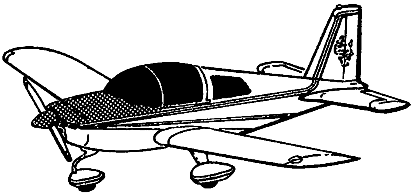
PILOT'S OPERATING HANDBOOK

GRUMMAN AMERICAN AVIATION CORPORATION



Model AA-1C T-CAT and LYNX

1977

SERIAL NO. ____________________

REGISTRATION NO. ____________________

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY FAR PART 23.

GRUMMAN AMERICAN AVIATION CORPORATION
SAVANNAH, GEORGIA, USA

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THE TOTAL NUMBER OF PAGES IN THIS HANDBOOK IS 180, CONSISTING OF THE FOLLOWING. THIS TOTAL INCLUDES THE SUPPLEMENTS PROVIDED IN SECTION 9 WHICH COVER OPTIONAL SYSTEMS AVAILABLE IN THE AIRPLANE.

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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 is so with non-smokers.

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 symptons of hyperventilation are: dizziness; hot and cold sensations; tingling of the hands, legs and feet; nausea; sleepiness; and finally unconsciousness.

Should symptoms occur, consciously slow your breathing rate until symptoms clear and then resume normal breathing rate. Breathing can be slowed by breathing into a bag, or talking loud.

ALCOHOL

Common sense and scientific evidence dictate that you not fly as a crew member while under the influence of alcohol. Even small amounts of alcohol in the human system can adversely affect judgment and decision making abilities. FAR 91.11 states "(a) No person may act as a crew member — (1) within 8 hours after the consumption of any alcoholic beverage."

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 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

WELCOME ABOARD!

Your AA-1C has been designed and constructed to provide you with a responsive two-place airplane to serve your needs for either pleasure or business flying in both comfort and economy.

This handbook has been prepared to help you obtain the maximum pleasure and utility from your airplane. Read it carefully, review it frequently, and keep it with you in the airplane at all times.

With proper operational techniques and good maintenance, your Grumman American should serve you well. Get to know your Grumman American Dealer. He is equipped to provide any assistance that may be required.

PERFORMANCE - SPECIFICATIONS

	CLIMB PROP	CRUISE PROP
TOP SPEED AT SEA LEVEL	118 KNOTS	126 KNOTS
CRUISE: Recommended Lean Mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 50% power.		
CRUISE AT 75% POWER, ALTITUDE	4500 FEET	8500 FEET
Speed	112 KNOTS	117 KNOTS
Range	293 N.M.	299 N.M.
Endurance	2 HRS:39 MIN	2 HRS:39 MIN
RATE OF CLIMB AT SEA LEVEL	750 FPM	700 FPM
SERVICE CEILING	11,900 FT	11,500 FT
TAKEOFF PERFORMANCE:		
Ground Roll	840 FT	890 FT
Total Distance Over 50-ft Obstacle	1530 FT	1590 FT
LANDING PERFORMANCE:		
Ground Roll	425 FT	425 FT
Total Distance Over 50-Ft Obstacle	1125 FT	1125 FT
STALL SPEED (CAS):		
Flaps Up, Power Off	57 KNOTS	57 KNOTS
Flaps Down, Power Off	53 KNOTS	53 KNOTS
MAXIMUM WEIGHT	1600 LBS	1600 LBS
STANDARD EMPTY WEIGHT:	1002 LBS	1066 LBS
BAGGAGE ALLOWANCE (Normal Category)	100 LBS	100 LBS
WING LOADING:Pounds/Sq Ft	15.9	15.9
POWER LOADING: Pounds/HP	13.9	13.9
FUEL CAPACITY: Total	24 GAL	24 GAL
OIL CAPACITY	6 QT	6 QT
ENGINE: Avco Lycoming 115 BHP at 2700 RPM	0-235-L2C	
PROPELLER: Fixed, (Diameter/Pitch)	72/52	72/56

*Performance specifications are based upon standard atmosphere, zero wind, and gross weight conditions.

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GRUMMAN AMERICAN AVIATION CORPORATION (herein GRUMMAN AMERICAN) warrants each new aircraft and part thereof manufactured by it, together with all new aircraft equipment and accessories bearing the name "GRUMMAN AMERICAN AVIATION," to be free from defects in material and workmanship under normal use and service, but extends no warranty of any kind, expressed or implied, to any items not manufactured by GRUMMAN AMERICAN, or not so bearing its name, whether incorporated into or installed in the aircraft, except that the workmanship involved in installing such items is warranted to be without defect. The obligation of GRUMMAN AMERICAN under this warranty is limited to replacement or repair, at the option of GRUMMAN AMERICAN, of any such aircraft, or any part or accessory which shall within six (6) months of operation be found defective. Such aircraft, part or accessory is to be returned to a GRUMMAN AMERICAN DEALER upon which examination by GRUMMAN AMERICAN, shall disclose to its reasonable satisfaction to have been thus defective. This warranty shall not in any way apply to or cover any products which are in GRUMMAN AMERICAN's opinion damaged as a result of being in any manner altered or repaired outside of the factory of GRUMMAN AMERICAN or that shall have been subject to misuse or negligence.

GRUMMAN AMERICAN makes no warranty whatsoever with respect to engines, radios, propellers, ignition apparatus, starting devices, generators, batteries, or other trade accessories, inasmuch as such products are generally warranted separately by their respective manufacturers.

"THESE WARRANTY PROVISIONS ARE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, STATUTORY OR IMPLIED IN FACT OR BY LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATION OR LIABILITY ON THE PART OF GRUMMAN AMERICAN, EXPRESSED OR IMPLIED, OF ANY NATURE WHATSOEVER. GRUMMAN AMERICAN NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON OR BUSINESS ORGANIZATION TO ASSUME FOR IT ANY OTHER WARRANTY OR LIABILITY IN CONNECTION WITH THE SALE, USE OR OPERATION OF ITS PRODUCTS."

IMMEDIATELY ON COMMENCING FIRST USE OF AN AIRCRAFT, A WARRANTY VALIDATION CARD MUST BE FILLED OUT AND MAILED TO THE ATTENTION OF THE CUSTOMER SERVICE MANAGER, COMMERCIAL LIGHT AIRCRAFT, P.O. BOX 2206, SAVANNAH, GEORGIA, 31402. NO WARRANTY CLAIMS WILL BE HONORED IF THIS CARD IS NOT ON FILE AT THE FACTORY.

SECTION 1
GENERAL

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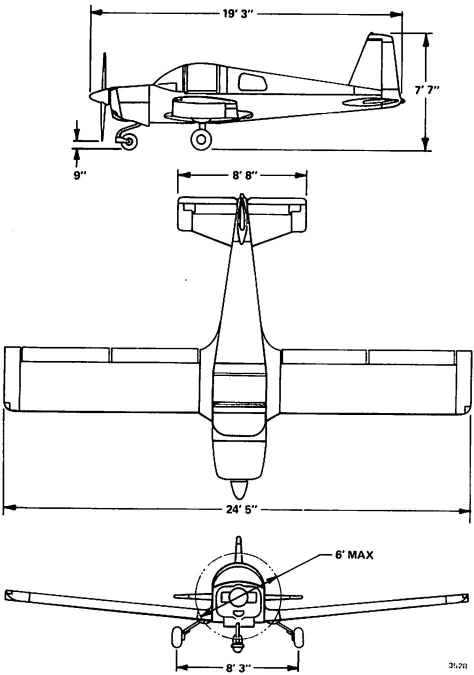

NOTES:

1. Wheel base length 4 feet, 5 inches.
2. Minimum turning radius 16 feet, 4 inches.
3. Pivot point – center of main gear tire.

Figure 1-1. Three View

INTRODUCTION

The ten sections of this handbook contain the information needed by the pilot for safe and efficient operation of the Grumman American Model AA-1C airplanes. This handbook also includes the material required to be furnished to the pilot by FAR, Part 23, and supplemental data covering Grumman American designed optional equipment installed in the airplane.

Section 1 provides basic data and information of general interest to the pilot, to assist him in loading, sheltering, handling, and routine preflight checking of the airplane. Also included in this section are definitions and explanations of the symbols, abbreviations and terminology used in this handbook.

NOTE

Unless otherwise noted, all performance and operational data in this book are based on sea level, standard day, and airplane gross weight conditions.

DESCRIPTIVE DATA

ENGINE

Number of Engines: 1
Manufacturer: Avco Lycoming
Model Number: 0-235-L2C
Type: Normally-aspirated, direct-drive, air-cooled, horizontally-opposed, carburetor equipped, four-cylinder engine with 233.3 cubic inch displacement.
Horsepower Rating and Engine Speed: 115 HP at 2700 RPM

PROPELLER

Manufacturer: Sensenich
Model Number: 72CK-0-56 or 72CK-0-52
Diameter: 72 inches
Type: Fixed pitch

FUEL

CAUTION

UNDER NO CIRCUMSTANCES SHOULD FUEL OF A LOWER OCTANE RATING THAN THAT SPECIFIED BELOW, OR AUTOMOTIVE FUEL (REGARDLESS OF OCTANE) BE USED.

Grade (and color): 100/130 Minimum Grade Aviation Fuel (green). 100 Low Lead Aviation Fuel (blue) is also approved. Refer to the latest revision of Lycoming Service Instruction No. 1070 for further information concerning fuels.

Capacity at an ambient temperature of 70°F (21°C):

Total: 24 U.S. gallons (20 Imperial gallons) (90.8 Liters)
Each Tank: 12 U.S. gallons (10 Imperial gallons) (45.4 Liters)
Total Usable: 22 U.S. gallons (18.3 Imperial gallons) (83.3 Liters)

OIL

Grade (Specification):

Aviation Grade Straight Mineral Oil MIL-L-6082 (Figure 1-2) shall be used to replenish oil supply during the first 25 hours of operation and at the first 25-hour oil change. Continue to use this grade of oil for the first 50 hours of operation.

NOTE

The airplane is delivered from the factory with corrosion preventative airplane engine oil. This oil should be drained after the first 25 hours of engine operation.

MIL-L-22851 (Figure 1-2) Ashless Dispersant Oil: This specification oil should be used after the first 50 hours of engine operation.

TRADE NAME	MANUFACTURER
MIL-G-21164 GREASE (Note 1)	
Aeroshell Grease 17	Shell Oil Company
Braycote 664	Bray Oil Company
PED 3350 Grease	Standard Oil Company
Royco 64 Grease	Royal Lubricants Company
TG-4727 Grease	Texaco Inc.
MIL-G-6711 GRAPHITE (Note 1)	
Graphite	Dixon Company
Graphite	Electrofilm Company
Graphite	Electro-Graph Company
MIL-H-5606 HYDRAULIC FLUID (Note 1)	
3125 HVD Oil	Humble Oil & Refining Company
Brayco Micronic 756C	Bray Oil Company
PED-3337, -3335	Standard Oil Company
Royco 756A & B	Royal Lubricants Company
XSL 7828	Shell Oil Company
YT-283	Union Carbide
VV-P-236 PETROLATUM (Note 1)	
Braycote 236	Bray Oil Company
Parmo 70	Humble Oil & Refining Company
Royco 1R	Royal Lubricants Company
MIL-L-7870 OIL (Note 1)	
Brayco 363	Bray Oil Company
Cosmolube 263	E. F. Houghton Company
Enco Instrument Oil	Humble Oil & Refining Company
Low Temperature Oil 1692	Texaco Inc.
Royco 363	Royal Lubricants Company

Figure 1-2 Lubricants (Page 1 of 3)

TRADE NAME	MANUFACTURER
MIL-G-25760 GREASE (Note 1)	
Aeroshell Grease 16	Shell Oil Company
Braycote 6605	Bray Oil Company
Royco 60R	Royal Lubricants Company
Supermil ASU No. 06752	American Oil Company
TG-4971 Grease	Texaco Inc.
MIL-G-7711 GREASE (Note 1)	
Aeroshell No. 6	Shell Oil Company
Regal AFB 2	Texaco Inc.
MIL-L-6082 STRAIGHT MINERAL OIL – ENGINE (Notes 1 and 2)	
Aeroshell Oil 65	Shell Oil Company
Aeroshell Oil 100	Shell Oil Company
Chevron Aviation Oil 65	Chevron Oil Company
Grade 1100	Chevron Oil Company
Avrex 101/1065	Mobil Oil Company
Avrex 101/1100	Mobil Oil Company
Conoco Aero Oil 1065	Continental Oil Company
Conoco Aero Oil 1100	Continental Oil Company
Grade 1065	Champion Oil & Refining Company
Grade 1100	Champion Oil & Refining Company.
MIL-L-22851 ASHLESS DISPERSANT OIL – ENGINE (Notes 1 and 2)	
Aeroshell W120	Shell Oil Company
Aeroshell W80	Shell Oil Company
Chevron Aero Oil Grade 120	Standard Oil Company
RT-451	Mobil Oil Company
RM-173E	Mobil Oil Company

Figure 1-2 Lubricants (Page 2 of 3)

TRADE NAME	MANUFACTURER
MIL-L-22851 ASHLESS DISPERSANT OIL – ENGINE (Notes 1 and 2) (Cont.)	
RM-180E	Mobil Oil Company
TX-6309	Texaco Inc.
Premium AD 120	Texaco Inc.
Premium AD 80	Texaco Inc.
Oil E-120	Exxon Company
Oil A-100	Exxon Company
Oil E-80	Exxon Company

Note 1: The vendor products listed in this chart have been selected as representative of the specification under which they appear. Other equivalent products conforming to the same specifications may be used.

Note 2: Oils conforming to the latest revision of Lycoming Service Instruction No. 1014 may be used.

Figure 1-2. Lubricants (Page 3 of 3)

*Recommended Viscosity:

Average Ambient Air Temperature	Mineral Grade	Ashless Dispersant
Above 60°F (16°C)	SAE 50	SAE 40 or SAE 50
30°F (-1°C) to 90°F (32°C)	SAE 40	SAE 40
0°F (-18°C) to 70°F (21°C)	SAE 30	SAE 40 or SAE 20W-30
Below 10°F (-12°C)	SAE 20	SAE 20W-30

*Refer to latest revision of Lycoming Service Instruction No. 1014 for further information.

Oil Capacity

Sump: 6 U.S. Quarts (5 Imperial Quarts) (5.68 Liters)
Minimum Safe Quantity in Sump: 2 U.S. Quarts (1.67 Imperial Quarts) (1.89 Liters)

It is recommended that lubricating oil be changed at least every 50 hours of engine operation.

MAXIMUM CERTIFICATED WEIGHTS

Takeoff: 1600 pounds

Landing: 1600 pounds

Weight in Baggage Compartment, 100 pounds maximum allowable if c.g. is within Center of Gravity Envelope (Figure 6-5). Refer to Section 6 for cargo loading instructions.

STANDARD AIRPLANE WEIGHTS

NOTE

Actual weights for each airplane will vary, according to installed equipment. Refer to weight and balance data supplied with the particular airplane for specific data for that airplane.

	T-CAT	Lynx
Standard Empty Weight:	1002 lbs	1066 lbs
Maximum Useful Load:	598 lbs	534 lbs

CABIN AND ENTRY DIMENSIONS

Detailed dimensions of the cabin interior and canopy opening are provided in Section 6.

BAGGAGE SPACE AND ENTRY DIMENSIONS

Baggage area and access dimensions are provided in Section 6.

SPECIFIC LOADINGS

Wing Loading: 15.85 pounds per square foot
Power Loading: 13.91 pounds per B.H.P.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

KCAS — **Knots Calibrated Airspeed** is indicated airspeed corrected for position and instrument error and expressed in knots. Knots calibrated airspeed is equal to KTAS in standard atmosphere at sea level.

KIAS — **Knots Indicated Airspeed** is the speed shown on the outer scale of the airspeed indicator and expressed in knots.

KTAS — **Knots True Airspeed** is the airspeed expressed in knots relative to undisturbed air which is KCAS corrected for altitude and temperature.

V_A	**Maneuvering Speed** is the maximum speed at which application of full available control will not overstress the airplane.
V_{FE}	**Maximum Flap Extended Speed** is the highest speed permissible at which wing flaps can be extended.
V_{NO}	**Maximum Structural Cruising Speed** is the speed that should not be exceeded except in smooth air, then only with caution.
V_{NE}	**Never Exceed Speed** is the speed limit that may not be exceeded at any time.
V_S	**Stalling Speed (Clean)** is the minimum steady flight speed at which the airplane is controllable.
V_{S_O}	**Stalling Speed (Landing)** is the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_X	**Best Angle-of-Climb Speed** is the speed which results in the greatest gain of altitude in a given horizontal distance.
V_Y	**Best Rate-of-Climb Speed** is the speed which results in the greatest gain in altitude in a given time.

METEOROLOGICAL TERMINOLOGY

OAT	**Outside Air Temperature** is the free air static temperature. It is expressed in either degrees Celsius (Centigrade) or degrees Fahrenheit.
Standard Temperature	**Standard Temperature** is 15°C (59°F) at sea level pressure altitude and decreases by 2°C (4°F) for each 1000 feet of altitude.
Pressure Altitude	**Pressure Altitude** is the altitude read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013 mb).

ENGINE POWER TERMINOLOGY

BHP	**Brake Horsepower** is the power developed by the engine.
RPM	**Revolutions Per Minute** is engine speed (number of revolutions engine turns per minute).

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.
Usable Fuel	**Usable Fuel** is the fuel available for flight.
Unusable Fuel	**Unusable Fuel** is the quantity of fuel that cannot be used in flight.
GPH	**Gallons Per Hour** is the amount of fuel (in gallons) consumed per hour.
g	**g** is a unit of acceleration equivalent to that produced by the force of gravity.

WEIGHT AND BALANCE TERMINOLOGY

Reference Datum	**Reference Datum** is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	**Station** is a location along the airplane longitudinal axis given in terms of the distance from the reference datum.
Arm	**Arm** is the horizontal distance from the reference datum to the center of gravity (c.g.) of an item.
Moment	**Moment** is the product of the weight of an item multiplied by its arm. (Moment divided by the constant 1000 is used in this Handbook to simplify balance calculations by reducing the number of digits.)
Center of Gravity (c.g.)	**Center of Gravity** is 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	**Center of Gravity Arm** is the arm obtained by adding the airplane's individual moment and dividing the sum by the total weight.

c.g. Limits	**Center of Gravity Limits** are the extreme center of gravity locations within which the airplane can be operated at a given weight.
Standard Empty Weight	**Standard Empty Weight** is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.
Basic Empty Weight	**Basic Empty Weight** is the standard empty weight plus the weight of optional equipment.
Useful Load	**Useful Load** is the difference between maximum gross weight and the basic empty weight.
Gross Weight	**Gross Weight** is the maximum weight to which the airplane is certificated.
Maximum Takeoff Weight	**Maximum Takeoff Weight** is the maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	**Maximum Landing Weight** is the maximum weight approved for the landing touchdown.
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.

SECTION 2
LIMITATIONS

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INTRODUCTION

This section presents the operating limitations, instrument markings, and basic placarding necessary for the safe operation of the airplane, its engine, standard systems and standard equipment. Where the significance of an operating limitation, marking or placard is not obvious, an explanation is presented. Limitations associated with Grumman American designed optional equipment are contained in Section 9.

The Grumman American Model AA-1C is certificated under FAA Type Certificate No. A11EA.

The airplane is equipped for day VFR (with standard equipment) and may be equipped for night VFR and/or IFR operations. FAR Part 91 establishes the minimum required instruments and equipment for these operations. The reference to types of flight operations on the operating limitations placard reflects equipment installed at the time the Airworthiness Certificate was issued.

THIS AIRPLANE IS NOT APPROVED FOR FLIGHT IN ICING CONDITIONS.

AIRSPEED LIMITATIONS

Airspeed limitations and their optional significance are shown in Figure 2-1.

	SPEED	KCAS (MPH CAS)	KIAS (MPH IAS)	REMARKS
V_{NE}	Never Exceed Speed	169 (195)	170 (196)	Do Not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	125 (144)	126 (145)	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed	117 (135)	117 (135)	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed	100 (115)	100 (115)	Do not exceed this speed with flaps extended.
	Maximum Canopy Open Speed	113 (130)	113 (130)	Do not exceed this speed with canopy open.

Figure 2-1. Airspeed Limitations

AIRSPEED INDICATOR MARKINGS

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

MARKING	KCAS (MPH CAS) VALUE OR RANGE	SIGNIFICANCE
White Arc	53-100 (61-115)	Flap Operating Range. Lower limit is maximum weight V_{S_O} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	57-125 (66-144)	Normal Operating Range. Lower limit is maximum weight V_S with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	125-169 (144-195)	Operations must be conducted with caution and only in smooth air.
Red Line	169 (195)	Maximum speed for any operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Avco Lycoming.

Engine Model Number: 0-235-L2C

Engine Operating Limits for Takeoff and Continuous Operations:
Maximum Power: 115 BHP
Maximum Engine Speed: 2700 RPM
Maximum Oil Temperature: 245°F (118°C)

Oil Pressure Minimum (idling): 25 PSI
Maximum: 100 PSI
Normal Range: 60 to 90 PSI

Fuel Pressure, Minimum: 0.5 PSI
Maximum: 8 PSI

Propeller Manufacturer: Sensenich

Propeller Model Number: 72CK-0-56 or 72CK-0-52

Propeller Diameter, Maximum: 72 inches.

POWER PLANT INSTRUMENT MARKINGS

Power plant instrument markings and their color code significance are shown in Figure 2-3.

INSTRUMENT	RED LINE	GREEN ARC	RED LINE
	MINIMUM LIMIT	NORMAL OPERATING	MAXIMUM LIMIT
Tachometer	–	2200-2700 RPM	2700 RPM
Oil Temperature	–	75° F-245°F (24°C-118°C)	245°F (118°C)
Fuel Pressure	0.5 PSI	0.5-8 PSI	8 PSI
Oil Pressure	25 PSI*	60-90 PSI	100 PSI**
*Idling **Start and warm-up			

Figure 2-3. Power Plant Instrument Markings

Issued: December 15,1976

WEIGHT LIMITS

Maximum Takeoff Weight: 1600 lbs.
Maximum Landing Weight: 1600 lbs.

Weight in Baggage Compartment: 100 pounds maximum allowable if C.G. is within center of gravity envelope (Figure 6-5). Refer to Section 6 for cargo loading instructions.

CENTER OF GRAVITY LIMITS

Center of Gravity Range:

Forward: 75.5 inches aft of datum at 1385 lbs. or less, with a straight line variation to 78.0 inches aft of datum at 1600 lbs.

Aft: From 78.0 inches to 81.0 inches aft of reference datum at all weights up to 1600 lbs.

Reference Datum: is 50.0 inches. It is located forward of front face of firewall.

MANEUVER LIMITS

This airplane is not designed for aerobatic flight. however, in the acquisition of various certificates such as commercial pilot, instrument pilot and flight instructor, certain maneuvers are required by the FAA. All of these maneuvers **except spins,** are permitted in this airplane.

Maximum Design Weight . . . . 1600 lbs.
Design Maneuvering Speed . . . . 117 KCAS (135 MPH)

No aerobatic maneuvers are approved except those listed below:

Maneuver	Recommended Entry Speed*
Chandelles	117 KCAS (135 MPH)
Lazy Eights	117 KCAS (135 MPH)
Steep Turns	117 KCAS (135 MPH)
Stalls (Except Whip Stalls)	Slow Deceleration
Spins Prohibited	

*Abrupt use of the controls is prohibited above 117 KCAS (135 MPH).

