-15
FATIGUE 10-16
HYPOXIA 10-16
HYPERVENTILATION 10-17
ALCOHOL 10-17
DRUGS 10-18
SCUBA DIVING 10-18
ADDITIONAL INFORMATION 10-18

INTRODUCTION

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

We urge you to be thoroughly familiar with the contents of your operating manuals, placards, and check list to insure maximum utilization of your airplane. When the airplane has changed ownership, some of these may have been misplaced. If any are missing, replacements should be obtained from any Mooney Marketing or Service Center as soon as possible.

For your added protection and safety, we have added this special section to the Pilot's Operating Handbook to refresh you 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.

MOONEY AIRCRAFT CORPORATION

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 material 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 throughly.
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 airplane wake turbulence.
12. Switch fuel tanks before engine starvation occurs.
13. Practice engine out, emergency landing gear extension and other emergency procedures at safe altitudes; 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.

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

GENERAL SOURCES OF INFORMATION

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

RULES AND REGULATIONS

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

This document covers such subjects as:

Responsibilities and authority of the pilot in command
Certificates required
Liquor and drugs
Flight plans

Pre-flight action
Fuel requirements
Flight rules
Maintenance, preventative maintenance, alterations, inspections and maintenance records.

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

FEDERAL AVIATION REGULATIONS, PART 39, AIRWORTHINESS DIRECTIVES

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

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

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

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

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

ADVISORY INFORMATION

Airmen can subscribe to services to obtain FAA NOTAMS and Airman Advisories, and these are also available at FAA Flight Service Stations.

NOTAMS are documents that have information of a time-critical nature that would affect a pilot's decision to make a flight; for example, an airport closed, terminal radar out of service, enroute navigational aids out of service, etc.

GENERAL INFORMATION

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 pre-flight 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 tanks or engines should be checked and filled as required.

INSPECTIONS - MAINTENANCE

In addition to maintenance inspections and pre-flight information required by FAR Part 91, a complete preflight 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 if possible 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 lists.
All internal control locks removed.
Check freedom of controls.
Cabin and baggage door properly closed and latched.
Seat belts and shoulder harnesses fastened.
Passengers briefed.

Engine and propeller operating satisfactorily.
All engine gages checked for proper readings.
Cowl flaps in proper position.
Fuel selector in proper position.
Fuel quantity checked by gages.
Altimeter setting checked.

FLIGHT OPERATIONS

GENERAL

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

TURBULENT WEATHER

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

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

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

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

FLIGHT IN TURBULENT AIR

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

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

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

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

MOUNTAIN FLYING

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

VFR - LOW CEILINGS

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

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, obstacle such as TV towers, or communities in the area flown. This is especially true in mountainous terrain, where there is usually very little ground reference and absolute minimum clearance is 2,000 feet. Don't depend on your being able to see obstacles in time to miss them. Flight on dark nights over sparcely populated country can be almost the same as IFR and should be avoided by untrained pilots.

VERTIGO - DISORIENTATION

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

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

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

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

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

STALLS, SPINS AND SLOW FLIGHT

Stalls, and slow flight should be practiced at safe altitudes to allow for recovery. Any of these maneuvers should be performed at an altitude in excess of 6,000 feet above ground level.

Spins may be dangerous and should be avoided. In fact, most airplanes are placarded against intentional spins. Spins are preceded by stalls. A prompt and decisive stall recovery protects against inadvertent spins.

All airplanes are required to have flight characteristics that give adequate advance warning of an impending stall or they must be equipped with an artificial stall warning device. Keep the artificial system in good working order. Do not operate the airplane with the device made inoperative by the use of circuit breakers or other means.

Stalls should be practiced at safe altitudes for ample recovery. Should a spin be encountered inadvertently, spin recovery should be initiated immediately.

As stall attitude is approached, be alert. Take prompt corrective action to avoid the stall or if you are practicing stalls, react the moment the stall occurs. The following is suggested:

1. Do not carry passengers. Be certain that the airplane's center of gravity is as far forward as possible. Forward CG aids spin recovery.
2. Be certain that both student pilot and instructor pilot have a full set of operable controls.
3. Conduct such practicing at altitudes in excess of 6,000 feet above ground level.

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

STANDARD PROCEDURE FOR SPIN RECOVERY

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

1. Rudder - Apply FULL RUDDER opposite the direction of spin.
2. Control Wheel - FORWARD of neutral in a brisk motion. Additional FORWARD elevator control may be required if the rotation does not stop.
3. Ailerons - NEUTRAL.
4. Throttle - RETARD to IDLE.
5. Flaps - If extended, RETRACT as soon as possible.
6. Rudder - NEUTRALIZE.
7. Control Wheel - Smoothly move aft to bring the nose up to a level flight attitude.

VORTICES - WAKE TURBULENCE

Every airplane generates wakes of turbulence while in flight. Part of this is from the propeller or jet engine and part from the wing tip vortices. The larger and heavier the airplane the more pronounced and turbulent the wakes will be. Wing tip vortices from large heavy airplanes are very severe at close range, degenerating with time, wind and space. These are rolling in nature from each wing tip. In test, vortex velocities of 133 knots have been recorded. Exhaust velocities from large airplanes at takeoff have been measured at 25 mph, 2100 feet behind medium large airplanes.