NOTE

The operating limitations of this airplane include **SPINS PROHIBITED.** A spin is not possible without a prolonged stall condition. All types of stalls (except whip, which are prohibited) can be performed in this airplane without spinning by simply recovering from the stall when it occurs (moving the control wheel forward sufficiently to reduce angle of attack for normal forward flight).

There is evidence that permitting a spin to go beyond one turn without initiating proper recovery procedures can allow a spin mode to develop from which recovery is not possible.

The important thing to remember in flight maneuvers is that the airplane is clean in aerodynamic design and will build up speed quickly with the nose down. Since proper speed control is essential for execution of any maneuver, care should always be exercised to avoid excessive engine RPM, speed, and its resultant heavy airframe loads. In the execution of all maneuvers, avoid abrupt use of controls.

As noted, **SPINS ARE PROHIBITED.** In case of an inadvertent spin, recovery is effected by reducing throttle to idle, neutralizing the aileron, applying full rudder opposite to the spin rotation, and applying full down elevator simultaneously with rudder application. The controls should be applied briskly and held until rotation stops. As the rotation stops, neutralize the anti-spin rudder, then apply smooth elevator back pressure to bring the nose up to a level flight attitude and add throttle to sustain flight. (Refer to Section 3 for procedures.)

FLIGHT LOAD FACTOR LIMITS

Flight Load Factors (Gross Weight — 1600 lbs.)

Flaps Up . . . . +4.4g, –1.76g
Flaps Down . . . . +3.5g

FUEL LIMITATIONS

2 Tanks: 12 U.S. gallons each. (10 Imperial gallons) (45.4 Liters)
Total Fuel: 24 U.S. gallons (20 Imperial gallons) (90.8 Liters)
Usable Fuel (all flight conditions): 22 U.S. gallons (18.3 Imperial gallons) (83.3 Liters)
Unusable Fuel: 2 U.S. gallons (1.7 Imperial gallons) (7.6 Liters)

PLACARDS

The following information is displayed in the form of composite or individual placards:

(1) In full view of the pilot:

THIS AIRPLANE MUST BE OPERATED AS A UTILITY CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS

MAXIMUM DESIGN WEIGHT ....1600 LBS
DESIGN MANEUVERING SPEED, V_A .... 117 KNOTS, CAS
FLIGHT LOAD FACTORS:
FLAPS UP .... +4.4 –1.76 .... FLAPS DOWN +3.5

ACROBATIC MANEUVERS ARE LIMITED TO THE FOLLOWING:

MANEUVER	ENTRY SPEED (CAS)
CHANDELLES	117 KNOTS
LAZY EIGHTS	117 KNOTS
STEEP TURNS	117 KNOTS
STALLS (EXCEPT WHIP STALLS)	SLOW DECELERATION

SPINS PROHIBITED

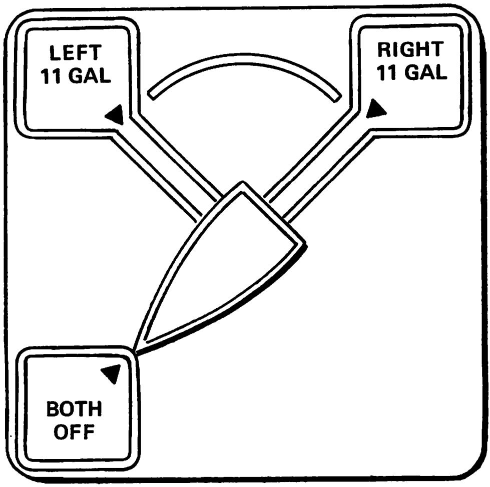
MAXIMUM ALTITUDE LOSS IN STALL .... 200 FEET
DEMONSTRATED CROSSWIND VELOCITY ....16 KNOTS

THIS AIRPLANE NOT APPROVED FOR FLIGHT IN ICING CONDITIONS. READ FUEL GAGES IN LEVEL FLIGHT ONLY. FOR NORMAL OPERATION MAINTAIN FUEL BALANCE.
DEMONSTRATED FUEL UNBALANCE .... 7 GAL
REFER TO WEIGHT AND BALANCE DATA FOR LOADING INSTRUCTIONS:
THIS AIRPLANE IS CERTIFICATED FOR THE FOLLOWING OPERATIONS AS OF DATE OF ORIGINAL AIRWORTHINESS CERTIFICATE: IFR VFR DAY NIGHT WHEN PROPERLY EQUIPPED PER FAR 91
16-803007-65 AA1C

(2) On control gust lock:

CONTROL LOCK
REMOVE BEFORE STARTING ENGINE

(3) On fuel selector valve:



(4) Left side of instrument panel

MODEL AA-1C				
STALL SPEED KNOTS CAS				
	BANK ANGLE			
CONDITION	0°	20°	40°	60°
FLAPS UP	57	59	65	81
FLAPS DN	53	55	61	75
1600 LBS.	POWER OFF			

(5) Around fuel tank caps:

(6) On instrument panel (if strobe lights are installed):

TURN OFF STROBE IN CLOUD, FOG
OR HAZE. TAXI WITH STROBE OFF

(7) On instrument panel:

CAUTION: FLASHING BEACON IN CLOUDS
MAY CAUSE VISUAL DISORIENTATION

(8) On Instrument panel:

SPINS PROHIBITED
POWER SETTINGS

(9) In baggage compartment:

BAGGAGE CAPACITY
100 POUNDS MAX

(10) Inside canopy rail, left side:

⇧ 113 KNOTS MAX WITH CANOPY OPEN TO HERE
NO FLIGHT WITH CANOPY OPEN BEYOND THIS POINT

(11) On wing outer ribs (if strobe lights are installed):

WARNING
— HIGH —
VOLTAGE

WAIT 5 MINUTES AFTER
SHUTTING OFF BEFORE STARTING
ANY WORK ON THIS UNIT

——— CAUTION ———

THIS UNIT POLARITY SENSITIVE
WHITE OR RED LEAD POSITIVE
BLACK LEAD AND OR CASE NEGATIVE

(12) Adjacent to auxiliary power plug (if installed):

CAUTION: 12 VOLT
D.C. ONLY, MASTER
SW. MUST BE OFF

(13) On lower left side of instrument panel:

CHECKLIST
TAKE-OFF

1 FUEL–FULLEST TANK
2 MIXTURE– RICH
3 AUX PUMP–ON
4 INSTR'S–SET & CHECK
5 TRIM–SET
6 FLAPS–UP
7 THROTTLE–FULL
8 RAISE NOSE–55 KNOTS

LANDING

1 FUEL–FULLEST TANK
2 MIXTURE–RICH
3 AUX. PUMP–ON
4 CARB HEAT–A/R
5 FLAPS–A/R
6 APPROACH–70 KNOTS

(14) On glove box door:

TIRE PRESSURE	NOSE 22 LBS
	MAIN 19 LBS

SECTION 3
EMERGENCY PROCEDURES

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AMPLIFIED PROCEDURES

INTRODUCTION

This section provides the pilot with checklists and amplified procedures that enable him to cope with emergencies that may be encountered in operating the airplane. If proper preflight inspections, operating procedures, and maintenance practices are used, emergencies due to airplane or engine malfunction should be rare. Likewise, careful flight planning and good pilot judgement can minimize enroute weather emergencies. However, should any emergency develop, the guidelines in this section should be considered and applied as necessary to correct the problem.

AIRSPEEDS FOR SAFE OPERATIONS (IAS)

Engine Failure After Takeoff . . . . .70 KIAS (81 MPH)
Maneuvering Speed . . . . 117 KIAS (135 MPH)
Maximum Glide . . . . .77 KIAS (89 MPH)
Precautionary Landing With Engine Power . . . . .70 KIAS (81 MPH)
Landing Without Engine Power . . . . .70 KIAS (81 MPH)

OPERATIONAL CHECKLISTS

ENGINE FAILURES

Engine Failure During Takeoff Run

(1) Throttle – IDLE.
(2) Brakes – APPLY.
(3) Mixture – IDLE CUT-OFF.
(4) Ignition Switch – OFF.
(5) Master – OFF.

Engine Failure Immediately After Takeoff

(1) Airspeed – 70 KIAS (81 MPH)
(2) Mixture – IDLE CUT-OFF.
(3) Fuel Selector Valve – OFF.
(4) Ignition Switch – OFF.
(5) Master Switch – OFF.

Engine Failure During Flight

(1) Airspeed – 77 KIAS (89 MPH).
(2) Carburetor Heat – ON.
(3) Fuel Selector Valve – SWITCH TANKS.
(4) Mixture – RICH.
(5) Master Switch – ON
(6) Auxiliary Fuel Pump – ON
(7) Throttle – OPEN 1/4 inch
(8) Ignition Switch – BOTH
(9) Primer – IN and LOCKED.
(10) Starter – PRESS if propeller is stopped.

NOTE

Gliding distance is approximately 1.4 nautical miles (1.6 statute miles)for each 1000 feet of altitude above terrain.

FORCED LANDINGS

Emergency Landing Without Engine Power

(1) Airspeed – 70 KIAS (81 MPH)
(2) Radio – TRANSMIT MAYDAY on 121.5 MHz giving location and intentions.
(3) Mixture – IDLE CUT-OFF.
(4) Fuel Selector Valve – OFF.
(5) Ignition Switch – OFF
(6) Wing Flaps – AS REQUIRED.
(7) Master Switch – OFF.
(8) Canopy – UNLATCH PRIOR TO TOUCHDOWN
(9) Touchdown – SLIGHTLY NOSE HIGH.
(10) Brakes – AS REQUIRED

Precautionary Landing With Engine Power

(1) Airspeed – 70 KIAS (81 MPH)
(2) Radio – Advise ATC of intentions.
(3) Wing Flaps – AS REQUIRED
(4) Select Field – FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
(5) Radio and Electrical Switches – OFF
(6) Wing Flaps – DN (on final approach).

(7) Airspeed – 70 KIAS (81 MPH)
(8) Master Switch – OFF.
(9) Canopy – UNLATCH PRIOR TO TOUCHDOWN.
(10) Touchdown – SLIGHTLY NOSE HIGH.
(11) Ignition Switch – OFF
(12) Brakes – AS REQUIRED.

Ditching

(1) Radio – TRANSMIT MAY DAY ON 121.5 MHz, giving location and intentions (If electrical power is available).
(2) Heavy Objects – SECURE
(3) Flaps – DN
(4) Approach – High Winds, Heavy Seas – INTO THE WIND.
Light Winds, Heavy Swells – PARALLEL TO SWELLS.
(5) Power – ESTABLISH 350 FT/MIN DESCENT at 70 KIAS (81 MPH)
(6) Canopy – FULLY OPEN
(7) Touchdown – NOSE HIGH ATTITUDE AT MINIMUM DESCENT RATE AND AIRSPEED
(8) Face – CUSHION at touchdown with folded coat or seat cushion
(9) Airplane – EVACUATE through canopy
(10) Life Vests and Raft – INFLATE

FIRES

During Start On Ground

(1) Cranking – CONTINUE to get a start which would suck the flames and accumulated fuel through the carburetor and into the engine.

If engine starts:

(2) Power – 1800 RPM for a few minutes.
(3) Engine – SHUTDOWN and inspect for damage.
a. Fuel Selector – OFF
b. Master Switch – OFF.
c. Ignition Switch – OFF.

If engine fails to start:

(4) Evacuate passenger.
(5) Engine – SECURE.
a. Mixture – IDLE CUTOFF.

b. Master Switch – OFF.
c. Ignition Switch – OFF.
d. Fuel Selector Valve – OFF.

(6) Fire – EXTINGUISH using fire extinguisher, seat cushion, wool blanket, or dirt.

Engine Fire in Flight

(1) Mixture – IDLE CUTOFF
(2) Fuel Selector Valve – OFF
(3) Master Switch – OFF
(4) Cabin Heat and Air – OFF
(5) Airspeed – 115 KIAS (132 MPH) If fire is not extinguished, increase glide speed to attempt to blow the fire out.
(6) Forced Landing – EXECUTE (as described in Landing Without Engine Power).

Electrical Fire in Flight

If fire is in engine compartment:

(1) Master Switch – OFF.
(2) Vents/Cabin Air/Heat – OFF/CLOSED
(3) Land airplane as soon as possible

If fire is in cockpit:

(1) Master Switch – OFF
(2) All Other Switches (except ignition switch) – OFF
(3) Vents/Cabin Air/Heat – CLOSED
(4) Fire Extinguisher – ACTIVATE (if available)

If fire appears to be out and electrical power is necessary to continue flight:

(5) Master Switch – ON
(6) Circuit Breakers – CHECK for faulty circuit, do not reset.
(7) Radio/Electrical Switches – ON one at a time, with delay after each until short circuit is located.
(8) Vents/Cabin Air/Heat – OPEN when fire is out.

Cabin Fire

(1) Master Switch – OFF
(2) Vents/Cabin Air/Heat – CLOSED

(3) Fire Extinguisher – ACTIVATE (if available)

WARNING

AFTER DISCHARGING AN EXTINGUISHER WITHIN A CLOSED CABIN, VENTILATE THE CABIN.

(4) Land the airplane as soon as possible to inspect for damage.

Wing Fire

(1) Navigation Light Switch – OFF
(2) Pitot Heat Switch (if installed) – OFF
(3) Scrobe light (if installed) – OFF
(4) Land as soon as possible.

ICING

Inadvertent Icing Encounter

(1) Pitot Heat Switch – ON (if installed)
(2) Carburetor Heat – ON as required

NOTE

Continuous engine operation with carburetor heat on is not recommended due to the decrease in engine efficiency. If severe icing conditions require extended use of carburetor heat the engine mixture should be leaned during use of carburetor heat.

(3) Cabin Heat – ON
(4) Defrosters – OPEN
(5) Engine – Increase RPM, (do not exceed red line) and periodically change RPM to minimize ice buildup on propeller blades.
(6) Turn back or change altitude to obtain outside air conditions that are less likely to cause icing.
(7) If icing continues plan a landing at the nearest airport. Under extremely rapid icing conditions select a suitable emergency landing site.

WARNING

WITH AN ICE ACCUMULATION ON OR NEAR THE WING LEADING EDGES A HIGHER STALLING SPEED MAY BE EXPECTED. PLAN ALL MANEUVERS ACCORDINGLY.

(8) Airspeed — If possible, increase airspeed and fly at a higher than normal cruise speed until a landing is begun.
(9) Approach for landing at a higher airspeed than normal depending on amount of ice accumulation.
(10) Flaps — UP (Do not attempt to extend flaps for landing)
(11) Land in a slightly nose high attitude.

LANDING WITH A FLAT MAIN TIRE

(1) Wing Flaps — AS DESIRED
(2) Elevator Control — NOSE HIGH
(3) Aileron Control — BANK TOWARD GOOD TIRE.
(4) Touchdown — GOOD TIRE FIRST, hold airplane off flat tire as long as possible.

LANDING WITH A FLAT NOSEWHEEL TIRE

(1) Wing Flaps — AS DESIRED
(2) Elevator Control — NOSE HIGH
(3) Touchdown — hold nose gear off runway as long as possible.
(4) Brakes — Use brakes cautiously. Allow airplane to roll to a stop if possible.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Ammeter Shows Discharge

(1) Alternator Circuit Breaker — Check

NOTE

If circuit breaker trips, wait 15 seconds before resetting it.

(2) Field Circuit Breaker – Check
(3) If Field Circuit Breaker is tripped, land as soon as practical.
(4) If Field Circuit Breaker is not tripped, and ammeter continues to show discharge, set alternator side of master switch to OFF and land as soon as practical.

AMPLIFIED PROCEDURES

ENGINE FAILURES

If the engine fails during the takeoff run, prior to liftoff, the airplane should be stopped as soon as possible. In cases of partial failure (resulting in loss of power) the pilot may have the option of continuing the takeoff or aborting it. Obviously this is a decision that must be made by the pilot in light of existing conditions, however, an aborted takeoff (if possible) in most cases is the safest approach.

This checklist provides items that may assist the pilot in increasing the safety of the airplane during such situations.

If the engine fails (either completely or partially) it is essential that the nose of the airplane be lowered promptly so that a safe airspeed can be maintained. At low altitudes, in most cases, the airplane should be flown straight ahead for a landing, with only small directional changes to avoid obstructions or people on the ground. Seldom are there either the altitude or airspeed available for a 180° gliding turn back to the runway. These checklists are based upon the assumption that the pilot will have adequate time to secure the fuel and ignition systems prior to touchdown, however, the pilot must keep in mind that his primary duty is control of the airplane.

If the engine fails in flight (complete loss of power) the best glide speed, as shown in Figure 3-1 should be established as quickly as possible. Once the proper gliding speed has been established and a glide toward a suitable landing site entered, an effort should be made to determine the cause of the engine failure. If there is sufficient time an engine restart should be attempted per the checklist. Either lack of time for a restart or failure of the engine to start will necessitate a forced landing. Obviously a thorough knowledge of the airplane and the appropriate checklists may give the pilot that slight margin of time necessary to make a restart rather than a forced landing.

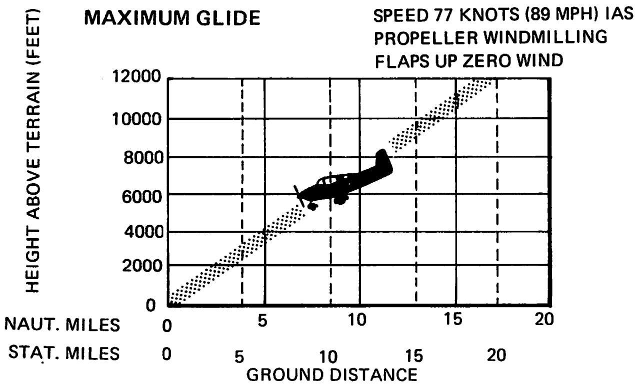

Figure 3-1. Maximum Glide

FORCED LANDINGS

If the engine cannot be restarted and a forced landing is imminent, select a suitable landing zone and prepare for a landing as discussed in the EMERGENCY LANDING WITHOUT ENGINE POWER checklist.

If engine power is available and a landing is to be attempted at an area other than an airport, the landing area should be observed from a safe but low altitude. Inspect the terrain for obstructions and surface conditions prior to attempting a landing. Perform the landing as discussed in the PRECAUTIONARY LANDING WITH ENGINE POWER checklist.

If ditching is to be attempted heavy objects in the baggage area should be secured. Folded coats or cushions should be available for occupants to use for face protection at touchdown. If there is sufficient time, transmit a Mayday message on 121.5 MHz giving location and intentions. Perform the ditching as discussed in the DITCHING checklist.

GROUND FIRES

Ground fires may be caused by over-priming the engine, therefore, proper procedures will help prevent fires when starting the engine.

Should a ground fire occur, the following procedures are suggested:

(1) Keep the engine running to ingest the flames into carburetor. Increase engine RPM to 1800 RPM.
(2) Dispatch ground personnel for fire equipment.
(3) When assistance arrives, turn fuel selector valve OFF. Let engine stop due to fuel starvation. Set Master Switch and Ignition Switch to OFF.
(4) If no assistance is available or the fire is beyond control, turn the fuel selector OFF, mixture IDLE CUTOFF, Master Switch OFF, Ignition Switch OFF. ABANDON AIRCRAFT.

IN-FLIGHT ENGINE FIRES

In-flight engine fires in today's modern aircraft are extremely rare. It should be noted that the presence of smoke does not always mean that a flaming fire exists. For example, it may be engine oil on the exhaust system. If, in the pilot's judgement, an engine fire exists, the following procedures are suggested:

(1) Mixture – IDLE CUTOFF
(2) Fuel Selector Valve – OFF
(3) Master Switch – OFF
(4) Cabin Heat and Air – OFF
(5) Establish a maximum safe rate of descent. Increasing speed may blow the fire out.
(6) Slide slip maneuvers may be used, as necessary, to direct flames away from cabin area.
(7) Select a suitable field for a forced landing.
(8) Notify ATC if possible.
(9) Complete the forced landing. Do not attempt to restart the engine.

IN-FLIGHT ELECTRICAL FIRES

Indication of in-flight electrical fires may be wisps of smoke or the smell of hot or burning insulation. Should an electrical fire develop, the following procedures are suggested:

If fire is in engine compartment:

(1) Master Switch – OFF.
(2) Vent/Cabin Air/Heat – OFF/CLOSED
(3) Land airplane as soon as possible

If fire is in cockpit:

(1) Master Switch – OFF
(2) All Other Switches (except ignition switch) – OFF
(3) Vents/Cabin Air/Heat – CLOSED
(4) Fire Extinguisher – ACTIVATE (if available)

If fire appears to be out and electrical power is necessary to continue flight:

(5) Master Switch – ON
(6) Circuit Breakers – CHECK for faulty circuit, do not reset.
(7) Radio/Electrical Switches – ON one at a time, with delay after each until short circuit is located.
(8) Vents/Cabin Air/Heat – OPEN when fire is out.

EMERGENCY OPERATION IN CLOUDS

Vacuum System Failure

A vacuum system failure may disable the directional and attitude indicators, thus forcing the pilot to rely on the turn coordinator or turn and bank indicator and magnetic compass if he inadvertently flies into clouds. The following procedures assume that only the electrically-powered turn coordinator or turn and bank indicator is operative, and the pilot is not instrument rated.

Executing a 180° Turn in Clouds

Upon inadvertently entering the clouds, an immediate plan should be made to turn back as follows:

(1) Note the time of the minute hand and observe the position of the sweep second hand on the clock. Note compass heading.
(2) When the sweep second hand indicates the nearest half-minute, initiate a standard rate left turn, holding the turn coordinator symbolic airplane wing opposite the lower left index mark for 60 seconds. Then roll back to level flight by leveling the miniature airplane.
(3) Check accuracy of the turn by observing the compass heading which should be reciprocal of the original heading.
(4) If necessary, adjust heading primarily with skidding motions rather than rolling motions so that the compass will read more accurately.
(5) Maintain altitude and airspeed by cautious application of elevator control. Avoid overcontrolling by using a very small pitch control changes.

Emergency Descent Through Clouds

If VFR flight conditions cannot be re-established by performing a 180° turn, a descent through the cloud deck to VFR conditions may be appropriate. If possible, obtain radio clearance for an emergency descent through clouds. To guard against a spiral dive, choose an easterly or westerly heading to minimize compass card swings due to changing bank angles. In addition, use a minimum control wheel movement and steer a straight course with rudder control by monitoring the turn coordinator. Occasionally check the compass heading and make minor corrections to hold an approximate course. Before descending into the clouds, set up a stabilized let-down condition as follows:

(1) Apply full carburetor heat.
(2) Reduce power to set up a 500 to 600 ft./min. rate of descent.
(3) Adjust the elevator trim control wheel for a stabilized descent at 70 KIAS (81 MPH).
(4) Use minimum control wheel motion and avoid abrupt movement.
(5) Monitor turn coordinator and make corrections by rudder alone.
(6) Check trend of compass card movement and make cautious corrections with rudder to stop turn.
(7) Upon breaking out of clouds, resume normal cruising flight.

Recovery from a Spiral Dive

If a spiral is encountered, proceed as follows:

(1) Close throttle.
(2) Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon reference line.
(3) Cautiously apply elevator back pressure to slowly reduce the indicated airspeed to 70 KIAS (81 MPH).
(4) Adjust the elevator trim control to maintain a 70 KIAS (81 MPH) glide.
(5) Use minimum control wheel movement, using rudder control to hold a straight heading.
(6) Apply carburetor heat.
(7) Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
(8) Upon breaking out of clouds, resume normal cruising flight.

FLIGHT IN ICING CONDITIONS

Carburetor ice may be encountered at any time. Normally, the first indication of carburetor ice in the AA-1C is a slight drop in engine RPM, which may be accompanied by slight engine roughness. If carburetor icing is suspected, the following procedures are suggested:

(1) Apply full carburetor heat. Engine roughness may then occur due to an over-rich mixture or water from the melting ice.

NOTE

Continuous engine operation with carburetor heat on is not recommended due to the resultant decrease in engine efficiency. If severe icing conditions require extended use of carburetor heat the engine mixture should be leaned during use of carburetor heat.

Flying in known icing conditions is prohibited by FAA regulations. However, should wing icing occur the following procedures are suggested:

(1) Turn pitot heat ON
(2) Turn cabin heat ON.
(3) Open windshield defroster vent.
(4) If IFR or under control of an in-flight ground facility, notify them of the condition and request assistance. A change of altitude, if possible, or reversing course to fly out of the icing conditions may be desirable.
(5) Pilot technique is important in this situation:
    A. Increase and decrease engine RPM (do not exceed red line) to keep propeller clear of ice.
    B. Increase airspeed if possible. This technique reduces angle of attack exposing less surface area for ice accumulation.
    C. Do not extend flaps. A clean configuration will expose less surface to ice and will prevent a change in air flow over the tail surfaces.
(6) Monitor engine RPM for any indication of carburetor ice. (Refer to Carburetor Ice Procedures.)
(7) Plan a landing at the first suitable airport. The following procedures are suggested:
    A. If the windshield is obstructed, the canopy may be opened to improve visibility. A forward slip may be helpful.

B. Remember that ice accumulation increases wing loading, decreases performance, decreases range and INCREASES STALL SPEEDS. When landing, plan a slightly higher than normal air speed during landing approach. Guard against increased stall speed created by the above mentioned conditions. Touch down in a slightly nose high attitude.

REMEMBER: Intentional flying in icing conditions IS PROHIBITED!

STATIC SOURCE BLOCKED

If erroneous readings are suspected on the instruments associated with the pitot-static system (airspeed indicator, altimeter and vertical speed indicator) pitot heat should be applied (for erroneous airspeed indications) in case the problem is due to ice or water accumulation in the pitot head. Failure of pitot heat to correct the problem may indicate blockage of the static sources. Obviously in a situation such as this, a landing should be planned at the nearest suitable airport. If it is necessary to continue the flight, and particularly if the flight is in marginal conditions, a static source must be supplied to the airspeed indicator and altimeter.

A static source can be supplied to the airspeed indicator and altimeter by breaking the glass on the face of the vertical speed indicator.

If this is done remember the following:

(1) The vertical speed indicator will be inoperative.
(2) Some error may be expected in airspeed and altitude indications. At airspeeds above 87 KIAS (100 MPH) subtract 6 KIAS (7 MPH)from indicated airspeed and 80 feet from indicated altitude.
(3) The canopy must be kept closed, since opening it could introduce large errors in airspeed and altitude indications.

SPINS

The AA-1C is not certificated for spins, in either the Normal or Utility category, therefore, INTENTIONAL SPINS ARE PROHIBITED. However, should inadvertent spin occur, the following recovery procedure is recommended:

(1) Throttle – Idle
(2) Ailerons – Neutral
(3) Rudder – Hold opposite direction of rotation, full rudder.
(4) Elevator – Wheel full forward, simultaneously with rudder application.
(5) Hold controls in these positions until rotation stops.
(6) When rotation stops neutralize rudder and recover from dive.

NOTE

If disorientation precludes a visual determination of the direction of rotation, the symbolic airplane in the turn coordinator or the needle of the turn and bank indicator may be referred to for this information.

ROUGH ENGINE OPERATION OR LOSS OF POWER

Carburetor Icing

An unexplained drop in RPM and engine roughness may result from the formation of carburetor ice. To clear the ice, apply full throttle (do not exceed red line) and pull the carburetor heat knob full out until the engine runs smoothly. Then remove carburetor heat and readjust the throttle. If conditions require the continued use of carburetor heat in cruise flight use the minimum amount of heat necessary to prevent ice from forming and lean the mixture for smooth engine operation.

Spark Plug Fouling

A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from BOTH to either L or R position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the most likely cause, lean the mixture to the recommended lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the BOTH position of the ignition switch unless extreme roughness dictates the use of single ignition position.

Magneto Malfunction

A sudden engine roughness or misfiring is usually evidence of magneto problems. Switching from BOTH to either L or R ignition switch position will identify which magneto is malfunctioning. Select different power settings and use a richer mixture to determine if continued operation on BOTH magnetos is practicable. If not, switch to the good magneto and land at the nearest airport for repairs.

Low Oil Pressure/Engine Overheat

A low oil pressure reading may be caused by malfunction of the indicating system, oil pump failure, or loss of oil. Monitor the oil temperature gauge for a marked increase in temperature. If no temperature change is detected, the failure is most likely in the oil pressure indicating system.

Proceed to the nearest airport, land, check the oil level and determine the difficulty.

In flight, if the oil pressure indication is low and is accompanied by high oil temperatures, reduce power and proceed to the nearest airport or suitable landing area. If possible, notify the nearest ATC radio facility of your difficulty and land.

REMEMBER: A THOROUGH AND COMPLETE PREFLIGHT WILL USUALLY PREVENT LOW OIL PRESSURE EMERGENCIES.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

The ammeter system on the AA-1C indicates current flow to or from the battery. During normal operation, with a fully charged battery, the ammeter will indicate near zero or slightly toward the charge side. This indication will be true even though all electrical systems are energized, unless the capacity of the alternator (60 amps) has been exceeded.

Failure of the alternator is easily detected since the ammeter will show discharge to the extent of the loads being applied.

Should a component of the electrical system fail (landing light, radio, turn and bank indicator, etc.), visually check the related circuit protector and replace or reset as required.

If the alternator circuit breaker opens (pops out), wait 15 seconds then attempt to reset it by pushing the circuit breaker back into position.

Check field circuit breaker. If field circuit breaker is tripped, land as soon as practical. If field circuit breaker is not tripped, and ammeter continues to show discharge, set alternator side of master switch to OFF and land as soon as practical.

Overvoltage Protection

Overvoltage protection is provided by a diode attached to the field circuit breaker forward of the instrument panel. A sustained overvoltage condition will result in failure of the diode and subsequent opening of the alternator field circuit breaker. The breaker will not reset until the fault is corrected and the diode replaced.

Insufficient Output

If the ammeter shows a discharge with the alternator switch ON, an alternator related failure has occured, or the electrical loads have exceeded the rated output of the alternator due to a malfunction. Remove all unnecessary loads one at a time until the faulty load has been isolated. In any event, reduce all electrical loads as required to conserve battery energy.

BRAKE FAILURE

Brake failure is infrequent in any aircraft. However, if a brake failure is detected, proceed to the nearest airport with adequate runway length to accommodate an emergency brake-failure landing. It is not recommended, with a single brake failure, that either brake be utilized during landing and roll-out.

Plan the touchdown near the approach end of the runway. The aircraft nose should be aligned with the runway centerline. Use minimum safe airspeeds for existing conditions. Maintain directional control straight down the runway with use of rudder only. Allow the airplane to roll to a stop without the use of brakes. The engine may have to be stopped (with mixture control) to stop the ground roll. Request assistance from the appropriate ground control authority. It is recommended that towing to a parking area be accomplished manually with the hand tow bar or with a "tug".

WINDSHIELD OBSCURATION

A windshield obscuration caused by ice or moisture condensation may be encountered. Turn cabin heat on and defroster vent full open to clear the windshield of moisture. If obscuration persists, open the canopy, and proceed to the nearest airport. A safe landing may be accomplished by using a forward slip to a landing while looking through the opening in the canopy.

SECTION 4
NORMAL PROCEDURES

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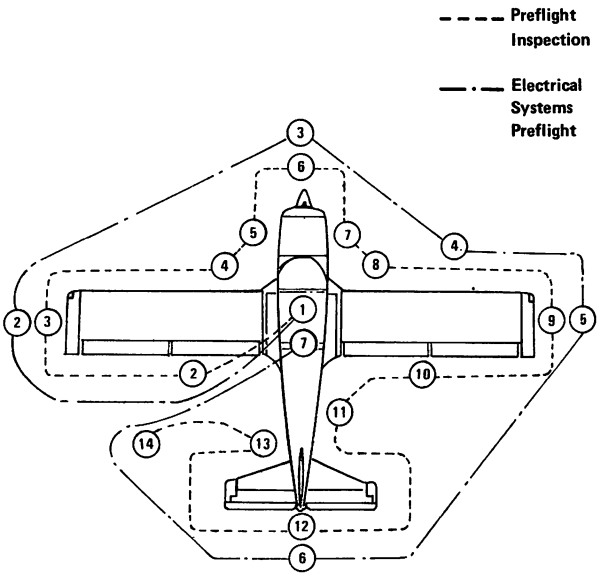
INTRODUCTION

Section 4 provides checklist and amplified procedures for the conduct of normal operation of the AA-1C airplane. Normal procedures associated with Grumman American designed Optional Systems can be found in Section 9.

SPEEDS FOR SAFE OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 1600 pounds and may be used for any lesser weight. However, to achieve the performance specified in Section 5 for takeoff distance, the speed appropriate to the particular weight must be used.

	KIAS	MPH
Takeoff:		
Normal Climb Out	80	92
Maximum Performance Takeoff, Speed at 50 feet	66	76
Enroute Climb, Flaps Up:		
Normal	80	92
Best Rate of Climb, Sea Level	78	90
Best Rate of Climb, 10,000 Feet	73	84
Best Angle of Climb, Sea Level	64	74
Best Angle of Climb, 10,000 Feet	70	81
Landing Approach:		
Normal Approach, Flaps UP	77	89
Normal Approach, Flaps DN	70	81
Short Field Approach, Flaps DN	65	75
Balked Landing:		
During Transition to Maximum Power, Full Flaps	68	78
Maximum Recommended Turbulent Air Penetration Speed:		
1600 Lbs	117	135
Maximum Demonstrated Crosswind Velocity:		
Takeoff or Landing	16 knots	



NOTE

Visually check airplane for general condition during walk-around inspection. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces.

Figure 4-1. Preflight Inspection

CHECKLIST PROCEDURES

PREFLIGHT INSPECTION

1. **Cabin**
   (1) Canopy – OPEN (turn handle counterclockwise to open.)
   (2) Control Wheel Lock – REMOVE
   (3) Ignition Switch – OFF.
   (4) Master Switch – OFF
   (5) Mixture – IDLE CUTOFF.

2. **Left Wing Trailing Edge**
   (1) Flap – Secure and undamaged.
   (2) Aileron – Freedom of movement
   (3) Tank Drain – Fuel free of water and sediment, drain secure.

3. **Left Wing**
   (1) Wing Tip and Light – Undamaged
   (2) Fuel Tank – Full, cap seal checked for damage, cap secure
   (3) Fuel Tank Vent – Unobstructed
   (4) Wing Inspection Plates – Secure
   (5) Tiedown – Removed
   (6) Pitot Tube – Unobstructed
   (7) Fuel – Proper color

4. **Left Wing Leading Edge**
   (1) Landing Gear Wheel Fairing and Tire – Undamaged, tire properly inflated
   (2) Chocks – Removed

5. **Left Cowl**
   (1) Windshield – Clean, undamaged
   (2) OAT Gauge – Secure, undamaged
   (3) Fuel Pump Overflow Drain – Unobstructed
   (4) Fresh Air Vents – Unobstructed

(5) Oil Breather Vent — Unobstructed
(6) Baffles — Secure, Undamaged
(7) Cowling — Latches Secured

6. **Nose**
(1) Propeller and Spinner — Secure, undamaged
(2) Cowling — Secure, undamaged
(3) Landing Light — Secured, undamaged
(4) Nose Gear, and Fairing — Undamaged, tire properly inflated, mud scraper clear
(5) Tow Bar — Removed and stowed
(6) Chocks — Removed
(7) Engine Cooling Openings — Unobstructed
(8) Alternator Belt — Proper tension
(9) Carburetor Air Intake — Unobstructed

7. **Right Cowl**
(1) Engine Oil Level — 2 Quarts minimum, capacity 6 quarts
(2) Engine Oil Dipstick — Secured (finger tight)
(3) Vacuum Pump Vent — Unobstructed
(4) Battery — Secure
(5) Cowling — Latches secured

8. **Right Wing Leading Edge**
(1) Landing Gear, Wheel Fairing and Tire — Undamaged, tire properly inflated
(2) Chocks — Removed

9. **Right Wing**
(1) Wing Tip and Light — Undamaged
(2) Fuel Tank — Full, cap seal checked for damage, cap secure
(3) Fuel Tank Vent — Unobstructed
(4) Wing Inspection Plates — Secured
(5) Tiedown — Removed
(6) Fuel — Proper color

10. **Right Wing Trailing Edge**
    (1) Aileron — Freedom of movement
    (2) Flap — Secure and undamaged
    (3) Tank Drain — Fuel free of water and sediment, drain secure

11. **Right Side of Fuselage**
    (1) Static Source — Unobstructed
    (2) Antennas — Secure, undamaged
    (3) Fuselage — Undamaged

12. **Empennage**
    (1) Elevators — Freedom of movement
    (2) Rudder — Freedom of movement
    (3) Trim Tabs — Secure
    (4) Tail Cone and Light — Secure, undamaged
    (5) Tie Down — Removed

13. **Left Side of Fuselage**
    (1) Static Source — Unobstructed
    (2) Fuselage — Undamaged

14. **Night Flight Preflight**
    (1) Fuses and Circuit Breakers — Check
    (2) Spare Fuses — In Map Compartment
    (3) Flashlight — Aboard
    (4) Required Charts — Aboard

ELECTRICAL SYSTEMS PREFLIGHT

1. **Cabin**
    (1) Master Switch — ON
    (2) Instrument Lights — Check Rheostat, OFF
    (3) Navigation Lights — ON
    (4) Flashing Beacon — ON
    (5) Strobe Lights — ON
    (6) Pitot Heat — ON
    (7) Landing Light — ON

2. **Left Wing Tip**
    (1) Navigation Light — Illuminated
    (2) Strobe Light — Flashing

3. **Nose**
   (1) Landing Light — Illuminated

4. **Right Wing**
   (1) Stall Warning Vane — Lift, check that stall warning horn sounds

WARNING

DO NOT TOUCH PITOT TUBE DIRECTLY, IT CAN BE HOT ENOUGH TO BURN SKIN.

   (2) Pitot Tube — Check for heat

5. **Right Wing Tip**
   (1) Navigation Light — Illuminated
   (2) Strobe Light — Flashing

6. **Empennage**
   (1) Navigation Light — Illuminated
   (2) Flashing Beacon — Operating

7. **Cabin**
   (1) Master Switch — OFF
   (2) Navigation Lights — OFF
   (3) Flashing Beacon — OFF
   (4) Strobe Lights — OFF
   (5) Pitot Heat — OFF
   (6) Landing Light — OFF

BEFORE STARTING ENGINE

(1) Preflight Inspection — Complete
(2) Seats, Seat Belts and Shoulder Harness — Adjusted, locked
(3) Radios, Autopilot, Electrical Equipment — OFF
(4) Brakes — Test and set
(5) Controls — Check for proper operation

STARTING ENGINE

(1) Mixture — FULL RICH
(2) Carburetor Heat — OFF
(3) Fuel Selector Valve — Set to fullest tank
(4) Prime — As required
(5) Master/Alternator Switch — ON
(6) Flaps — UP

(7) Auxiliary Fuel Pump – ON (Check pressure 0.5 – 8 PSI)
(8) Auxiliary Fuel Pump – OFF
(9) Propeller – CLEAR
(10) Ignition Switch – ON LEFT
(11) Throttle – CLOSED
(12) Starter Button – Press, release when engine starts
(13) Ignition Switch – ON BOTH
(14) Oil Pressure – Check, if no pressure within 30 seconds, shut down engine
(15) Engine – Warm up at 1000 to 1200 RPM

NOTE

Aviod prolonged idling while on the ground.

BEFORE TAKEOFF

(1) Brakes – Set
(2) Throttle – Set for 1800 RPM
(3) Engine Instruments – In green arc
(4) Ammeter – Charging
(5) Vacuum Gage – 4.6 to 5.4 in. Hg.
(6) Magnetos – Check, 175 RPM maximum drop, not over 50 RPM difference between left and right magnetos
(7) Carburetor Heat – ON, check for RPM drop, then set to OFF
(8) Throttle – Set for 1000 RPM
(9) Radios – ON, checked
(10) Engine – Idles smoothly
(11) Engine is ready for takeoff when it will take throttle without hesitating or faltering.
(12) Trim Tab – SET
(13) Flaps – Checked for operation, set UP
(14) Mixture – FULL RICH (or as required by field elevation)
(15) Throttle Friction Lock – ADJUSTED
(16) Auxiliary Fuel Pump – ON
(17) Flight Instruments – SET (clock, directional gyro, altimeter, radios)
(18) Lights – ON, as required
(19) Fuel Primer – Locked

TAKEOFF

Normal Takeoff

(1) Flaps – UP
(2) Carburetor Heat – OFF

(3) Auxiliary Fuel Pump – ON
(4) Throttle – FULL OPEN
(5) Elevator Control – Raise nosewheel at 55 KIAS (63 MPH) to 60 KIAS (69 MPH)
(6) Climb Speed – 80 KIAS (92 MPH)

Obstacle Clearance Takeoff

(1) Flaps – UP
(2) Carburetor Heat – OFF
(3) Auxiliary Fuel Pump – ON
(4) Throttle – FULL OPEN
(5) Elevator – Apply light back pressure at 55 KIAS (63 MPH), lift nosewheel at 60 KIAS (69 MPH)
(6) Climb Speed – 65 KIAS (75 MPH)

CLIMB

(1) Normal Climb Speed – 80 KIAS (92 MPH) at full throttle
(2) Best Rate of Climb Speed – 78 KIAS (90 MPH) at sea level, full throttle
(3) Best Angle of Climb Speed – 64 KIAS (74 MPH) at sea level, full throttle.

CRUISE

(1) Auxiliary Fuel Pump – OFF
(2) Power – SET at 2200 to 2700 RPM
(3) Trim Tab – SET as required
(4) Mixture – SET as required. Full rich when operating at more than 75% power. If in doubt of percentage of power being used, use full rich mixture for operation below 5000 ft.
(5) To maintain best fuel, load balance, change fuel selector at approximately 30-minute intervals during cruise. If flying solo, maintain the left tank about 1/2-tank lower than the right. This technique will improve lateral trim.

DESCENT

(1) Power – As required for descent
(2) Mixture – As required by altitude
(3) Carburetor Heat – As required by engine power setting and weather conditions
(4) Trim Tab – SET as required

BEFORE LANDING

(1) Seats, Seat Belts and Shoulder Harness – Adjust and lock
(2) Fuel Selector – On fullest tank
(3) Mixture – FULL RICH
(4) Auxiliary Fuel Pump – ON
(5) Carburetor Heat – ON if required
(6) Flaps – SET as required, below 100 KIAS (115 MPH)
(7) Airspeed – 65 KIAS (75 MPH) to 70 KIAS (81 MPH)
(8) Landing Light – ON as required

BALKED LANDING

(1) Power – Full throttle
(2) Carburetor Heat – OFF
(3) Airspeed – 70 KIAS (81 MPH)
(4) Establish Climb Attitude
(5) Flaps – Retract slowly, maintain safe airspeed

LANDING

Normal Landing

(1) Touch down on main gear.

CAUTION

IF THE NOSE GEAR IS ALLOWED TO CONTACT THE RUNWAY PRIOR TO MAIN GEAR TOUCHDOWN A PORPOISE MANEUVER MAY OCCUR. SHOULD THE AIRPLANE BEGIN PORPOISING RECOVER AS FOLLOWS:

A. APPLY FULL POWER
B. MAINTAIN STEADY ELEVATOR BACK PRESSURE FOR A NORMAL CLIMB.
C. ESTABLISH A NORMAL CLIMB AT 80 KIAS (92 MPH)
D. SLOWLY RETRACT FLAPS
E. EXECUTE A NORMAL GO-AROUND.

(2) Lower nosewheel slowly as speed decreases.
(3) Use rudder to maintain directional control down to approximately 17 KIAS (20 MPH)
(4) Brakes — Use as required for stopping and directional control.

Obstacle Clearance Landing

(1) Flaps — Fully extended below 100 KIAS (115 MPH)
(2) Airspeed — 65 KIAS (75 MPH)
(3) Touch down on main gear
(4) Elevator — Slowly apply full up control
(5) Flaps — UP
(6) Brakes — As required for directional control and stopping.

AFTER LANDING

(1) Flaps — UP
(2) Auxiliary Fuel Pump — OFF
(3) Landing Light — OFF (if used)
(4) Carburetor Heat — OFF
(5) Strobe Light — OFF (if used)

SHUT-DOWN/SECURING AIRPLANE

(1) Electrical Equipment, Radios, Lights — OFF
(2) Mixture — IDLE CUTOFF
(3) Ignition — OFF (after propeller has stopped)
(4) Master Switch — OFF
(5) Control Lock — Installed
(6) Brakes — SET, if required
(7) Chocks/Tiedowns — Installed

AMPLIFIED PROCEDURES

STARTING ENGINE

Before priming, apply brakes. It is good practice to have all radios and lights off, both to limit battery drain during the start and to protect avionics from voltage surges.

NOTE

Normally, one to three strokes of the priming pump is sufficient for quick starting. In temperatures below 40°F (4°C), however, four to six strokes may be necessary. During extremely cold days, starting will be aided by pulling the propeller through four or five revolutions by hand. SWITCHES MUST BE OFF WHEN PULLING THE PROPELLER. Preheating the engine or oil before starting in sub-zero temperatures will speed the start and conserve the battery charge.

With brakes applied, place the mixture in the full rich position; throttle closed; turn master switch and alternator switch ON; clear propeller area; set ignition switch to left; and engage the starter. If the engine fails to start on the first attempt, a second attempt should be made without priming. If the day is hot and the second attempt fails, it is possible the engine is over-primed. Pull the mixture control to full lean, throttle full open, and turn the engine with the starter. When the engine starts, push the mixture control to full rich and reduce throttle. If the day is cold, it is more likely the engine is under-primed. In this event, a few extra strokes of the primer should provide a prompt start. As soon as engine starts set ignition to both.

Check the oil pressure when the engine starts. If no oil pressure is indicated within 30 seconds (60 seconds on a very cold day), stop the engine and determine the source of trouble. Oil pressure should indicate approximately 25 PSI with the engine at idle. Release parking brake by pushing parking brake knob and pressing brakes.

NOTE

Parking brake can be operated only from the left seat.

TAXIING

All taxiing should be done at slow speed, and the controls should be positioned such that the affects of gusty wind are minimized. (See Taxiing Diagram, Figure 4-2.) Since the rudder controls on the AA-1C are not directly coupled to the nosewheel, directional control during taxiing is maintained by use of differential braking.

Taxiing over loose gravel or cinders should be done at low engine speed to minimize damage to the propeller tips, landing gear and empennage due to abrasion or stone damage.