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

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

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

TAKE-OFF AND LANDING CONDITIONS

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

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

Use caution when taking off or landing during gusty wind conditions. Also be aware of the special wind conditions caused by buildings or other obstructions located near the runway in a crosswind pattern.

MEDICAL FACTS FOR PILOTS

GENERAL

Modern industry's record in providing reliable equipment is very good. When the pilot enters the airplane, he becomes an integral part of the man-machine system. He

is just as essential to a successful flight as the control surfaces. To ignore the pilot in pre-flight planning would be as senseless as failing to inspect the integrity of the control surfaces or any other vital part of the machine. The pilot himself has the responsibility for determining his reliability prior to entering the airplane for flight.

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

FATIGUE

Fatigue generally slows reaction times and causes foolish errors due to inattention. In addition to the most common cause of fatigue, insufficient rest and loss of sleep, the pressures of business, financial worries and family problems, can be important contributing factors. If your fatigue is a factor prior to a given flight, don't fly. To prevent fatigue effects during long flights, keep mentally active by making ground checks and radio-navigation position plots.

HYPOXIA

Hypoxia in simple terms is a lack of sufficient oxygen to keep the brain and other body tissues functioning properly. There is wide individual variation in susceptibility to hypoxia. In addition to progressively insufficient oxygen at higher altitudes, anything interfering with the blood's ability to carry oxygen can contribute to hypoxia (anemias, carbon monoxide, and certain drugs). Also, alchohol and various drugs decrease the brain's tolerance to hypoxia.

Your body has no built in alarm system to let you know when you are not getting enough oxygen. Is is impossible to predict when or where hypoxia will occur during a given flight, or how it will manifest itself. A major early symptom of hypoxia is an increased sense of well-being (referred to as euphoria). This progresses to slow reactions, impaired thinking ability, unusual fatigue, and dull headache feeling.

The symptoms are slow but progressive, insidious in onset, and are most marked at altitudes starting above ten thousand feet. Night vision, however, can be impaired starting at altitudes lower than 10,000 feet. Heavy smokers may experience early symptoms of hypoxia at altitudes lower than non-smokers. Use oxygen on flights above 10,000 feet and at any time when symptoms appear.

HYPERVENTILATION

Hyperventilation or overbreathing, is a disturbance of respiration that may occur in individuals as a result of emotional tension or anxiety. Under conditions of emotional stress, fright, or pain, breathing rate may increase, causing increased lung ventilation, although the carbon dioxide output of the body cells does not increase. As a result, carbon dioxide is "washed out" of the blood. The most common symptoms of hyperventilation are: dizziness; hot and cold sensations; tingling of the hands, legs and feet; tetany; nausea; sleepiness; and finally unconsciousness.

Should symptoms occur that cannot definitely be identified as either hypoxia or hyperventilation try three or four deep breaths of oxygen. The symptoms should improve markedly if the condition was hypoxia (recovery from hypoxia is rapid). If the symptoms persist, discontinue use of oxygen and consciously slow your breathing rate until symptoms clear and then resume normal breathing rate. Normal breathing can be aided by talking aloud.

ALCOHOL

Common sense and scientific evidence dicate that you not fly as a crew member while under the influence of alcohol. Even small amounts of alcohol in the human system can adversely affect judgment and decision making abilities. FAR 91.11 states "(a) No person may act as a crew member - (1) within 8 hours after the consumption of any alcoholic beverage."

Tests indicate that as a general rule, 2 ounces of alcohol at 15,000 feet produce the same adverse effects as 6 ounces at sea level. In other words, the higher you get, "the higher you get".

DRUGS

Self-medication or taking medicine in any form when you are flying can be extremely hazardous. Even simple home or over-the-counter remedies and drugs such as aspirin, antihistamines, cold tablets, cough mixtures, laxatives, tranquilizers, and appetite suppressors, may seriously impair the judgment and coordination needed while flying. The safest rule is to take no medicine before or while flying, except on the advice of your Aviation Medical Examiner.

SCUBA DIVING

Flying shortly after any prolonged scuba diving could be dangerous. Under the increased pressure of the water, excess nitrogen is absorbed into your system. If sufficient time has not elapsed prior to takeoff for your system to rid itself of this excess gas, you may experience the bends at altitudes even under 10,000 feet, where most light planes fly.

ADDITIONAL INFORMATION

In addition to the coverage of subjects in this section, the National Transportation Safety Board and the Federal Aviation Administration periodically issue general aviation pamphlets concerning aviation safety, and in greater detail. These can be obtained at FAA Offices, Weather Stations, Flight Service Stations, or Airport Facilities. These are very good sources of information and are highly recommended for study. Some of these are titled:

Airman's Information Manual
12 Golden Rules for Pilots
Weather or Not

Disorientation
Plane Sense
Weather Info Guide for Pilots
Wake Turbulence
Don't Trust to Luck, Trust to Safety
Thunderstorm - TRW
IFR-VFR Either Way Disorientation Can Be Fatal