WARM-UP AND GROUND CHECK

Engine warm-up should be at 1000 to 1200 RPM. The magneto check is run at 1800 RPM using the BOTH-RIGHT-BOTH-LEFT-BOTH sequence. Maximum RPM drop per magneto should not exceed 175 RPM, or 50 RPM differential between magnetos. The carburetor heat should be checked for operation at this time, then returned to the full OFF position. The engine is ready for takeoff when it will take full throttle without hesitation or faltering.

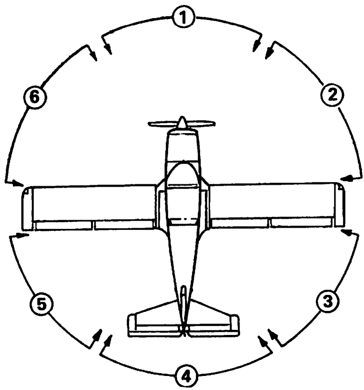
TAKEOFF

Power Check

It is important to check full-throttle engine operation early in the takeoff run. Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff.

Smooth and uniform throttle application should be used to ensure best engine acceleration and to give long engine life. This technique is important under hot weather conditions which may cause a rich mixture that could hinder engine response if the throttle is applied too rapidly.

Full-throttle runups over loose gravel are especially harmful to propeller tips. When takeoffs must be made over a gravel surface, it is very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it.



NUMBER	WIND DIRECTION	CONTROL POSITION
(1)	FWD	Wheel Neutral – Back
(2)	FWD RH Quarter	Wheel Right – Back
(3)	Aft RH Quarter	Wheel Left – Forward
(4)	AFT	Wheel Neutral – Forward
(5)	Aft LH Quarter	Wheel Right – Forward
(6)	FWD LH Quarter	Wheel Left – Back

Figure 4-2. Taxiing Diagram

Prior to takeoff from fields above 5000 feet elevation, the mixture should be leaned to give maximum power.

After full throttle is applied, adjust the throttle friction lock clockwise to prevent the throttle from creeping back from a maximum power position. Similar friction lock adjustment should be made as required in other flight conditions to maintain a fixed throttle setting.

Normal Takeoff

Before beginning the takeoff roll, align the airplane with the runway. Aligning the nose wheel with the takeoff direction will allow minimum brake usage during the initial ground roll. When full power is applied for takeoff, directional control is maintained with light toe pressure on the brakes. At speeds above 13 KIAS (15 MPH) to 17 KIAS (20 MPH), the rudder becomes fully effective and brake steering is NOT necessary. Continued use of brake steering will only prolong the takeoff roll.

Accelerate to 55 KIAS (63 MPH) before applying a light back pressure on the control wheel to lift off the nose wheel. Raising the nose wheel too soon or to an excessive angle may increase takeoff ground distance. When airborne, accelerate to the desired climb speed.

Soft Field Takeoff

After alignment in the takeoff direction and with the elevator held in the full up position, apply takeoff power smoothly. As the airplane accelerates and the elevator becomes effective, the nose load will lighten reducing nose wheel drag. As the nose raises, the elevator should be eased forward so the nose wheel is held just clear of the ground. After lift off, accelerate to the best angle of climb speed 64 KIAS (74 MPH) or best rate of climb speed 78 KIAS (90 MPH) depending on obstacles.

NOTE

Avoid prolonged engine run-up in loose gravel, since the propeller will tend to pick up stones and debris causing propeller blade, landing gear and empennage damage.

Short Field Takeoff

After alignment in the takeoff direction, hold the brakes to prevent movement and apply full throttle. When full power is reached, release brakes and begin the takeoff roll with the elevator neutral. Use light smooth brake pressures to maintain low speed directional control. At 55 KIAS (63 MPH) apply elevator back pressure, lift nosewheel at 60 KIAS (69 MPH), then climb at 65 KIAS (75 MPH). When obstacles are cleared, accelerate to the desired climb speed.

Crosswind Takeoff

The airplane is accelerated to a speed slightly higher than normal, then flown off abruptly to prevent possible settling back to the runway while drifting. When clear of the ground, make a coordinated turn into the wind to correct for drift.

CLIMB

A normal climb speed of 80 KIAS (92 MPH) is recommended once all ground obstacles have been cleared. This speed offers good visibility, excellent over-the-ground speed and rate of climb. The best rate of climb speed varies from 78 KIAS (90 MPH) at sea level to 73 KIAS (84 MPH) at 10,000 ft. The best angle of climb speed varies from 64 KIAS (70 MPH) at sea level to 70 KIAS (81 MPH) at 10,000 ft. Refer to Section 5 performance charts for additional information.

NOTE

The mixture should be full rich during takeoff and climb at altitudes below 5000 ft. MSL. However, during takeoff or climb from high-altitude airports, the engine should be leaned to achieve best power (maximum RPM).

CRUISE

The maximum recommended cruise power setting is 100% of the rated horsepower. True airspeeds, which are determined by the particular altitude and power setting chosen, can be obtained from the tables in Section 5. To maintain best fuel load balance, change fuel selector at approximately 30-minute intervals during cruise. If flying solo, maintain the left tank about 1/2-tank lower than the right. This technique will improve lateral trim.

NOTE

On new airplanes power should be maintained at 75% power or more until a total of 50 hours has accumulated. This is to ensure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

After the initial break-in period, fuel consumption can be reduced significantly, especially at high altitudes, by leaning the mixture in cruising flight. For optimum fuel consumption in cruise at 75% power or less, lean the mixture as follows:

(1) Slowly move the mixture control from full rich position toward lean position.
(2) Continue leaning until engine roughness is noted.
(3) Enrich mixture slightly until engine runs smoothly.

The Cruise Performance fuel consumption given in Section 5 is based upon this leaning technique.

NOTE

If engine runs rough during cruise with carburetor heat on, it may be due to an over-rich condition. To correct for engine roughness in such a situation, lean mixture to smooth engine operation.

DESCENT

Power on descents of up to 125 KIAS (144 MPH) can be utilized to reduce enroute flight time. Higher airspeeds are permissible in smooth air conditions. Placarded airspeed limitations must be observed.

STALLS

The AA-1C's stall characteristics are conventional in all configurations. Elevator buffeting occurs approximately 2 KIAS (3 MPH) above the stall and becomes more pronounced as the stall occurs. An audible stall warning horn begins to blow steadily 5 KIAS to 10 KIAS above the actual stall speed.

NOTE

Rudder is the primary control for yaw. The aileron is the primary control for roll. Both controls should be used as necessary to control roll and yaw through the stall. For specific stall speeds at maximum weight with flaps up and down, refer to the Stall Speed Table in Section 5.

LANDING

Normal Landing

Trim the airplane to an approach speed between 65 KIAS (75 MPH) and 70 KIAS (81 MPH) depending on weight and wind conditions. Normal approach speed is 70 KIAS (81 MPH). Maximum flap extension speed is 100 KIAS (115 MPH). Any flap setting may be used for landings.

As a general rule, it is good practice to contact the ground at a minimum safe speed consistent with existing conditions. After touchdown, hold the nose wheel off as long as possible on roll-out. Lower the nose gently and apply brakes as needed. Retract the flaps after touchdown to minimize the possibility of skidding when braking. In gusty or crosswind conditions, many pilots prefer to increase their airspeed slightly above the normal approach speed; this decision, however, can only be made by the pilot in light of his own experience and training.

NOTE

A power-off nose-high touchdown attitude is the best assurance of a porpoise-free landing, and excessive touchdown speed is not required with direct crosswinds up to 16 knots.

A pilot-induced porpoise maneuver may be encountered during landing by contacting the nose wheel first. The porpoise could be accentuated by a wavy or rolling runway surface. Should a porpoise occur, use the following technique to recover:

(1) Apply full power.
(2) Carburetor heat – OFF
(3) Maintain steady elevator-back pressure for a normal climb.
(4) Normal climb – 80 KIAS (92 MPH).
(5) Retract flaps.
(6) Execute normal go-around

Soft Field Landing

For soft fields, the airplane should be trimmed to an approach speed of 65 KIAS (75 MPH) with flaps fully extended. Use power as necessary to control glide path consistent with existing conditions. Touchdown in a rough or soft field should be in a nose-high pitch attitude at the slowest safe airspeed. The nose wheel should be held off the surface as long as possible, and braking should be the minimum required for directional control and safety. (Maximum braking on soft surfaces may lead to excessive gear loads.)

Short Field Landing

When making a landing where obstacle clearance or ground roll is a factor, the AA-1C should be trimmed to an approach speed of 65 KIAS (75 MPH) with flaps fully extended. Touchdown should be made on the main gear at the slowest safe airspeed. Best braking can be obtained by applying light pressure immediately after touchdown and continuously increasing brake pressure just enough so the wheels do not skid.

Crosswind Landing

When landing in a strong crosswind, use the minimum flap setting required for the field length. Although the crab or combination method of drift correction may be used, the crab method gives the best control. After touchdown, hold a straight course with the rudder and occasional braking.

BALKED LANDINGS (Go-Arounds)

Should a landing be balked, apply full power immediately; carburetor heat OFF; establish a positive rate of climb at 70 KIAS (81 MPH); retract the flaps and trim for normal climb.

SLIPS TO LANDINGS

Slips are very effective in the AA-1C. Rapid descents with high sink rates can be obtained through a properly executed slip. It is recommended, however, that slips be practiced at a safe altitude until the pilot is familiar with the AA-1C. The recommended slip speeds are 70 KIAS (81 MPH) to 75 KIAS (86 MPH) depending on load, pilot proficiency, and local conditions. Pilots should make themselves familiar with the airplane at a variety of slip speeds.

GROUND HANDLING AND TIEDOWN

The AA-1C is easily handled on the ground by hand with the aid of a tow bar attached to the nose wheel fork. Tiedown rings are provided under each wing tip and under the tail. Proper tiedown is the best insurance against damage to the airplane by gusty or strong winds. Installation of the control wheel lock helps avoid damage to the movable surfaces under such conditions.

Care should be taken when using the parking brakes for an extended period of time during which an air temperature rise could cause the hydraulic fluid to expand. This in turn, could damage the brake system and/or cause difficulty in releasing the parking brake. For prolonged parking, tiedown and wheel chocks are recommended.

COLD WEATHER OPERATION

Starting

Prior to starting on a cold morning, it is advisable to pull the propeller through several times by hand to "break loose" or "limber" the oil, thus conserving battery energy.

WARNING

WHEN PULLING THE PROPELLER THROUGH BY HAND, TREAT IT AS IF THE IGNITION SWITCH IS TURNED ON. A LOOSE OR BROKEN GROUND WIRE ON EITHER MAGNETO COULD CAUSE THE ENGINE TO START.

Starting With Preheat:

(1) With ignition switch turned off and throttle closed, prime the engine four to eight strokes as the propeller is being turned over by hand.

NOTE

Use heavy strokes of the primer for best atomization of fuel. After priming, push primer all the way in and turn to the locked position to avoid the possibility of the engine drawing fuel through the primer.

(2) Mixture – FULL RICH.
(3) Propeller Area – CLEAR.
(4) Master Switch – ON.
(5) Auxiliary Fuel Pump – ON
(6) Throttle – CLOSED
(7) Ignition Switch – ON LEFT.
(8) Starter Button – Press, release when engine starts.
(9) Ignition Switch – ON BOTH.
(10) Oil Pressure – Check

Starting Without Preheat:

(1) Prime the engine six to ten strokes while the propeller is being turned by hand with the throttle closed. Leave the primer charged and ready for a stroke.
(2) Mixture – FULL RICH.
(3) Propeller Area – CLEAR.
(4) Master Switch – ON.
(5) Auxiliary Fuel Pump – ON
(6) Throttle – CLOSED
(7) Ignition Switch – ON LEFT.
(8) Starter Button – Press, release when engine starts.
(9) Ignition Switch – ON BOTH.
(10) Continue to prime the engine until it is running smoothly.
(11) Oil Pressure – CHECK.
(12) Apply full carburetor heat after the engine has started. Leave on until the engine is running smoothly.

(13) Primer – LOCKED.

NOTE

If the engine does not start or if engine firing diminishes in strength, it is probable that the spark plugs have been frosted over. Preheat must be used before attempting another start.

During cold weather operations, no indication will be apparent on the oil temperature gauge prior to takeoff if outside air temperatures are very cold. After a suitable warm-up period (2 to 5 minutes at 1000 RPM), accelerate the engine several times to higher engine RPM. If the engine accelerates smoothly and the oil pressure remains normal and steady, the airplane is ready for takeoff.

FLIGHT OPERATIONS

Takeoff is made normally with carburetor heat off and mixture set for prevailing altitude.

When operating in temperatures below -18°F (-28°C), avoid using partial carburetor heat. Partial heat may increase the carburetor air temperature to the 32°F (0°C) to 70°F (21°C) range, where icing is critical under certain atmospheric conditions.

HOT WEATHER OPERATION

The normal starting information in this section is appropriate. Avoid prolonged engine operation on the ground.

NOISE ABATEMENT

Public concern over environmental pollution has placed increased emphasis on control of airplane noise.

As Pilots, we can assist in reducing public exposure to airplane noise as follows:

(1) When flying VFR over outdoor assemblies of persons, recreational areas or other noise-sensitive areas attempt to fly at least 2000 feet above the surface.

(2) During climb out or descent to an airport attempt to plan the maneuver so that prolonged flight at low altitude can be minimized.

NOTE

The above recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgment, an altitude of less than 2000 feet is necessary for him to adequately exercise his duty to see and avoid other airplanes.

SECTION 5
PERFORMANCE

TABLE OF CONTENTS

INTRODUCTION

The performance charts and tables presented on the following pages enable the pilot to know what to expect from the AA-1C airplane under various conditions. These charts also provide the pilot with a valuable aid in accurate flight planning, therefore they should be consulted prior to each flight.

These charts are a compilation of data obtained through actual flight tests conducted in an AA-1C airplane with an engine in good condition, and using average piloting techniques.

The performance in the range and endurance profile charts (Figures 5-15 through 5-18) allows for 45 minutes reserve fuel at 50% power. Fuel flow data for cruise (Figures 5-11 through 5-14) is based upon the recommended leaning procedure. Some variables, such as mixture leaning technique, engine and propeller condition, and air turbulence may affect range and endurance by 10% or more.

The AA-1C airplane may be equipped with either a climb propeller (72CK-0-52) or a cruise propeller (72CK-0-56). Since the airplane's performance is materially affected by the type of propeller used, performance data are presented for AA-1C airplanes having each type of propeller installed.

When using the performance charts, ensure that the chart for your particular airplane's propeller installation is used.

USE OF PERFORMANCE CHARTS

The performance data is presented in tabular or graphical form, depending upon which presentation method best portrays the specific data. Each table or graph contains explanatory material when the use of the table or graph is not obvious. In addition, a sample problem, involving typical use of the performance data in this section, is presented, to illustrate usage of the tables and graphs.

SAMPLE PROBLEM

A sample flight plan has been outlined below to show the use of the performance data presented in this section.

CONDITIONS

Origin — Norfolk, Nebraska (OFK)

Outside Air Temperature	68°F (20°C)
Field Elevation	1571 Ft.
Altimeter Setting	29.75 in. Hg.
Wind	110° at 10 Kts.
Runway 13 length	5800 Ft.
Initial Weight	1540 Lbs.

Destination — North Platte, Nebraska (LBF)

Outside Air Temperature	50°F (10°C)
Field Elevation	2779 Ft.
Altimeter Setting	29.80 in. Hg.
Wind	360° at 20 Kts.
Runway 35 length	4400 Ft.

ROUTE OF TRIP

*OFK - V219 - OBH - V172 - LBF - V6 - SNY — V160 — DEN

Route Segment	Magnetic Course	Dist Nm	Wind 8500 Feet DIR/KTS	OAT 8500 Feet °C	Alt. Setting In. Hg.
OFK — OBH	220°	55	090/30	0	29.75
OBH — LBF	256°	111	090/30	0	29.80

* Reference: Enroute Low Altitude Charts L-11 and L-8

ABBREVIATION	AIRPORT
OFK	Norfolk, Nebraska
OBH	Wolbach, Nebraska
LBF	North Platte, Nebraska

To determine pressure altitude at origin and destination airports, add 100 feet to field elevation for each .1 in. Hg. below 29.92, and subtract 100 feet from field elevation for each .1 in. Hg. above 29.92.

Pressure Altitude at OFK;
29.92 — 29.75 = .17 in. Hg.
The pressure altitude at OFK is 170 feet above the field elevation.
1571 + 170 = 1741 Ft.

Pressure Altitude at LBF
29.92 – 29.80 = .12 in. Hg.

The pressure altitude at LBF is 120 feet above the field elevation.
4400 + 120 = 4520 Ft.

NOTE

For flight planning, the difference between cruise altitude and pressure altitude has been ignored.

TAKEOFF

Using the conditions listed for Norfolk, Nebraska, the takeoff distance required can be found. It should be kept in mind that the distances shown are based on maximum performance techniques. Conservative distances can be established by reading the chart at the next higher value of weight, altitudes and temperature. For this sample problem, 1600 lbs., 2000 ft. pressure altitude, and 20°C should be used to determine the takeoff distance from Figure 5-5 (Cruise Propeller).

Ground roll . . . . 1114 Feet
Total Distance to clear a 50-foot obstacle . . . . 1976 Feet

A correction for the affect of wind may be made based on Note 1 of Takeoff Distance (Figure 5-5) Using Figure 5-4, the headwind component is determined to be 9.5 Knots.

The distance correction for a 9.5 Knot headwind is:

$$\frac{9.5 \text{ Knots}}{5 \text{ Knots}} \times 5\% = 10\% \text{ Decrease}$$

This results in the following distances, corrected for wind:

Ground roll, zero wind (feet) 1114
Decrease in ground roll (1114 x 10%) . . . . –111
Corrected ground roll 1003

Total distance to clear a 50-foot obstacle, zero wind 1976
Decrease in total distance (1976 x 10%) . . . . –198
Corrected total distance to clear a 50-foot obstacle 1778

The distance is well within the takeoff distance available of 5800 Feet.

TIME, FUEL AND DISTANCE TO CLIMB:

Enter the graph for Time, Fuel and Distance to Climb (Figure 5-9) at the initial altitude (1571 feet) and at the cruise altitude (8500 feet).

Time to Climb = 19 –2.5 = 16.5 min
Fuel to Climb = 2.35 –.3 = 2.05 gal. (12.3 lbs.)
Distance Traveled = 26 –3 = 23 N.M.

CRUISE PERFORMANCE:

Based on the distance required, cruise performance tables (Figure 5-11 through 5-13), and the range and endurance profiles (Figure 5-15 through 5-17) for the cruise propeller, a power setting of 2600 RPM has been selected for this sample flight.

At 2600 RPM, enter the cruise performance tables at 8000 and 9000 feet, standard day and 20°C above standard.

STANDARD TEMPERATURE					
PRESSURE ALTITUDE FEET	TEMP	% BHP	TAS KTS	TAS MPH	FUEL FLOW GPH
8000	-1°C (31°F)	68	111	128	6.0
9000	-3°C (27°F)	67	110	127	5.8
20°C ABOVE STANDARD TEMPERATURE					
PRESSURE ALTITUDE FEET	TEMP	% BHP	TAS KTS	TAS MPH	FUEL FLOW GPH
8000	19°C (67°F)	65	109	126	5.7
9000	17°C (63°F)	63	108	125	5.6

Interpolating for 8500 feet for the appropriate route segment yields:

STANDARD TEMPERATURE					
PRESSURE ALTITUDE FEET	TEMP	% BHP	TAS KTS	TAS MPH	FUEL FLOW GPH
8500	-2°C (28°F)	68	111	128	5.9

20°C ABOVE STANDARD TEMPERATURE					
PRESSURE ALTITUDE FEET	% TEMP	% BHP	TAS KTS	TAS MPH	FUEL FLOW GPH
8500	18°C (64°F)	64	109	126	5.7

Interpolating for the temperature of the appropriate route segment yields:

Route Segment	TEMP	% BHP	TAS KTS	TAS MPH	Fuel Flow GPH
OFK – LBF	0°C (32°F)	68	111	128	5.9

NOTE

The above are values for the assumed conditions.

Time and fuel used were calculated as follows:

$$\text{Time} = \frac{\text{Distance}}{\text{Ground Speed}}$$

Fuel Used = (Time) (Fuel Flow)

Route Segment	Distance N.M.	Est. Ground Speed KTS	Est. Ground Speed MPH	Time at Cruise Altitude HRS:MIN	Fuel Used For Cruise GAL
OFK – OBH	32*	130	150	:15	1.5
OBH – LBF	111	140	161	:48	4.7

*Distance required to climb has been subtracted from segment distance.

Time — Fuel — Distance

Item	Time HRS:MIN	Fuel GAL	Distance N.M.
Start, Runup, Taxi and Take-off	0:00	.7	0
Acceleration Climb	:17	2.5	23
Cruise	1:03	6.1	143
Total	1:20	8.9	166

Total flight time: 1 hour, 20 minutes

Block speed: 166 NM ÷ 1 hour, 20 minutes = 125 knots
The estimated weight is determined by subtracting the fuel required for the trip from the initial takeoff weight:

Initial takeoff weight = 1540 Lbs.
Estimated fuel used from OFK to LBF = 8.9 gal. (53 Lbs.)
Estimated landing weight = 1540 – 53 = 1487 Lbs.

LANDING

The landing distance required is determined in a similar manner to the procedure used in determining takeoff distance. Using 1500 lbs., 4000 ft. and 10°C, the distance can be found from Figure 5-19.

Ground roll . . . . 448 Feet
Total distance to clear a 50-foot obstacle . . . . 1185 Feet

A correction for the affect of wind may be made based on Note 1 of the landing chart. Using Figure 5-4, headwind component is determined to be 19.5 Knots. The distance correction for 19.5 Knots headwind is:

$$\frac{19.5 \text{ Knots}}{5 \text{ Knots}} \times 3\% = 12\% \text{ Decrease}$$

The results is the following distances, corrected for wind:

Ground roll, zero wind (feet)	448
Decrease in ground roll (448 x 12%)	-54
Corrected ground roll	394
Total landing distance to clear a 50-foot obstacle, zero wind	1185
Decrease in total distance (1185 x 12%)	-142
Corrected total distance to clear a 50-foot obstacle	1043

This distance is well within the landing distance available of 4400 feet.

NOISE LEVEL

FAR 36, Appendix F noise level has been demonstrated and found to be 68.8 dbA.

AIRSPEED CALIBRATION

NOTES:

(1) Indicated Airspeed assumes zero instrument error.
(2) Corrections are not affected by flap position.

KNOTS	
IAS	CAS
50	50
60	60
70	70
80	80
90	90
100	100
110	110
120	119
130	129
140	139
150	149

MILES PER HOUR	
IAS	CAS
60	60
70	70
80	80
90	90
100	100
110	110
120	120
130	130
140	139
150	149
160	159
170	169

Figure 5-1. Airspeed Calibration

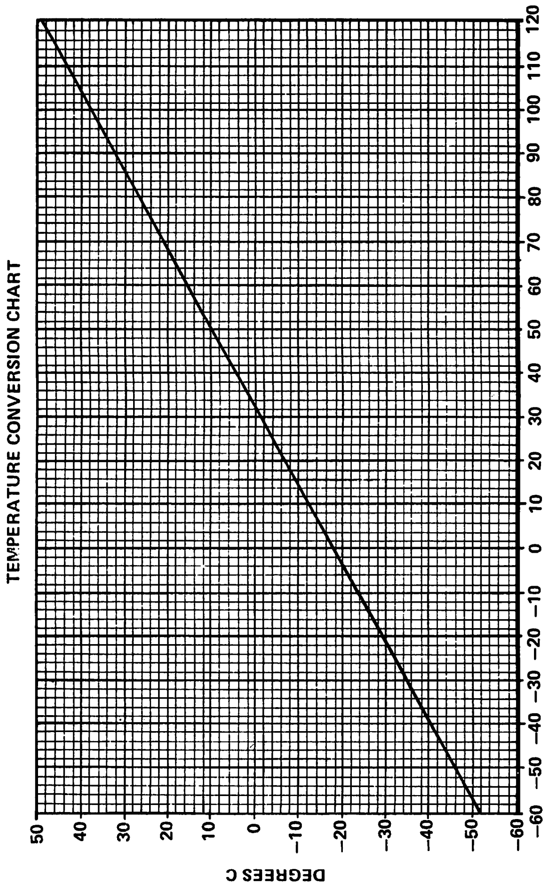


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS – POWER IDLE

EXAMPLE:

WEIGHT	1400 LBS
FLAPS	0°
ANGLE OF BANK	30°
STALL SPEED	59 KTS (68 MPH)

NOTES:

1. MAXIMUM ALTITUDE LOSS IN A NORMAL STALL RECOVERY IS APPROXIMATELY 200 FEET.
2. STALL SPEEDS APPLY FOR BOTH CALIBRATED AND INDICATED AIRSPEEDS.

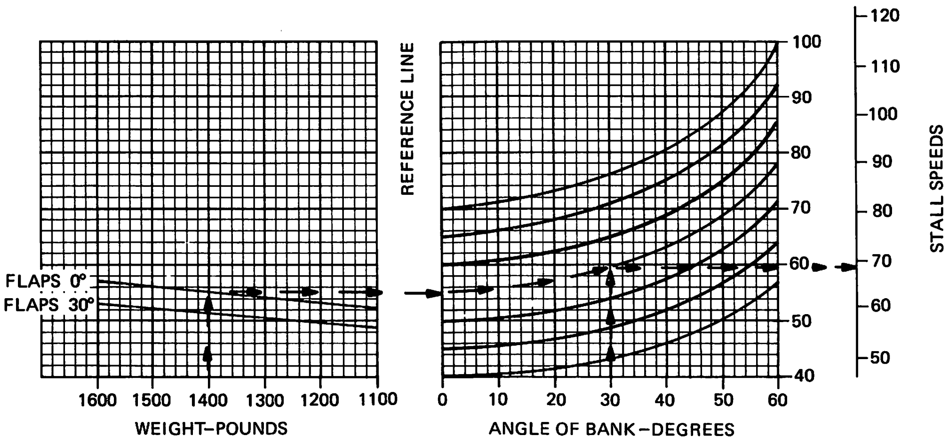


Figure 5-3. Stall Speeds

CROSSWIND COMPONENT CHART

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

NOTE
Demonstrated crosswind component is 16 knots.

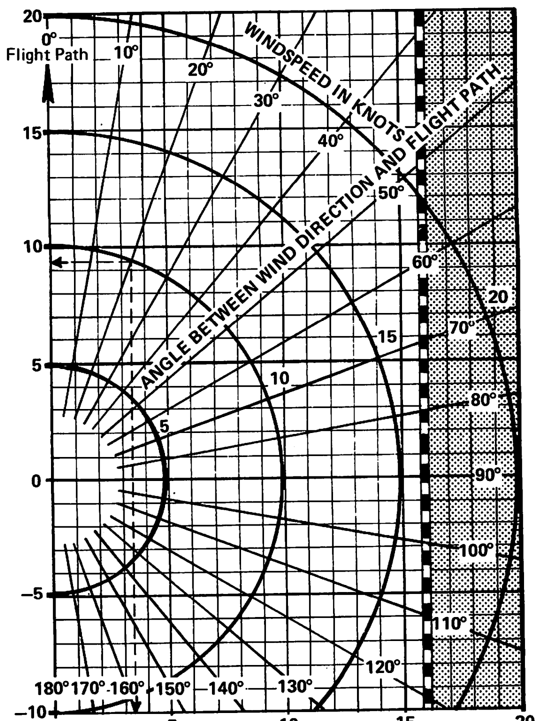


Figure 5-4. Crosswind Component Chart

TAKEOFF DISTANCE, CRUISE PROPELLER

ASSOCIATED CONDITIONS:

Power — Maximum
Flaps — Up
Runway — Hard surface (level & dry)
Fuel Mixture — Full throttle climb, mixture leaned above 5000 feet to smooth engine operation

NOTES:

1. Decrease distance 5% for each 5 knots headwind. For operation with tailwinds up to 10 knots increase distance by 10% for each 2.5 knots.
2. Where distance value is shaded, climb performance after lift-off, based on the engine operating at takeoff power at takeoff speed, is less than 150 feet per minute.
3. If takeoff power is set without brakes applied, then distances apply from point where full power is attained.

WEIGHT LBS	TAKEOFF SPEED KIAS (MPH)		PRESS. ALT. FT.	0°C (32°F)		10°C (50°F)		20°C (68°F)		30°C (86°F)		40°C (104°F)	
	LIFT OFF	CLEAR 50 FT.		GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.
1600	58 (67)	66 (76)	S.L.	762	1365	846	1513	963	1670	1031	1838	1133	2017
			2000	908	1615	1007	1789	1114	1976	1228	2175	1349	2386
			4000	1083	1915	1202	2122	1330	2344	1466	2579	1610	2830
			6000	1296	2277	1439	2523	1591	2786	1754	3067	1927	3365
			8000	1555	2714	1726	3008	1909	3321	2104	3655	2312	4011
1500	57 (66)	64 (74)	S.L.	653	1176	725	1303	801	1439	883	1583	970	1737
			2000	777	1391	863	1541	954	1702	1052	1873	1155	2055
			4000	928	1650	1030	1828	1139	2019	1255	2221	1379	2437
			6000	1110	1961	1232	2173	1363	2400	1502	2641	1650	2898
			8000	1332	2338	1479	2590	1635	2860	1802	3148	1980	3454
1400	56 (64)	62 (71)	S.L.	553	1003	614	1111	679	1227	748	1350	822	1481
			2000	659	1186	731	1314	809	1451	891	1597	979	1752
			4000	786	1406	873	1558	965	1721	1064	1894	1169	2078
			6000	841	1672	1044	1853	1155	2046	1273	2252	1398	2470
			8000	1129	1993	1253	2208	1386	2438	1527	2684	1678	2944

Figure 5-5. Takeoff Distance, Cruise Propeller

TAKEOFF DISTANCE, CLIMB PROPELLER

ASSOCIATED CONDITIONS:

Power — Maximum
Flaps — Up
Runway — Hard surface (level & dry)
Fuel Mixture — Full throttle climb, mixture leaned above 5000 feet to smooth engine operation

NOTES:

1. Decrease distance 5% for each 5 knots headwind. For operation with tailwinds up to 10 knots increase distance by 10% for each 2.5 knots.
2. Where distance value is shaded, climb performance after lift-off, based on the engine operating at takeoff power at takeoff speed, is less than 150 feet per minute.
3. If takeoff power is set without brakes applied, then distances apply from point where full power is attained.

WEIGHT LBS	TAKEOFF SPEED KIAS (MPH)		PRESS. ALT. FT.	0°C (32°F)		10°C (50°F)		20°C (68°F)		30°C (86°F)		40°C (104°F)	
	LIFT OFF	CLEAR 50 FT.		GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.
1600	57 (66)	66 (76)	S.L.	719	1313	798	1455	883	1607	973	1769	1069	1940
			2000	857	1554	951	1722	1051	1901	1159	2092	1273	2295
			4000	1022	1842	1135	2042	1255	2254	1383	2481	1520	2772
			6000	1224	2190	1358	2427	1502	2680	1655	2949	1819	3236
			8000	1468	2610	1629	2892	1802	3194	1986	3515	2182	3856
1500	56 (64)	64 (74)	S.L.	616	1132	684	1254	756	1385	834	1524	916	1672
			2000	734	1339	814	1483	901	1638	993	1802	1090	1977
			4000	876	1587	972	1759	1075	1942	1185	2137	1302	2345
			6000	1048	1887	1163	2091	1286	2308	1418	2541	1558	2787
			8000	1257	2248	1395	2491	1543	2751	1701	3028	1869	3322
1400	55 (63)	62 (71)	S.L.	522	965	580	1069	641	1181	706	1299	776	1425
			2000	622	1141	690	1265	763	1397	841	1537	924	1686
			4000	742	1353	824	1500	911	1656	1004	1822	1103	1999
			6000	888	1609	986	1783	1090	1968	1201	2166	1320	2376
			8000	1065	1917	1183	2124	1308	2345	1441	2581	1584	2832

Figure 5-6. Takeoff Distance, Climb Propeller

RATE OF CLIMB-CRUISE PROPELLER

ASSOCIATED CONDITIONS:

Power — Maximum
Flaps — Up
Fuel Mixture — Full throttle climb, mixture leaned above 5000 feet to smooth engine operation.

WEIGHT LBS	PRESSURE ALTITUDE FT	CLIMB SPEED KIAS	RATE-OF-CLIMB – FT/MIN			
			−20°C (−4°F)	0°C (32°F)	20°C (68°F)	40°C (104°F)
1600	SL	78	958	798	668	560
	2000	77	818	669	547	448
	4000	76	677	539	427	336
	6000	75	537	409	307	223
	8000	74	397	279	186	111
	10000	73	256	150	—	—
1500	SL	77	1074	909	774	664
	2000	76	928	774	650	549
	4000	75	782	640	526	433
	6000	74	636	506	401	317
	8000	73	490	371	277	202
	10000	72	344	237	153	—
1400	SL	76	1205	1033	894	791
	2000	75	1053	893	765	661
	4000	74	900	753	636	542
	6000	73	748	613	507	422
	8000	72	596	474	378	303
	10000	71	443	334	249	183

Figure 5-7. Rate of Climb, Cruise Propeller

RATE OF CLIMB,CLIMB PROPELLER

ASSOCIATED CONDITIONS:

Power Maximum
Flaps Up
Fuel Mixture Full throttle climb, mixture leaned above 5000 feet to smooth engine operation.

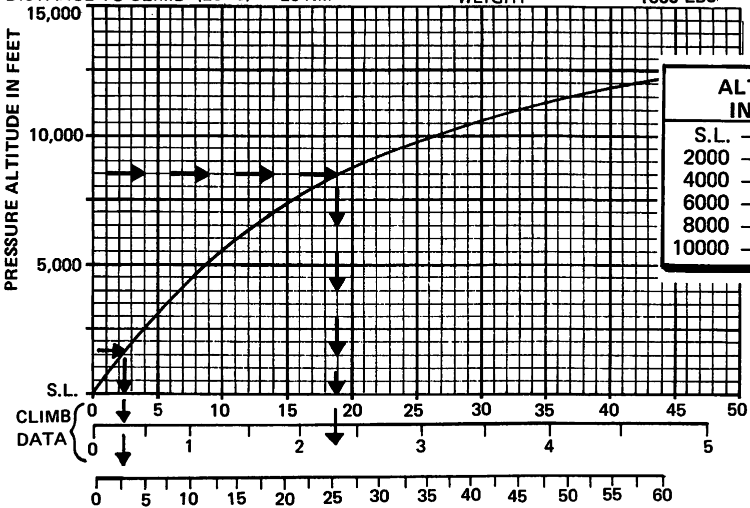
WEIGHT LBS	PRESSURE ALTITUDE FT	CLIMB SPEED KIAS	RATE-OF-CLIMB – FT/MIN			
			−20°C (−4°F)	0°C (32°F)	20°C (68°F)	40°C (104°F)
1600	SL	78	1016	848	713	599
	2000	77	870	714	587	482
	4000	76	724	579	461	365
	6000	75	578	444	335	247
	8000	74	432	310	209	129
	10000	73	286	175		
1500	SL	77	1138	967	822	706
	2000	76	986	824	692	585
	4000	75	833	682	562	464
	6000	74	680	539	432	343
	8000	73	527	397	302	222
	10000	72	374	254	171	101
1400	SL	76	1279	1094	945	826
	2000	75	1117	946	810	700
	4000	74	955	798	675	575
	6000	73	793	651	540	450
	8000	72	631	503	404	324
	10000	71	468	355	269	199

Figure 5-8. Rate of Climb, Climb Propeller

TIME FUEL AND DISTANCE TO CLIMB, CRUISE PROPELLER

EXAMPLE:
AIRPORT ALTITUDE — 1570 FT.
CRUISE ALTITUDE — 8500 FT.
TIME TO CLIMB (19–2.5) — 16.5 MIN.
FUEL TO CLIMB (2.35–.3) — 2.05 GAL.
DISTANCE TO CLIMB (26–3) — 23 NM

ASSOCIATED CONDITIONS:
POWER — FULL THROTTLE
MIXTURE — RECOMMENDED LEANING SCHEDULE
CLIMB SPEEDS — IAS AS SCHEDULED
TEMPERATURE — STANDARD DAY (ISA)
FUEL DENSITY — 6.0 LBS. PER U.S. GAL.
WEIGHT — 1600 LBS



ALTITUDE IN FEET	CLIMB SPEED KTS	CLIMB SPEED MPH
S.L. – 2000	77	88
2000 – 4000	76	87
4000 – 6000	75	86
6000 – 8000	74	85
8000 – 10000	73	84
10000 – 11500	72	83

NOTE: Add 5 pounds of fuel for start, taxi, and takeoff.

Figure 5-9. Time Fuel and Distance to Climb, Cruise Propeller

TIME FUEL AND DISTANCE TO CLIMB, CLIMB PROPELLER

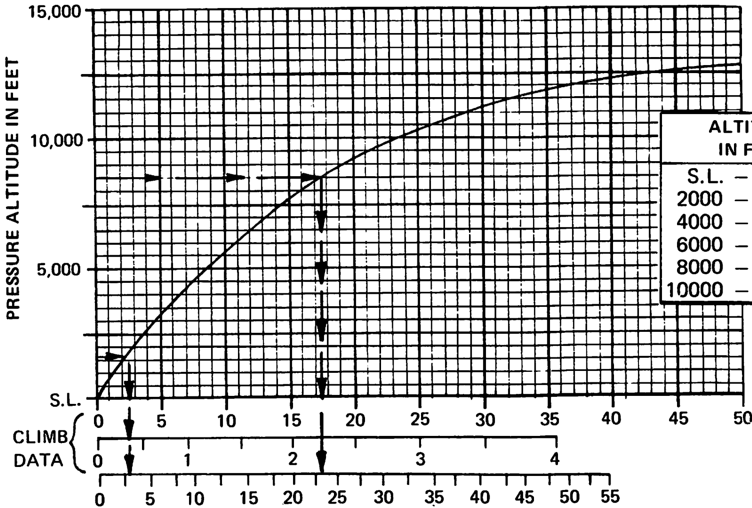
EXAMPLE:

AIRPORT ALTITUDE —— 1570 FT.
CRUISE ALTITUDE —— 8500 FT.
TIME TO CLIMB (17.5 – 2.2) —— 15.3 MIN.
FUEL TO CLIMB (2.25 – .30) —— 2 GAL.
DISTANCE TO CLIMB (23 – 2.7) - 20.3 NM

ASSOCIATED CONDITIONS:

POWER —— FULL THROTTLE
MIXTURE —— RECOMMENDED LEANING SCHEDULE
CLIMB SPEEDS —— IAS AS SCHEDULED
TEMPERATURE —— STANDARD DAY (ISA)
FUEL DENSITY —— 6.0 LBS. PER U.S. GAL.
WEIGHT —— 1600 LBS.

NOTE: Add 5 pounds of fuel for start, taxi, and takeoff.



ALTITUDE IN FEET	CLIMB SPEED KTS	CLIMB SPEED MPH
S.L. – 2000	77	88
2000 – 4000	76	87
4000 – 6000	75	86
6000 – 8000	74	85
8000 – 10000	73	84
10000 – 11900	72	82

Figure 5-10. Time Fuel and Distance to Climb, Climb Propeller

CRUISE PERFORMANCE, CRUISE PROPELLER

CONDITIONS:

Recommended lean mixture, weight 1600 pounds.

RPM	20°C BELOW STD. TEMP % BHP	TAS KTS	TAS MPH	FUEL GPH	STANDARD TEMP % BHP	TAS KTS	TAS MPH	FUEL GPH	20°C ABOVE STD. TEMP % BHP	TAS KTS	TAS MPH	FUEL GPH
PRESSURE ALTITUDE 2000 FEET												
	−9°C (16°F)				11°C (52°F)				31°C (88°F)			
2700	95	121	140	8.5	88	120	138	7.8	83	119	137	7.2
2600	85	116	133	7.4	79	115	132	6.9	75	114	131	6.5
2500	76	110	127	6.6	71	109	125	6.2	68	108	124	5.9
2400	68	105	120	5.9	64	103	119	5.7	61	102	117	5.4
2300	61	99	114	5.4	58	97	112	5.2	55	95	109	5.0
2200	54	92	106	5.0	52	90	103	4.8	50	88	101	4.6
PRESSURE ALTITUDE 3000 FEET												
	−11°C (12°F)				9°C (48°F)				29°C (84°F)			
2700	92	121	139	8.2	86	120	138	7.5	81	119	137	7.0
2600	82	115	133	7.2	77	114	131	6.7	73	113	130	6.3
2500	74	110	126	6.4	70	109	125	6.1	66	107	123	5.8
2400	67	104	120	5.8	63	103	118	5.6	59	101	116	5.3
2300	60	98	113	5.3	56	96	110	5.1	54	94	108	4.9
2200	53	92	105	4.9	51	89	102	4.7	49	87	100	4.6
PRESSURE ALTITUDE 4000 FEET												
	−13°C (9°F)				7°C (45°F)				27°C (81°F)			
2700	90	121	139	7.9	83	119	137	7.3	79	118	136	6.8
2600	80	115	132	7.0	75	114	131	6.5	72	113	130	6.2
2500	72	109	126	6.3	68	108	125	6.0	64	106	122	5.7
2400	65	104	119	5.7	61	102	117	5.4	58	100	115	5.2
2300	58	97	112	5.2	55	95	110	5.0	53	93	107	4.9
2200	52	91	104	4.8	50	88	101	4.7	48	85	98	4.6

Figure 5-11. Cruise Performance, Cruise Propeller (Sheet 1 of 3)

CRUISE PERFORMANCE, CRUISE PROPELLER

CONDITIONS:
Recommended lean mixture weight 1600 pounds.

RPM	20°C BELOW STD. TEMP				STANDARD TEMP				20°C ABOVE STD. TEMP			
	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH
PRESSURE ALTITUDE 5000 FEET												
	–15°C (5°F)				5°C (41°F)				25°C (77°F)			
2700	87	120	138	7.6	81	119	137	7.1	77	118	135	6.6
2600	78	115	132	6.8	74	113	130	6.4	69	112	129	6.0
2500	71	109	125	6.1	66	107	124	5.8	63	106	122	5.6
2400	63	103	118	5.6	60	101	116	5.4	57	99	114	5.1
2300	57	96	110	5.1	54	94	108	5.0	52	92	105	4.8
2200	51	89	103	4.7	49	87	100	4.6	48	83	95	4.5
PRESSURE ALTITUDE 6000 FEET												
	–17°C (2°F)				3°C (38°F)				23°C (74°F)			
2700	85	120	138	7.4	79	118	136	6.9	75	117	135	6.5
2600	76	114	131	6.6	72	113	130	6.2	68	111	128	5.9
2500	69	108	125	6.0	65	107	123	5.7	61	104	120	5.5
2400	62	102	118	5.5	59	100	115	5.2	56	97	112	5.1
2300	56	96	110	5.1	53	93	107	4.9	51	91	104	4.7
2200	50	88	102	4.7	49	86	98	4.6	47	80	93	4.5
PRESSURE ALTITUDE 7000 FEET												
	–19°C (–2°F)				1°C (34°F)				21°C (70° F)			
2700	82	119	137	7.2	77	118	136	6.7	73	117	134	6.3
2600	75	113	131	6.4	70	112	129	6.1	66	110	127	5.8
2500	67	108	124	5.9	63	106	122	5.6	60	104	119	5.4
2400	61	101	117	5.4	57	99	114	5.2	55	96	111	5.0
2300	55	95	109	5.0	52	92	106	4.8	50	89	102	4.7
2200	49	88	101	4.6	48	83	96	4.5	46	75	87	4.5

Figure 5-11. Cruise Performance, Cruise Propeller (Sheet 2 of 3)

CRUISE PERFORMANCE, CRUISE PROPELLER

CONDITIONS:
Recommended lean mixture, weight 1600 pounds.

NOTE:
Shaded area represents operation with full throttle.

RPM	20°C BELOW STD. TEMP				STANDARD TEMP				20°C ABOVE STD. TEMP			
	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH
PRESSURE ALTITUDE 8000 FEET												
	21°C (−6°F)				−1°C (31°F)				19°C (67°F)			
2700	79	118	136	6.9	75	117	135	6.5	71	116	133	6.2
2600	73	113	130	6.3	68	111	128	6.0	65	109	126	5.7
2500	66	107	123	5.8	62	105	121	5.5	59	102	118	5.3
2400	59	100	116	5.3	56	98	112	5.1	54	95	110	4.9
2300	54	93	107	4.9	51	91	105	4.8	50	86	99	4.6
2200	49	87	100	4.6	—	—	—	—	—	—	—	—
PRESSURE ALTITUDE 9000 FEET												
	−23°C (−9°F)				−3°C (27°F)				17°C (63°F)			
2700	75	116	133	6.5	72	116	133	6.3	69	115	132	6.0
2600	71	113	130	6.2	67	110	127	5.8	63	108	125	5.6
2500	64	106	122	5.6	61	104	120	5.4	58	101	116	5.2
2400	58	100	115	5.2	55	97	111	5.0	53	94	108	4.9
2300	53	92	106	4.8	51	89	103	4.7	49	84	96	4.6
2200	48	84	97	4.5	—	—	—	—	—	—	—	—
PRESSURE ALTITUDE 10,000 FEET												
	−25° (−13°F)				−5°C (23°F)				15°C (59°F)			
2700	70	113	130	6.1	68	113	130	6.0	67	113	130	5.8
2600	69	112	129	6.0	65	110	126	5.7	62	107	123	5.5
2500	62	105	121	5.6	59	103	118	5.3	57	100	115	5.1
2400	57	98	113	5.1	54	96	110	5.0	52	92	105	4.8
2300	52	91	105	4.8	50	87	100	4.7	—	—	—	—

Figure 5-11. Cruise Performance, Cruise Propeller (Sheet 3 of 3)

CRUISE PERFORMANCE, CLIMB PROPELLER

CONDITIONS:

Recommended lean mixture, weight 1600 pounds.

RPM	20°C BELOW STD. TEMP				STANDARD TEMP				20°C ABOVE STD. TEMP			
	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH
PRESSURE ALTITUDE 2000 FEET												
	−9°C (16°F)				11°C (52°F)				31°C (88°F)			
2700	84	114	131	7.3	79	113	130	6.8	75	112	129	6.5
2600	76	109	125	6.6	72	108	124	6.2	68	107	123	5.9
2500	69	103	119	6.0	65	102	118	5.7	62	101	116	5.5
2400	62	98	113	5.5	59	96	111	5.3	56	95	109	5.1
2300	56	92	106	5.1	53	91	105	4.9	51	89	102	4.7
2200	51	86	99	4.7	48	84	97	4.6	47	81	94	4.5
PRESSURE ALTITUDE 3000 FEET												
	−11°C (12°F)				9°C (48°F)				29°C (84°F)			
2700	82	113	131	7.1	77	112	129	6.7	73	111	128	6.4
2600	74	108	125	6.4	70	107	123	6.1	67	106	122	5.8
2500	67	103	118	5.9	64	101	117	5.6	61	100	115	5.4
2400	61	97	112	5.4	58	96	110	5.2	55	94	108	5.0
2300	55	92	105	5.0	52	90	103	4.8	50	88	101	4.7
2200	50	85	98	4.6	48	83	96	4.5	47	79	91	4.5
PRESSURE ALTITUDE 4000 FEET												
	−13°C (9°F)				7°C (45°F)				27°C (81°F)			
2700	80	113	130	6.9	76	112	129	6.5	72	111	128	6.2
2600	73	108	124	6.3	69	107	123	6.0	65	105	121	5.7
2500	66	103	118	5.8	62	101	116	5.5	60	99	114	5.3
2400	60	97	111	5.3	57	95	109	5.1	54	93	107	5.0
2300	54	91	105	5.0	52	89	102	4.8	50	87	100	4.7
2200	49	84	97	4.6	47	82	94	4.5	46	76	87	4.4

Figure 5-12. Cruise Performance, Climb Propeller (Sheet 1 of 3)

CRUISE PERFORMANCE, CLIMB PROPELLER

CONDITIONS:

Recommended lean mixture, weight 1600 pounds.

RPM	20°C BELOW STD. TEMP				STANDARD TEMP				20°C ABOVE STD. TEMP			
	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH
	PRESSURE ALTITUDE 5000 FEET											
	–15°C (5°F)				5°C (41°F)				25°C (77°F)			
2700	78	113	129	6.8	74	112	128	6.4	70	110	127	6.1
2600	71	107	124	6.2	67	106	122	5.9	64	104	120	5.6
2500	64	102	117	5.7	61	100	115	5.4	58	99	114	5.2
2400	58	96	111	5.2	56	95	109	5.1	53	92	106	4.9
2300	53	90	104	4.9	51	88	101	4.7	49	85	98	4.6
2200	48	84	96	4.6	47	80	92	4.5	—	—	—	—
	PRESSURE ALTITUDE 6000 FEET											
	–17°C (2°F)				3°C (38°F)				23°C (74°F)			
2700	77	112	129	6.6	72	111	128	6.3	68	109	126	6.0
2600	69	107	123	6.0	66	105	121	5.8	63	104	120	5.6
2500	63	101	116	5.6	60	100	115	5.4	57	98	112	5.2
2400	57	95	110	5.2	55	93	108	5.0	53	91	105	4.8
2300	52	89	103	4.8	50	87	100	4.7	49	83	95	4.6
2200	48	83	95	4.5	46	76	88	4.4	—	—	—	—
	PRESSURE ALTITUDE 7000 FEET											
	–19°C (–2°F)				1°C (34°F)				21°C (70°F)			
2700	75	112	129	6.5	70	110	127	6.1	67	109	125	5.9
2600	68	106	122	5.9	64	105	120	5.7	61	103	119	5.5
2500	62	100	116	5.5	59	99	114	5.3	56	97	111	5.1
2400	56	95	109	5.1	54	93	106	4.9	52	90	103	4.8
2300	51	88	102	4.7	49	85	98	4.6	48	79	91	4.6

Figure 5-12. Cruise Performance, Climb Propeller (Sheet 2 of 3)

CRUISE PERFORMANCE, CLIMB PROPELLER

CONDITIONS:
Recommended lean mixture, weight 1600 pounds.

NOTE:
Shaded area represents operation with full throttle.

	PRESSURE ALTITUDE 8000 FEET											
RPM	20°C BELOW STD. TEMP				STANDARD TEMP				20°C ABOVE STD. TEMP			
	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH	% BHP	TAS KTS	TAS MPH	FUEL GPH
	21°C (–6°F)				–1°C (31°F)				19°C (67°F)			
2700	73	111	128	6.3	69	110	126	6.0	66	108	124	5.8
2600	66	106	121	5.8	63	104	120	5.6	60	102	118	5.4
2500	61	100	115	5.4	58	98	113	5.2	55	95	110	5.0
2400	55	94	108	5.0	53	91	105	4.9	51	88	101	4.7
2300	50	87	101	4.7	49	83	96	4.6	—	—	—	—
	PRESSURE ALTITUDE 9000 FEET											
	–23°C (–9°F)				–3°C (27°F)				17°C (63°F)			
2700	71	111	127	6.2	67	109	125	5.9	64	107	123	5.7
2600	65	105	121	5.7	62	103	119	5.5	59	101	116	5.3
2500	59	99	114	5.3	56	97	112	5.1	55	95	109	5.0
2400	54	93	107	5.0	52	90	104	4.8	51	86	99	4.7
2300	50	86	99	4.6	—	—	—	—	—	—	—	—
	PRESSURE ALTITUDE 10,000 FEET											
	–25° (–13°F)				–5°C (23°F)				15°C (59°F)			
2700	69	110	126	6.0	66	108	125	5.8	63	107	123	5.6
2600	64	104	120	5.6	60	103	118	5.4	58	100	115	5.2
2500	58	99	114	5.2	55	96	110	5.0	54	93	107	4.9
2400	53	92	106	4.9	51	89	102	4.8	50	73	83	4.7
	PRESSURE ALTITUDE 11,000 FEET											
	–27°C (–16°F)				–7°C (20°F)				13°C (45°F)			
2700	68	109	125	5.9	65	108	124	5.7	62	105	121	5.5
2600	62	103	119	5.5	59	101	117	5.3	57	99	114	5.1
2500	57	97	112	5.1	55	95	109	5.0	53	91	104	4.9
2400	52	91	105	4.8	51	86	99	4.7	—	—	—	—

Figure 5-12. Cruise Performance, Climb Propeller (Sheet 3 of 3)

CRUISE SPEEDS - CRUISE PROPELLER

EXAMPLE:

PRESSURE ALTITUDE——8500 FT
POWER SETTING——68% MCP
TRUE AIRSPEED——111 KNOTS (128 MPH)

ASSOCIATED CONDITIONS:

CRUISE WEIGHT——1600 LBS
TEMPERATURE——STANDARD DAY (ISA)

NOTE: Cruise speeds are shown for airplane with wheel fairings. Wheel fairings increase speed approximately 1.7 KTS (2 MPH).

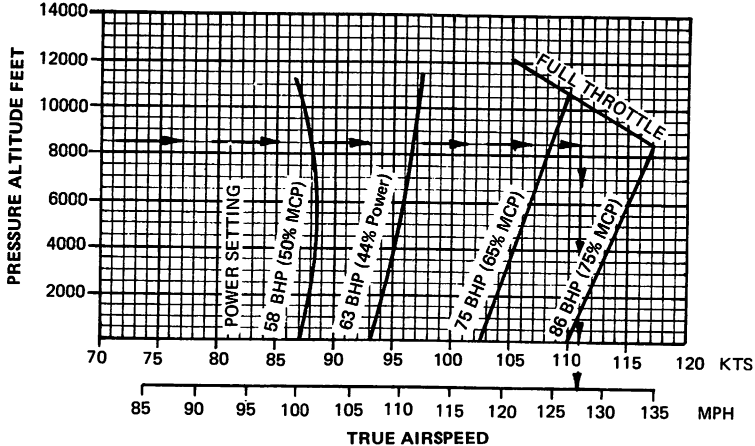


Figure 5-13. Cruise Speeds, Cruise Propeller

CRUISE SPEEDS - (CLIMB PROPELLER)

EXAMPLE:

PRESSURE ALTITUDE——8500 FT
POWER SETTING——62% MCP
TRUE AIRSPEED——103.5 KNOTS (119 MPH)

ASSOCIATED CONDITIONS:

CRUISE WEIGHT—— 1600 LBS
TEMPERATURE——STANDARD DAY (ISA)

NOTE: Cruise speeds are shown for airplane with wheel fairings. Wheel fairings increase speed approximately 1.7 KTS (2 MPH).

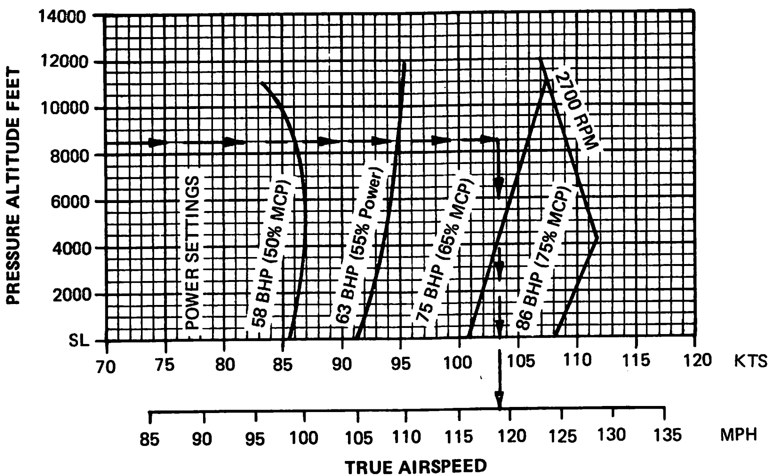


Figure 5-14. Cruise Speeds, Climb Propeller

RANGE PROFILE – CRUISE PROPELLER

EXAMPLE:

PRESSURE ALT——8500 FT
POWER SETTING——68%
RANGE—————308 NM

ASSOCIATED CONDITIONS:

WEIGHT ——————1600 LBS BEFORE ENG START
FUEL ——————AVIATION GASOLINE
FUEL DENSITY ————6.0 LBS PER U.S. GAL.
INITIAL FUEL LOADING—22 U.S. GAL.
MIXTURE ——————RECOMMENDED LEANING SCHEDULE

NOTES: 1) Range includes start, taxi, and climb with 45 minutes reserve at 50% MCP.
2) Cruise speeds are shown for airplane with wheel fairings. Wheel fairings increase speeds approximately 1.7 KTS (2 MPH).

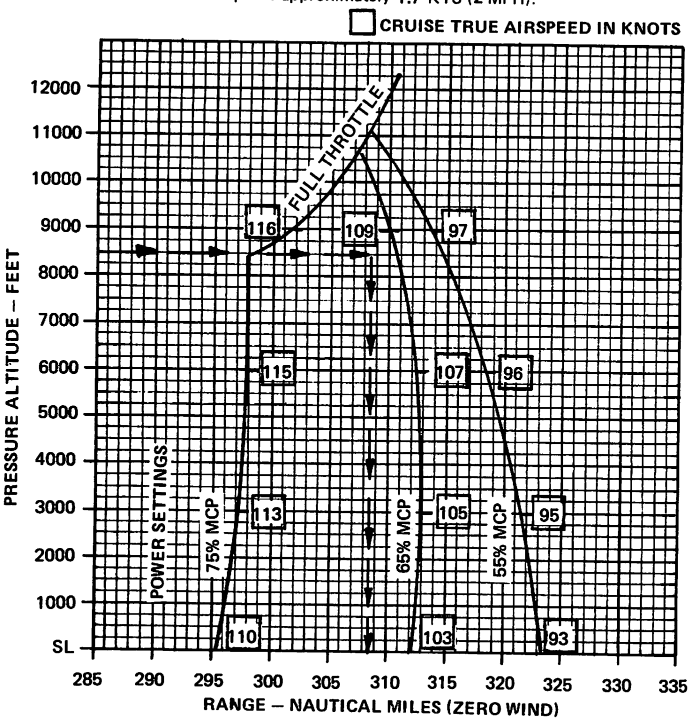


Figure 5-15. Range Profile, Cruise Propeller

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RANGE PROFILE – CLIMB PROPELLER

EXAMPLE:

PRESSURE ALT——8500 FT
POWER SETTING—— 62%
RANGE——————306 NM

ASSOCIATED CONDITIONS:

WEIGHT —————— 1600 LBS BEFORE ENG START
FUEL —————— AVIATION GASOLINE
FUEL DENSITY —————— 6.0 LBS PER U.S. GAL.
INITIAL FUEL LOADING— 22 U.S. GAL.
MIXTURE —————— RECOMMENDED LEANING SCHEDULE

NOTES:
1) Range includes start, taxi, and climb with 45 minutes reserve at 50% MCP
2) Cruise speeds are shown for airplane with wheel fairings. Wheel fairings increase speeds approximately 1.7 KTS (2 MPH).

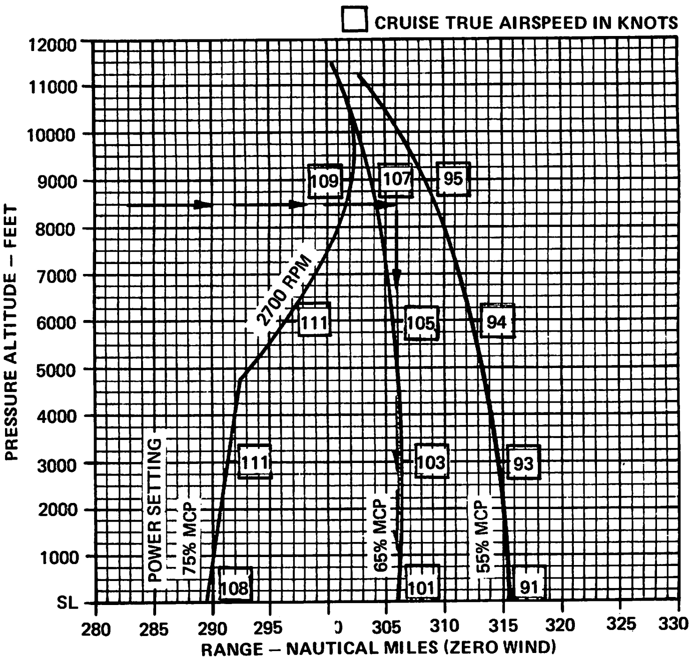


Figure 5-16. Range Profile, Climb Propeller

ENDURANCE PROFILE—CRUISE PROPELLER

EXAMPLE:		ASSOCIATED CONDITIONS:	
PRESSURE ALT.	8500 FT	WEIGHT	1600 LB. AT START
POWER SETTING	68% MCP	FUEL	AV. GAS
ENDURANCE	2 HR., 52 MIN.	FUEL DENSITY	6.0 LB/GAL.
		FUEL LOADING	22 U.S. GAL.
		MIXTURE	RECOMMENDED LEANING SCHEDULE

NOTES:

1. Endurance Includes start, taxi and climb with 45 minutes reserve at 50% MCP.
2. Cruise speeds are shown for airplane with wheel fairings which increase speeds by approximately 1.7 knots (2 MPH).

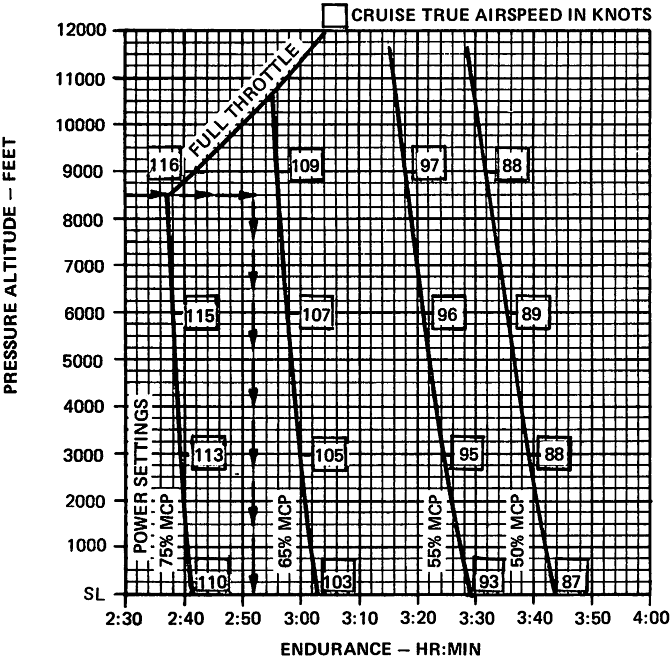


Figure 5-17. Endurance Profile — Cruise Propeller

ENDURANCE PROFILE — CLIMB PROPELLER

EXAMPLE:		ASSOCIATED CONDITIONS:	
PRESSURE ALT.	8500 FT	WEIGHT	1600 LB. AT START
POWER SETTING	62% MCP	FUEL	AV. GAS
ENDURANCE	3 HR., 1 MIN.	FUEL DENSITY	6.0 LB/GAL.
		FUEL LOADING	22 U.S. GAL.
		MIXTURE	RECOMMENDED LEANING SCHEDULE

NOTES:

1. Endurance Includes start, taxi and climb with 45 minutes reserve at 50% MCP.
2. Cruise speeds are shown for airplane with wheel fairings which increase speeds by approximately 1.7 knots (2 MPH).

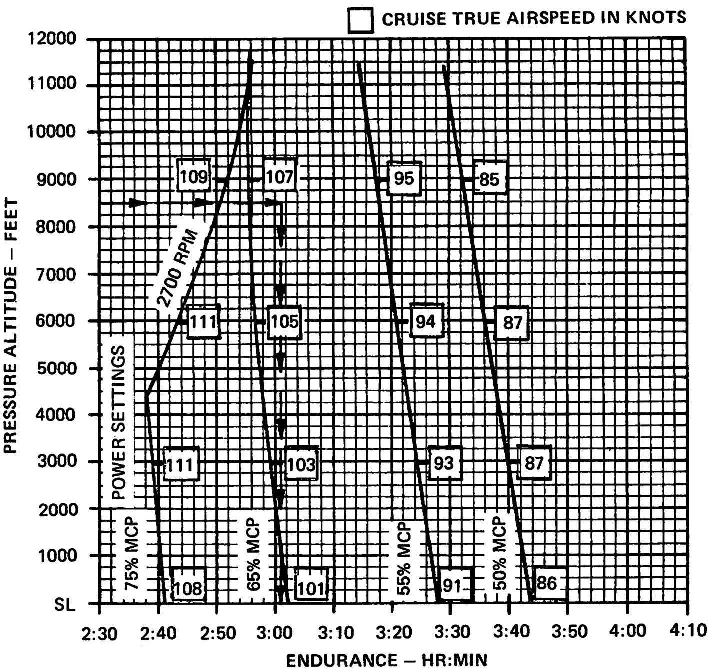


Figure 5-18. Endurance Profile — Climb Propeller

LANDING DISTANCE

ASSOCIATED CONDITIONS:
Power — Off
Flaps — Down
Runway — Hard surface (level & dry)
Braking — Maximum

NOTES:
1. Decrease distance 3% for each 5 knots headwind.

2. For operations with tailwinds up to 10 knots, increase distance by 8% for each 2.5 knots.

WEIGHT LBS	SPEED AT 50 FT.		PRESS. ALT. FT.	0°C (32°F)		10°C (50°F)		20°C (68°F)		30°C (86°F)		40°C (104°F)	
	KIAS	MPH		GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.	GROUND ROLL	CLEAR 50 FT.
1600	65	75	S.L.	408	1080	419	1110	431	1140	442	1171	454	1203
			2000	431	1142	444	1176	456	1209	469	1243	482	1278
			4000	458	1212	471	1249	485	1287	499	1324	513	1362
			6000	487	1291	502	1332	517	1373	533	1415	549	1457
			8000	520	1379	537	1424	554	1470	571	1516	588	1562
1500	64	74	S.L.	389	1028	399	1056	410	1084	421	1113	431	1142
			2000	410	1086	422	1117	434	1148	446	1180	458	1212
			4000	435	1151	448	1185	460	1220	474	1256	487	1291
			6000	462	1225	476	1263	491	1301	505	1340	520	1379
			8000	493	1307	508	1349	524	1391	540	1434	556	1477
1400	63	73	S.L.	369	975	379	1001	389	1027	398	1053	408	1081
			2000	389	1028	400	1057	411	1086	422	1116	433	1146
			4000	412	1089	424	1121	436	1153	448	1186	460	1219
			6000	437	1157	450	1193	464	1228	477	1264	491	1301
			8000	466	1234	480	1273	495	1312	510	1352	524	1392

Figure 5-19. Landing Distance

SECTION 6
WEIGHT & BALANCE/
EQUIPMENT LIST

TABLE OF CONTENTS

INTRODUCTION

This section contains the procedure for determining the basic empty weight and moment of the AA-1C airplane. Sample forms and the corresponding procedure for their use are provided to enable a rapid calculation of the weight and moment for various operations. A list of most commonly installed equipment for the AA-1C airplane is also provided.

It should be remembered that specific information on weight, arm, moment and installed equipment for this airplane can only be found in the appropriate weight and balance records carried in the airplane.

AIRPLANE WEIGHING PROCEDURES

PREPARATION

(1) Inflate all tires to recommended operating pressure.
(2) Drain all fuel from the tanks and fuel system.
(3) Drain all oil from the oil system.
(4) Move sliding seats to center of travel position.
(5) Raise flaps to fully retracted position.
(6) Place all controls in neutral position.
(7) Ensure that all objects not a part of the airplane or its accessories are removed from the airplane.
(8) Slide canopy to provide a 6-inch opening between canopy and windshield.

LEVELING THE AIRPLANE

(1) Place scales under each wheel (minimum capacity 1500 pounds for nose wheel and 1000 pounds capacity for main wheels), with a 1-inch thick wooden block between each wheel and the scale.
(2) Place levels on canopy track as shown in Figure 6-1.
(3) Level airplane both laterally and longitudinally by deflating one or two tires until the bubbles in the levels center.

WEIGHING THE AIRPLANE

(1) Remove the levels, and close canopy.
(2) With airplane level and brakes released, record the weight shown on each scale as shown in Figure 6-2.
(3) Deduct tare (chocks, etc.), if any, from the scale readings and record the result in the weighing form.

MEASURING ARM

(1) Obtain measurement A (Figure 6-2) as follows:
   - A. Stretch a string laterally across the airplane from the axle center of one main landing gear to the axle center of the other.
   - B. Connect a plumb bob such that it hangs from the engine firewall to the floor.
   - C. Using a tape, measure the distance from the plumb bob to the string stretched between the main landing gear.

(1) Open the canopy approximately six inches;

(2) Level airplane longitudinally by placing a short spirit level on the right canopy rail forward of the pilot's seat, and deflating nose tire or main gear tires to center the bubble.

(3) Level the airplane laterally by placing a 4-foot level across the canopy rails at windshield and differentially deflating main gear tires to center the bubble. Close canopy.

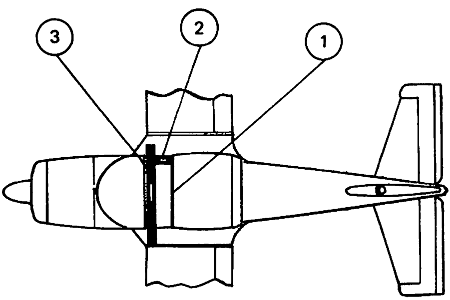
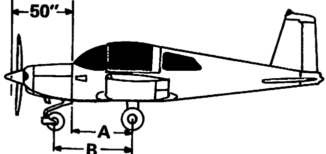


Figure 6-1. Airplane Leveling



Scale Position	Scale Reading	Tare	Symbol	Net Weight
Left Wheel			L	
Right Wheel			R	
Nose Wheel			N	
Total of Net Weights			W	

Calculate Arm (in inches) as follows:

NOTE

(50 + A) = NOSE LANDING GEAR ARM (IN INCHES)
50 – (B – A) = NOSE LANDING GEAR ARM (IN INCHES)
L = WEIGHT OF LEFT MAIN LANDING GEAR (IN POUNDS)
R = WEIGHT OF RIGHT MAIN LANDING GEAR (IN POUNDS)
N = WEIGHT OF NOSE LANDING GEAR (IN POUNDS)

$$\text{C.G. Arm} = \frac{[(50 + A)\ (L + R)] + [50 - (B - A)]\ N}{L + R + N}$$

Item	Weight	C.G. Arm	Moment/ 1000 Lbs. In.
Airplane Net Weight (W)			
Oil, 6 Qt. at 1.875 Lb./Qt.	11.0	39.0	.429
Unusable Fuel 2.0 Gal. at 6 Lb./Gal.	12.0	84.5	1.014
Equipment Changes			
Airplane Basic Empty Weight			

Figure 6-2. Sample Airplane Weighing

D. Record measurement A in the weighing form (Figure 6-2).

(2) Obtain Measurement B (Figure 6-2) as follows:

A. Ensure that the nose wheel is set straight along the centerline of the airplane.

B. Using a tape, measure from the center of the nose gear axle to the string stretched between the main landing gear wheels.

C. Record measurement B in the Weighing Form (Figure 6-2).

COMPUTING CENTER OF GRAVITY

(1) Using the weights previously recorded, calculate the airplane net weight (W), per Figure 6-2.

(2) Using the weights and measurements previously recorded, calculate the C.G. Arm according to the formula in Figure 6-2.

(3) Enter the airplane net weight (W) and C.G. Arm obtained in Steps (1) and (2) in the Airplane Basic Empty Weight Form at the bottom of Figure 6-2.

(4) Obtain moment by multiplying weight times C.G. Arm and dividing by 1000. Enter moment in the appropriate column.

(5) Add the entries in the weight column to obtain the AIRPLANE BASIC EMPTY WEIGHT.

(6) Add the entries in the MOMENT/1000 Lbs. In. column to obtain the AIRPLANE BASIC EMPTY WEIGHT MOMENT.

WEIGHT AND BALANCE

The following information will enable you to fly your AA-1C within the prescribed weight and center of gravity limitations. To calculate the weight and balance for your AA-1C, use the Sample Problem (Figure 6-3), Loading Graph (Figure 6-4) and Center of Gravity Envelope (Figure 6-5) charts as follows:

Write down the "Licensed Empty Weight" and "Moment" on the Sample Loading Problem chart (Figure 6-3) under the column marked "your airplane" from the Weight and Balance Data sheet (and/or changes listed on FAA Form 337) included with your airplane papers. Also add all additional weights and their corresponding moments (obtained from the "loading graph") of items to be carried on the flight. Plot the total weight and moment on the "Center of Gravity Envelope" chart (Figure 6-5) and if the intersection point is within the envelope, the loading is acceptable.

SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE			YOUR AIRPLANE		
	WEIGHT (LBS.)	ARM (IN.)	MOMENT (LB.-IN. /1000)	WEIGHT (LBS.)	ARM (IN.)	MOMENT (LB.-IN. /1000)
1. Licensed Empty Weight (Typical)	1041	73.4	76.449	______	______	______
2. Oil (6 qts.) 1 qt. = 1.875 lbs.	11	39.0	.429	______	39.0	______
3. Fuel (in excess of unuseable)	132	84.5	11.154	______	84.5	______
4. Pilot and Co-Pilot	340	92.5	31.450	______	92.5	______
5. Baggage (Max. allowable 100 lbs.)	76	120.0	8.880	______	120.0	______
6. Total Airplane Weight (loaded)	1600	79.4	128.362	______	______	______

*Maximum allowable is 100 pounds if C.G. is within Center of Gravity Envelope.

Figure 6-3. Sample Loading Problem

1. Add weight of items to be carried to licensed empty weight.
2. Add moment/1000 of items to be carried to total moment/1000.
3. Use center of gravity envelope to determine loading acceptability.

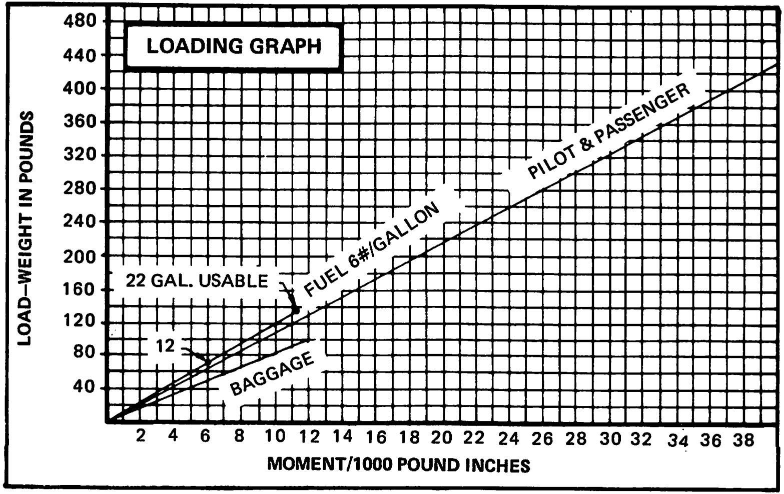


Figure 6-4. Loading Graph

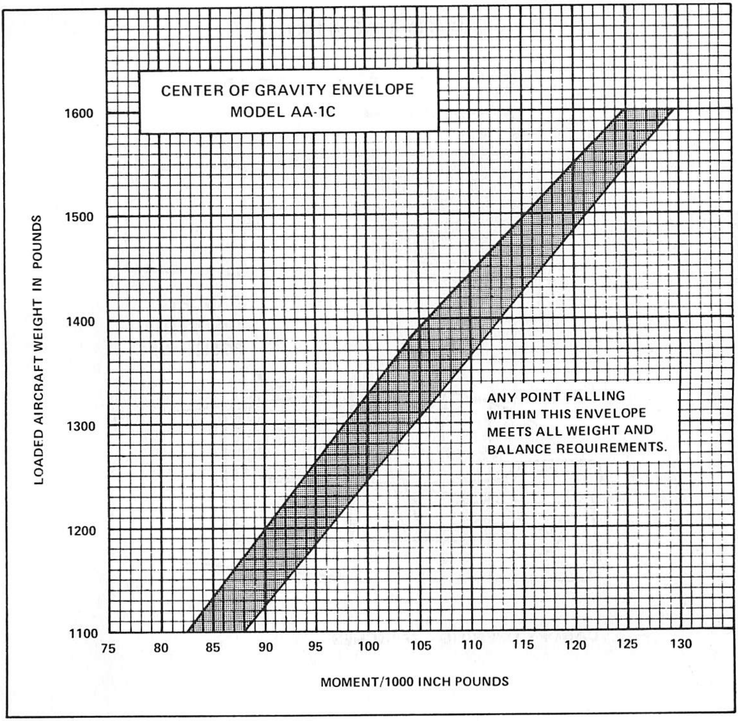


Figure 6-5. Center of Gravity Envelope

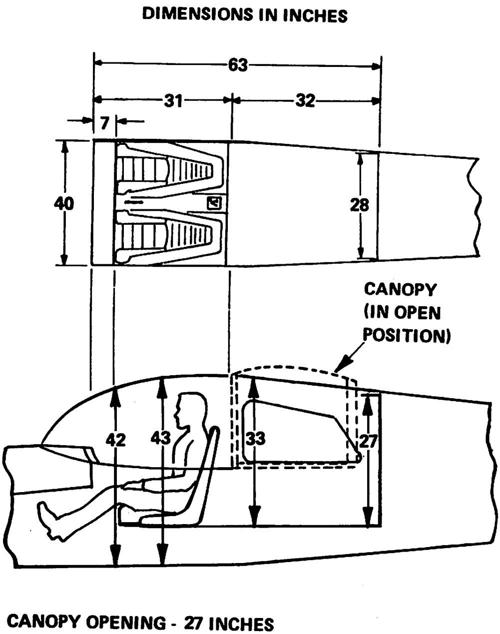


Figure 6-6. Internal Cabin Dimensions

EQUIPMENT LIST

The following equipment list contains equipment normally available for the AA-1C airplane. A separate equipment list of items installed in your specific airplane is provided in your airplane file. The following list and the specific list for your airplane have a similar order of listing.

NOTE

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

Refer to applicable FAR's for a listing of specific equipment required for each mode of airplane operation.

Columns showing **weight (in pounds)** and **arm (in inches)** provide the weight and center of gravity location for the equipment.

NOTE

Unless otherwise indicated, true values (not net change values) for the weight and arm are shown. Positive arms are distances aft of the airplane datum; negative arms are distances forward of the datum.

GRUMMAN AMERICAN AA-1C

EQUIPMENT LIST

STATUS OF EQUIPMENT: X = Installed in Airplane
O = Not Installed in Airplane

MODEL AA-1C SERIAL NO. REG. NO. DATE

STATUS	ITEM	WEIGHT	ARM
	STANDARD EQUIPMENT		
	Powerplant, Lycoming 0-235-L2C	247.30	34.70
	Alternator, 14V, 60A	---	---
	Mechanical Fuel Pump	---	---
	Quick Drain Oil Valve	---	---
	Engine Primer	---	---
	Muffler	13.32	33.45
	Oil Cooler	4.76	45.86
	Electric Fuel Pump	217	48.50
	Filter, Induction Air	.69	35.00
	Fuel Tank Quick Drains	.80	70.50
	Propeller, Sensenich 72CK-0-52 or -56	25.60	17.00
	Spinner	2.75	11.00
	Battery, 12V, 25 Ampere-hour	23.00	45.35
	Voltage Regulator, 12V	1.25	49.00
	Control Wheel, Pilot's	1.75	73.00
	Main Wheel, Tire & Brake Assembly (two 6.00 X 6, Type III, Cleveland)	31.90	89.30
	Nose Wheel, Tire & Tube (5.00 X 5, Cleveland)	8.70	36.40
	Nose Gear Shock Absorber Installation	---	---
	Wheel Hub Covers	.07	89.00
	Toe-Operated Brake	2.80	54.93
	Parking Brake	.74	65.75
	Electrical Flaps	17.18	104.09
	Audible Stall Warning	.61	62.10
	Aileron & Elevator Lock	.08	71.00
	Pitot System (Std.)	1.65	104.12
	Paint Scheme (Imron)	4.50	124.00
	Heat System, Carburetor	1.35	44.91
	Interior, Standard	26.66	94.34
	or Interior, Deluxe	29.91	94.34

STATUS	ITEM	WEIGHT	ARM
	STANDARD EQUIPMENT (Continued)		
	Cabin Heating System	2.95	52.89
	Cabin Air Ventilators	2.28	66.03
	Baggage Straps	.30	120.00
	Seats	24.00	93.50
	Shoulder Harness	2.26	121.72
	Airspeed Indicator		
	or True Airspeed Indicator	.50	68.50
	Altimeter (Std.)	1.12	68.00
	Instrument Cluster	.48	69.25
	Recording Tachometer	.75	67.50
	Fuse Holder & Spare Fuses	.01	69.00
	Magnetic Compass	.58	68.75
	Heated Pitot (Exchange)	.96	83.73
	Cabin Dome Light	.38	111.50
	Instrument Lights	.06	73.00
	Navigation Lights	.97	118.69
	OPTIONAL EQUIPMENT		
	Altimeter, Sensitive (Feet & MB)		
	or Altimeter, Sensitive (Feet & In/Hg)	.88	68.00
	Encoding Altimeter AR-800 Narco	1.08	66.98
	or 8040B-15K Aero Mach	.88	66.86
	or 5035PZ-P25 United Inst.	.88	66.86
	or 5035P-P22 United Inst.	.88	66.86
	Gyro System (With Vacuum System)	12.25	57.39
	Turn Coordinator – Indicator	2.40	66.56
	Auxiliary Power Receptacle	1.50	44.50
	Cigarette Lighter	.25	70.00

STATUS	ITEM	WEIGHT	ARM
	OPTIONAL EQUIPMENT (Continued)		
	Clock (Electric)	.33	70.00
	Corrosion Proofing	3.38	94.50
	Fire Extinguisher	4.60	106.97
	Hourmeter	.40	69.25
	Tinted Windows	– – –	– – –
	Tow Bar	2.00	134.00
	Indicator, Turn & Bank	1.94	68.00
	Indicator, Outside Air Temp.	.38	70.00
	Sunshade, Canopy	2.50	87.00
	Beacon, Omni Flash	1.05	207.60
	2-Light Strobe Installation	3.10	93.11
	Vacuum System, Engine Driven	6.75	50.99
	Wheel Fairings, Main Gear	14.76	88.53
	Wheel Fairing, Nose Gear	3.75	36.40
	Ballast	– – –	200.40
	Child's Seat Installation	7.61	129.24
	Cabin Speaker	1.50	105.50
	Vertical Speed Indicator	.50	68.25
	Dual Controls	7.50	60.81
	Landing Light	1.12	20.80
	VHF Antenna & Cable	.94	115.15
	VHF Antenna & Cable (2nd Set)	.47	142.00
	Omni Antenna & Cable	1.38	177.54
	Sidetone Intercom	.25	69.50
	Emergency Locator Beacon (CCC CIR-10)	2.50	208.41
	Narco		
	AT-50A Transponder	5.06	62.14
	Com 10/Nav 10 Com/Nav Transceiver	7.08	68.19

STATUS	ITEM	WEIGHT	ARM
	OPTIONAL EQUIPMENT (Continued)		
	Narco (Continued)		
	Com 11A/Nav 11 Com/Nav Transceiver	7.78	62.38
	Com 11A/Nav 12/UGR 2A Com/Nav Transceiver	9.88	60.38
	Com 11A/Nav 14 UGR 2A/DGO 10 Com/Nav Transceiver	14.58	59.14
	Com 111/Nav 111	7.78	62.38
	MBT-12 Marker Beacon (less light)	1.83	73.50
	Escort 110	6.37	61.61
	UGR-2A	3.81	186.35
	CP-125 Audio Panel	1.70	67.44
	ELT-10 Emergency Locator Beacon	3.62	209.40
	ELT-10C Emergency Locator Beacon	2.70	209.40
	ADF-140 ADF Receiver	9.36	90.72
	King		
	KX-170B/201C Nav/Com Transceiver	10.33	65.02
	KX-170B/214C Nav/Com Transceiver	10.53	65.07
	KX-175/KI-210C Nav/Com Transceiver	10.33	65.02
	KX-175/KI-211C Nav/Com Transceiver	10.53	65.07
	KT-78 Transponder	3.21	65.24
	KR-85/KI-225 ADF Receiver	7.89	83.65
	KMA-20 Marker Beacon Recorder	2.38	68.27
	KT-76 Transponder	3.21	65.24

SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

INTRODUCTION

This section describes the operation of the airplane and its various systems. Since some of the equipment described herein is optional it may not be installed on your particular airplane. Refer to Section 9, Supplements, for details of other optional equipment and systems.

AIRFRAME

The AA-1C is an all-metal, two-place, low-wing, single-engine airplane, equipped with tricycle landing gear, and designed for general utility uses.

The cabin portion of the fuselage is constructed of bonded metal honeycomb panels assembled to form a rigid structure. Flat bonded metal floor panels extend the length of the cabin area and baggage compartment. The aft fuselage is constructed of sheet aluminum panels bonded to form a semi-monocoque structure.

Passenger and crew entrance into the cabin area is provided by a sliding canopy, which may be closed and latched, or opened partially during flight. In addition to providing convenient access to the cabin, the canopy arrangement also provides excellent visibility for the pilot and passenger.

A tubular spar carry-through, located beneath the seats, provides the attachment points for the wings and main landing gear. This arrangement provides the AA-1C airplane with an extremely strong center section.

The full cantilever, modified laminar flow wings contain integral fuel tanks. They are constructed of stamped metal ribs adhesive bonded to the metal wing skin, and supported by a tubular spar extending the length of the wing. This type of structure provides an exceptionally strong wing with smooth, unmarred surface. Clean aerodynamic surfaces contribute significantly to the excellent performance of the AA-1C airplane. The integral fuel tanks are located in the wing tubular spars.

The AA-1C empennage consists of a conventional vertical stabilizer/rudder, and a horizontal stabilizer incorporating a conventional elevator with an anti-servo tab. Both horizontal and vertical stabilizers are of conventional rib-stiffened structure with the ribs bonded to a metal skin. The elevator provides a very responsive control with relatively light control pressures required.

FLIGHT CONTROLS

The control surfaces are operated by a combination of torque tubes and conventional cable systems. The elevator anti-servo trim tabs are located on the elevator trailing edges and are actuated manually by the trim wheel located on the center console. Ground adjustable tabs on the rudder and ailerons provide a simple method of adjusting directional and lateral trim.

FLAPS

Electrically operated flaps provide a full range of settings by means of a spring loaded, three position switch. The flap actuator switch is held down until the flap position indicator shows the desired flap angle; when released, it returns to neutral, and flap travel stops.

CAUTION

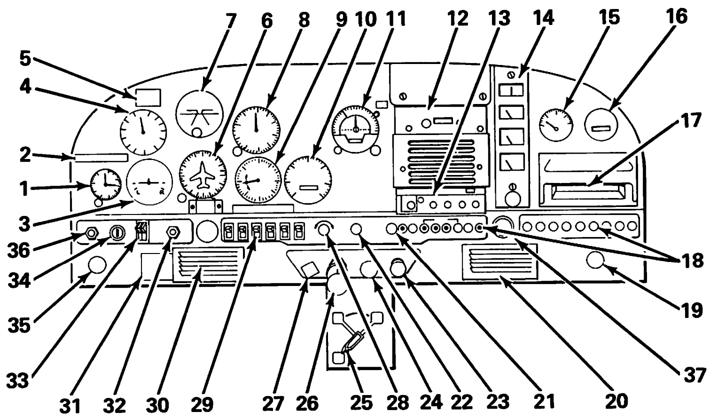
ABRUPTLY RELEASING THE SWITCH MAY CAUSE IT TO SNAP THROUGH THE NEUTRAL DETENT, INTO THE RETRACT POSITION.

INSTRUMENT PANEL

The instrument panel (Figure 7-1) employs a unique "eyebrow" design which shields the windshield from panel reflections during night flights. The eyebrow also houses the instrument panel lights which are controlled by a switch rheostat (OFF and INTENSITY) located just above the throttle. Other panel switches are the rocker type.

CONSOLE

The center console serves as a front seat divider and provides a storage clip for the microphone. It also houses the microphone jack, the flap switch, flap position indicator, trim wheel, trim position indicator, ash tray, and fuel selector valve.



1. Clock
2. Placard
3. Turn & Bank Indicator
4. Airspeed Indicator
5. Aircraft Registration Number
6. Directional Gyro
7. Horizon Gyro
8. Altimeter
9. Vertical Speed Indicator
10. Tachometer
11. Omni Head
12. Radios
13. Transponder
14. Instrument Cluster
15. Suction Gauge
16. Hourmeter
17. Map Compartment
18. Fuses & Circuit Breakers
19. Vent Control (RH)
20. Vent Louver (RH)
21. Parking Brake Control
22. Cabin Heat Control
23. Engine Primer
24. Mixture Control
25. Fuel Tank Selector
26. Throttle Control
27. Carb Heat Control
28. Instrument Lights Rheostat
29. Individual Circuit Controls
30. Vent Louver (LH)
31. Placard
32. Starter Button
33. Master Switch
34. Ignition Switch
35. Vent Control (LH)
36. Head Phone Jack
37. Cigarette Lighter

Figure 7-1. Instrument Panel

GROUND CONTROL

Since the AA-1C nose wheel is free-castering, ground control during taxiing is accomplished by use of differential braking. Application of left brake causes the airplane to turn left and right brake causes a right turn. Due to the fact that the nose wheel swivels approximately 90° either side of center, the AA-1C is capable of turning in a very tight radius (less than 17 feet).

During ground handling the airplane should be pushed and controlled by use of the tow bar provided with the airplane.

CAUTION

USING THE PROPELLER FOR GROUND HANDLING COULD RESULT IN SERIOUS DAMAGE, ESPECIALLY IF PRESSURE IS EXERTED ON THE OUTER ENDS. DO NOT ATTEMPT TO PUSH THE AIRPLANE BACKWARD WITHOUT THE AID OF A TOW BAR. THIS ACTION COULD RESULT IN THE NOSE WHEEL PIVOTING ABRUPTLY AND DAMAGING THE NOSE WHEEL STOPS.

LANDING GEAR SYSTEM

The FACE SAVER® main landing gear struts are of tough, laminated fiberglass to achieve outstanding shock absorption and good ground stability. The nose gear is free-castering to approximately 90° on either side of the centerline, which gives good maneuverability on the ground.

BAGGAGE COMPARTMENT

The baggage compartment occupies the area extending from the back of the seats to the aft cabin bulkhead. Access to the baggage compartment is gained from within the airplane cabin. Two tiedown straps extend diagonally across the baggage compartment, for use in securing luggage. For loading information regarding the baggage compartment see Section 6. When loading the airplane, children or pets should not be placed or permitted in the baggage compartment, and any material that might be hazardous to the airplane or its occupants should not be taken aboard. For baggage area dimensions refer to Section 6.

SEATS AND BELTS

Contoured seats are individually adjustable fore and aft using the adjustment levers located on the outboard side of each seat.

NOTE

SHOULDER BELTS ARE PROVIDED FOR YOUR SAFETY. BE SURE TO USE THEM. THE SHOULDER BELT FASTENS TO THE END OF THE OUTBOARD LAP BELT, ALLOWING BOTH BELTS TO BE FASTENED OR REMOVED IN ONE OPERATION. LAP AND SHOUDER BELTS MAY BE NEATLY STOWED BY HANGING THEM ON THE SIDE PANEL SUPPORTS PROVIDED.

LAP BELTS SHOULD BE ADJUSTED TO LIE LOW ON THE HIPS, WITHOUT ANY SLACK. SHOULDER BELTS SHOULD LIE OVER THE OUTER SHOULDER AND ACROSS THE CHEST, WITH JUST ENOUGH SLACK TO REACH ALL CONTROLS COMFORTABLY.

CANOPY

Entry into and exit from the airplane is accomplished by releasing the canopy latch and sliding the canopy aft. The canopy latch is actuated by an external handle on the front center of the canopy and an internal handle located inside the canopy at its front center. The external handle opens the latch by clockwise rotation and the internal handle opens the latch by rearward movement. A lock on the canopy skirt provides a means of externally locking the canopy. The canopy is designed to open a longitudinal distance of 27 inches and is limited by stops. See Section 6 for canopy entrance dimensions. The canopy may be partially opened in flight to provide ventilation or better visibility. The cabin windows aft of the canopy are of the fixed type and cannot be opened.

CONTROL LOCKS

A control lock is provided to lock the elevator control surfaces in the down position and the ailerons at neutral, to prevent damage to these systems by wind buffeting while the airplane is parked. Having the controls locked in the down position prevents takeoff with the lock installed. The lock consists of a shaped steel rod with a red metal flag attached to it. The flag is labeled CONTROL LOCK, REMOVE BEFORE STARTING ENGINE. To install the control lock, align the hole on the top of the pilot's control wheel shaft with the hole in the top of the shaft collar on the instrument panel and insert the rod into the aligned holes. Proper installation of the lock will place the red flag over the ignition switch. The control lock and any other type of locking device should be removed prior to starting the engine.

ENGINE

The airplane is powered by a horizontally-opposed, four-cylinder overhead-valve, air-cooled, carburetor equipped engine with a wet sump oil system. The engine is a Lycoming Model 0-235-L2C and is rated at 115 horsepower at 2700 RPM. Major accessories mounted on the engine include a direct-drive starter and belt-driven alternator on the front of the engine, dual magnetos, an engine-driven fuel pump, and a vacuum pump on the rear of the engine.

ENGINE CONTROLS

Engine power is controlled by a throttle located on the lower center portion of the instrument panel. The throttle operates in a conventional manner; in the full forward position, the throttle is open, and in the full aft position, it is closed. A friction lock, which is a round knurled disk, is located at the base of the throttle and is operated by rotating the lock clockwise to increase friction or counterclockwise to decrease it.

The mixture control, mounted to the right of the throttle, is a red knob with raised points around the circumference. The rich position is full forward, and full aft is the idle cut-off position. To adjust the mixture, move the control forward or aft.

The carburetor heat control is the square knob mounted to the left of the throttle. When this control is pushed in, ambient air is routed through the air filter and into the carburetor. When the control is pulled out, the ambient air is routed through a heater muff surrounding the exhaust pipe; where it is heated prior to induction directly into the carburetor.

ENGINE INSTRUMENTS

Engine operation is monitored by the following instruments: oil pressure gauge, oil temperature gauge, tachometer and fuel pressure gauge.

The oil pressure gauge, which is mounted in the instrument cluster on the right of the instrument panel, is operated directly by oil pressure from the engine. Gauge markings indicate a minimum idling pressure of 25 PSI (red line), a normal operating range of 60 to 90 PSI (green arc) and a maximum allowable pressure of 100 PSI (red line).

The oil temperature gauge, which is also mounted in the instrument cluster, is operated by an electrical resistance type temperature sensor powered by the airplane electrical system. Oil temperature limitations are the normal operating range (green arc) which is 75°F (24°C) to 245°F (118°). Maximum allowable (red line) is 245°F (118°C).

The engine-driven mechanical tachometer is located near the lower center portion of the instrument panel. The instrument is marked in increments of 100 RPM and indicates engine speed. An hour meter below the center of the tachometer dial records elapsed engine time in hours, tenths, and hundredths. Instrument markings include a normal operating range of 2200 to 2700 RPM. Maximum (red line) at any altitude is 2700 RPM.

A fuel pressure gauge, on the instrument cluster, indicates fuel pressure to the carburetor in pounds per square inch. The gauge is operated by fuel pressure. Gauge markings are in 0.5, 5 and 8 PSI with a red line at 0.5 PSI and 8 PSI. A green arc extends from 0.5 PSI to 8 PSI to indicate the normal operating range.

NEW ENGINE BREAK-IN AND OPERATION

The engine underwent a run-in at the factory and is ready for the full range of use. It is, however, recommended that power be maintained at 75% or more until a total of 50 hours has accumulated. This will ensure proper seating of the rings.

The airplane is delivered from the factory with corrosion preventive oil in the engine. If, during the first 25 hours, oil must be added, use only aviation grade straight mineral oil conforming to Specification No. MIL-L-6082 (Figure 1-2).

ENGINE OIL SYSTEM

Oil for engine lubrication is supplied from a sump on the bottom of the engine. The capacity of the engine sump is six quarts. Oil is drawn from the sump through an oil suction strainer into the engine-driven oil pump. From the pump, oil is routed to a bypass valve. If the oil is cold, the bypass valve allows the oil to go directly from the pump to the oil screen. If the oil is hot, the bypass valve routes the oil out of the accessory housing and into a flexible hose leading to the oil cooler on the left rear of the firewall. Pressure oil from the cooler returns to the accessory housing where it enters the oil screen. The filtered oil then enters a pressure relief valve which regulates engine oil pressure by allowing excessive oil to return to the pump, while the balance of the oil is circulated to various engine parts for lubrication. Residual oil is returned to the sump by gravity flow.

An oil filter cap/oil dipstick is located at the rear of the engine on the right side. The filler cap/dipstick is accessible through the engine cowling (or through the oil filler access door). The engine should not be operated on less than two quarts of oil. To minimize loss of oil through the breather, fill to five quarts for normal flights of less than three hours. For extended flight, fill to six quarts (dipstick indication only). For engine oil grade and specifications, refer to Section 8 of this handbook.

An oil quick-drain valve is available to replace the drain plug in the oil sump drain port, and provides quicker, cleaner draining of the engine oil. To drain the oil with this valve installed, slip a hose over the end of the valve and push upward on the end of the valve until it snaps into the open position. Spring clips will hold the valve open. After draining, use a suitable tool to snap the valve into the extended (closed) position and remove the drain hose.

IGNITION-STARTER SYSTEM

Engine ignition is provided by engine-driven dual magnetos, and two spark plugs for each cylinder. 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. Normal operation is conducted with both magnetos due to the more complete burning of the fuel-air mixture with dual ignition.

Ignition is controlled by a rotary, key-actuated switch located near the bottom left of the instrument panel. The switch is labeled clockwise; OFF, R, L, BOTH. The engine should be operated with the switch in the BOTH position except for starting and magneto checks. When the engine is started the ignition switch should be placed in the L (left magneto only) position to minimize the possibility of starter damage should there be an engine "kickback". **Once the engine is started** the switch should be set to BOTH, except for magneto checks, since extended engine operation on one magneto could result in spark plug fouling.

CAUTION

PRESSING THE STARTER BUTTON WITH THE ENGINE RUNNING CAN RESULT IN STARTER OR ENGINE DAMAGE.

The starter button is located immediately to the left of the ignition switch. When the master switch is on, the starter button actuates the starter as long as the button is depressed. Upon engine startup, the button should be released immediately.

AIR INDUCTION SYSTEM

The engine air induction system receives ram air through a carburetor air intake in the cowling nose cap. The ram air passes through a duct to the air filter located directly beneath the carburetor. This filter removes dust and foreign matter from the air prior to its entry into the carburetor.

When carburetor heat is being applied, a flapper valve in the intake to the air filter is closed off and the engine then draws its input from a shroud around the No. 4 exhaust pipe. See Section 8 for air filter servicing requirements.

EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies to a muffler and tailpipe. The muffler is constructed with a shroud around the outside which forms heating chambers for cabin heat air.

CARBURETOR AND PRIMING SYSTEM

The engine is equipped with an up-draft, float-type, fixed jet carburetor mounted on the bottom of the engine. The carburetor is equipped with simplified fuel passages to prevent vapor locking, an idle cut-off mechanism, and a manual mixture control. Fuel is delivered to the carburetor by an engine-driven fuel pump, or an auxiliary electric fuel pump from the fuel system. In the carburetor, fuel is atomized, proportionally mixed with intake air, and delivered to the cylinders through intake manifold tubes. The proportion of atomized fuel to air is controlled, within limits, by the mixture control on the instrument panel.

For easy starting in cold weather, the engine is equipped with a manual primer. The primer is actually a small pump which draws fuel from the fuel strainer when the plunger is pulled out, and injects it into the cylinder intake ports when the plunger is pushed back in. The plunger knob, on the instrument panel, is equipped with a lock, and, after being pushed full in, must be rotated either left or right until the knob cannot be pulled out.

COOLING SYSTEM

Ram air for engine cooling enters through two intake openings in the cowling nose cap. The cooling air is directed around the cylinders and other engine areas by baffling, and is then exhausted through openings in the bottom of the cowling.

PROPELLER

The AA-1C is equipped with an all-metal, two-bladed, fixed-pitch propeller, Sensenich No. 72CK-0-56 or 72CK-0-52

FUEL SYSTEM

The AA-1C's fuel system (Figure 7-2) consists of two tanks with a total capacity of 24 gallons, of which 22 gallons are usable, independent fuel sight gauges and a fuel selector valve. The fuel tanks are vented and equipped with fuel lines in each tank, located to ensure fuel supply in all normal flight attitudes. The fuel tank vents are located in the wing tips. A mechanical fuel pump, mounted on the engine, transfers fuel from the tanks to the carburetor.

An auxiliary electric fuel pump supplements the engine-driven pump. Fuel pressure is indicated on a gauge in the engine instrument cluster, located to the right of the radio section of the instrument panel. The electric pump should be turned on if the engine-driven pump fails as noted by a loss of fuel pressure. The electric fuel pump can also be used to provide fuel pressure redundancy during low altitude operation, such as during takeoff and landing.

There are two fuel drains on the airplane, one aft of each fuel tank. They can be reached under the aft side of the wing at the wing root on each side of the airplane. A drain cup is provided (in the glove box) for draining fuel which should be inspected for water or sediment contamination, prior to each flight.

BRAKES

The brakes are toe-operated, single-disc hydraulic systems with integral parking brakes. The brakes provide all steering control while taxiing. At speeds above 13 KIAS (15 MPH) to 17 KIAS (20 MPH), the rudder becomes fully effective and brake steering is not necessary. The parking brake is set by pressing the toe brakes; pulling the parking brake knob; then releasing brake pedal pressure. To release, push the parking brake knob in, then press the toe-brakes firmly. Parking brakes are operated from the left side only.

ELECTRICAL SYSTEM

The electrical system (Figure 7-3) uses a 14-volt, 60-amp alternator with internal power diodes which delivers DC power directly to the main bus through a 60-amp circuit breaker. An external voltage regulator controls the alternator output voltage and automatically adjusts the battery charging rate to maintain proper charge. The electrical system ammeter is located in the engine instrument cluster and indicates current charge (+) and discharge (—) of the battery.

The master switch is a split rocker type which serves two functions. One side (master) energizes the battery circuit for engine starting and operating electrical systems with the engine OFF. The other side (alt) energizes the alternator field circuit which produces the electrical field in the alternator. With the electrical field energized, the alternator supplies all of the required current for the system loads through the bus bar.

In the event of alternator failure, as indicated by a battery discharge indication on the ammeter, the alternator side of the master switch can be turned OFF and the airplane systems then operated on the existing battery voltage. To conserve the battery voltage, only the necessary electrical systems should be ON when operating from the battery.

The alternator circuits are protected by a 60-amp alternator circuit breaker and a 5-amp alternator field circuit breaker. Should either of these breakers open due to excessive current in the system, they should be reset after waiting at least 15 seconds. If either breaker will not reset, the alternator side of the master switch should be turned OFF and the airplane systems then operated on existing battery voltage.

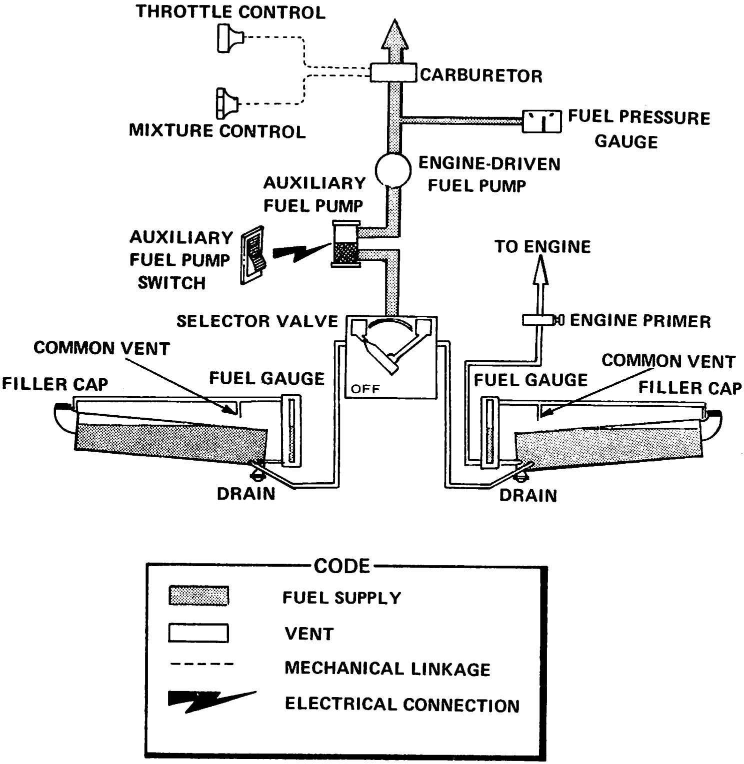


Figure 7-2. Fuel System

Overvoltage protection is provided by a diode attached to the field circuit breaker forward of the instrument panel. A sustained overvoltage condition will result in failure of the diode and subsequent opening of the alternator field circuit breaker. The breaker will not reset until the fault is corrected and the diode replaced.

Fuses and circuit breakers for the electrical systems are located on the lower right side of the instrument panel, and spare fuses are mounted in the right side of the glove compartment. Electrical switches for exterior lighting and accessories are located at the right of the pilot's control column.

The engine's dual-magneto ignition system is completely independent of the airplane electrical system, and will continue to operate in the event of an electrical system failure.

MASTER SWITCH

The master switch is a split-rocker type switch labeled MASTER, and is ON in the up position and OFF in the down position. The right half of the switch, labeled BAT, controls all electrical power to the airplane. The left half, labeled ALT, controls the alternator.

Normally, both sides of the master switch should be used simultaneously; however, the BAT side of the switch could be turned ON separately to check equipment while on the ground. The ALT side of the switch, when placed in the OFF position, removes the alternator from the electrical system. With this switch in the OFF position, the entire electrical load is placed on the battery.

CAUTION

DO NOT TURN OFF BATTERY SWITCH AT ANY TIME THAT THE ALTERNATOR IS OPERATING.

GROUND SERVICE PLUG RECEPTACLE

A ground service plug receptacle may be installed to permit the use of an external power source for cold weather starting and during lengthy maintenance work on the airplane electrical system. The receptacle is located under a cover plate, on the cowling on the right side of the fuselage.

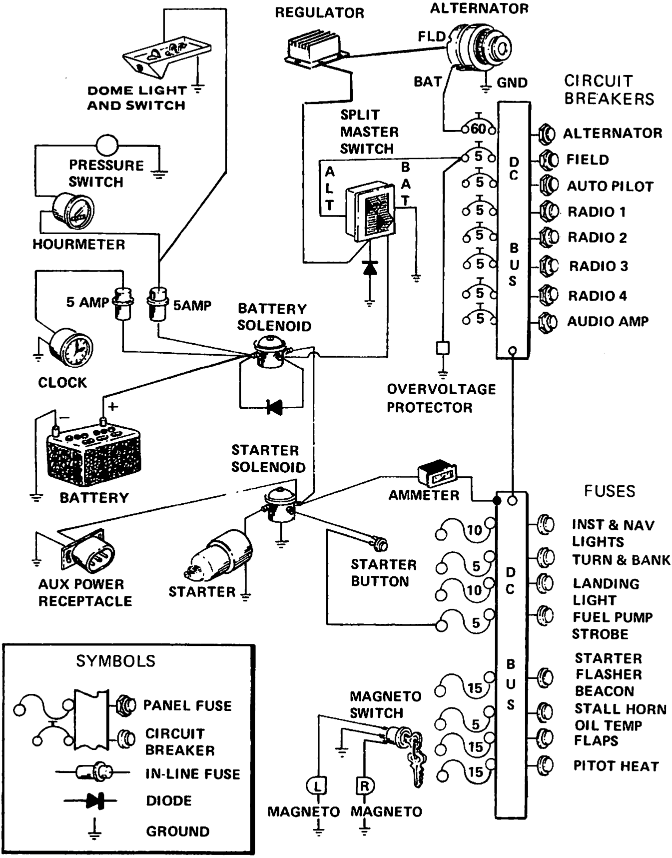


Figure 7-3. Electrical System

NOTE

When external power is used, voltage transients may be introduced into the electrical system. Ensure that all radios and other electronic equipment remain deenergized when external power is being applied to the airplane.

Just before connecting an external power source (generator type or battery cart), the master switch should be turned off.

LIGHTING SYSTEMS

EXTERIOR LIGHTING

Conventional navigation lights are located on the wing tips and tail cone. A landing light is installed in the nose cap, and a flashing beacon is mounted on top of the rudder. In addition, strobe lights are available for installation on each wing tip. All external lights are controlled by rocker type switches on the bottom left of the instrument panel. The switches are ON in the up position and OFF in the down position.

The flashing beacon should not be used when flying through clouds or overcast; the flashing light reflected from water droplets or particles in the atmosphere, particularly at night, can produce vertigo and loss of orientation.

The two strobe lights will enhance anti-collision protection. However, the lights must be turned off when taxiing in the vicinity of other airplanes, or during night flight through clouds, fog or haze.

INTERIOR LIGHTING

CABIN DOME LIGHT

A cabin dome light is provided for illuminating the seating area and baggage compartment. It is controlled by a rocker switch which is located adjacent to the speaker. It is energized directly from the battery regardless of the master switch position.

INSTRUMENT PANEL LIGHTS

The instrument panel lights are controlled by a rheostat mounted directly above the throttle. This control turns off the instrument panel lights when it is rotated fully counterclockwise. As the rheostat is rotated clockwise the brightness of the instrument lights is increased.

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEMS

HEATING-DEFROSTING SYSTEM

Cabin heating and defrosting temperature is controlled by the CABIN HEAT control, located on the instrument panel above the throttle. When this control is pushed in cabin heating is decreased, and when it is pulled out cabin heating is increased. Figure 7-4 shows schematically the operation of the cabin heating, defrosting, and ventilation systems.

When cabin heat is turned on, and the sliding doors on the defrosting ducts are closed, the heat is applied through vents near the firewall into the cabin beneath the instrument panel.

When defrosting is desired, the sliding doors on the defrosting outlets (below the windshield), can be opened to apply hot air directly to the windshield.

VENTILATION

As is shown in Figure 7-4, ventilation of the AA-1C airplane is accomplished by adjustable vents that provide fresh air individually controllable by each occupant.

Fresh air for the pilot and right front seat passenger is controlled by VENT controls located at the bottom left and right corners of the instrument panel. The air is directed through louvered vents directly to the front seat occupants.

Maximum ventilation can be obtained by sliding the canopy open to the placard marker on the canopy track at speeds up to 113 KIAS (130 MPH).

To obtain warm defrost air, pull out the cabin heat control (on the instrument panel) and slide open the defroster vents near the lower edge of the windshield. The fresh air vents also provide good defrost action when partially opened with the louvers directed toward the side canopy.

When cool and high humidity conditions exist, do not use partial defrost as the windshield may fog rapidly on takeoff. Always check defroster position before flight.

NOTE

The heater system and fresh air system can be turned on simultaneously during cold weather operations to provide a comfortable cabin atmosphere.

PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, vertical speed indicator and altimeter. The system is composed of a pitot tube mounted on the lower surface of the left wing, two external static ports, one on each side of the aft fuselage, and the associated plumbing necessary to connect the instruments to the sources. The static system also has a water drain.

The airplane may also be equipped with a pitot heat system. The system consists of a heating element in the pitot tube, a rocker-type switch labeled PITOT HEAT on the lower left side of the instrument panel, a 15 amp circuit breaker on the lower right side of the instrument panel, and associated wiring. When the pitot heat switch is turned on, the element in the pitot tube is heated electrically to maintain proper operation in possible icing conditions. Pitot heat should be used only as required to prevent ice.

AIRSPEED INDICATOR

The airspeed indicator is calibrated in both knots (outer scale) and miles per hour (inner scale). The limitations and range markings are as follows:

Marking	Significance	Range KCAS	Range MPH
White Arc	Flap operating range	53-100	61-115
Green Arc	Normal operation	57-125	66-144
Yellow Arc	Caution range	125-169	144-195
Red Line	Never exceed speed	169	195

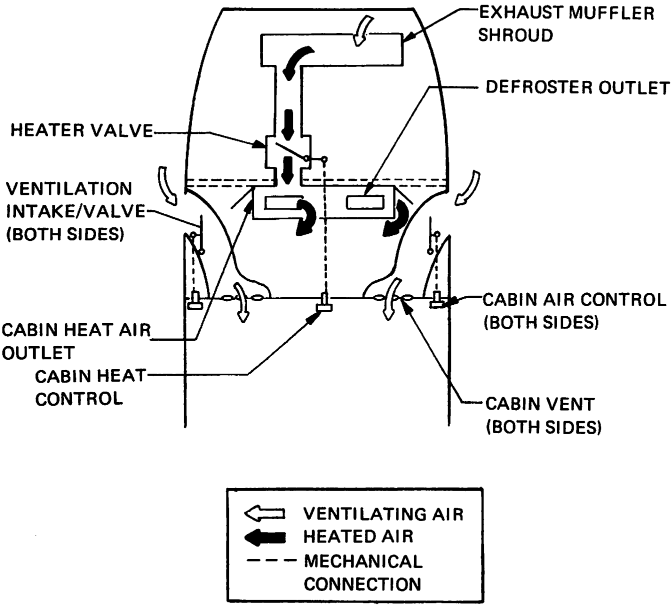


Figure 7-4. Heating-Defrosting System

If a true airspeed indicator is installed, it is equipped with a rotable ring which works in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer. To operate the indicator, first rotate the ring until **pressure** altitude is aligned with outside air temperature in degrees Fahrenheit. Pressure altitude should not be confused with indicated altitude. To obtain pressure altitude, momentarily set the barometric scale on the altimeter to 29.92 and read pressure altitude on the altimeter. Be sure to return the altimeter barometric scale to the original barometric setting after pressure altitude has been obtained. Having set the ring to correct for altitude and temperature, then read the airspeed shown on the rotable ring by the indicator pointer. For best accuracy, this indication should be corrected to calibrated airspeed by referring to the Airspeed Calibration chart in Section 5. Knowing the calibrated airspeed, read true airspeed on the ring opposite the calibrated airspeed.

VERTICAL SPEED (RATE OF CLIMB) INDICATOR

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

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.

VACUUM SYSTEM AND INSTRUMENTS

An engine-driven vacuum system (See Figure 7-5) is available and provides the suction necessary to operate the attitude indicator and directional indicator. The system consists of a vacuum pump mounted on the engine, a regulator and vacuum system air filter on the aft side of the firewall below the instrument panel, and instruments (including a suction gauge) on the instrument panel.

ATTITUDE INDICATOR

An attitude indicator is available and gives a visual indication of flight attitude. Bank attitude is presented by a pointer at the top of the indicator relative to bank scale which is marked in increments of 10°, 20°, 30°, 60°, and 90° either side of the center mark. Pitch attitude is presented by a miniature airplane in relation to the horizon bar. A knob at the bottom of the instrument is provided for in-flight adjustment of the miniature airplane to the horizon bar for a more accurate flight attitude indication.

DIRECTIONAL INDICATOR

A directional indicator is available and 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.

SUCTION GAUGE

A suction gauge is located at the upper right of the instrument panel. Suction available for operation of the attitude indicator and directional indicator is shown by this gauge, which is calibrated in inches of mercury. The desired suction range is 4.6 to 5.4 inches of mercury. A suction reading above or below this range may indicate a system malfunction or improper adjustment, and in this case, the indicators should not be considered reliable.

STALL WARNING SYSTEM

The AA-1C airplane is equipped with an electrically operated stall warning system. Power to the system is supplied through the STALL HORN/OIL TEMP. fuse from the airplane electrical system.

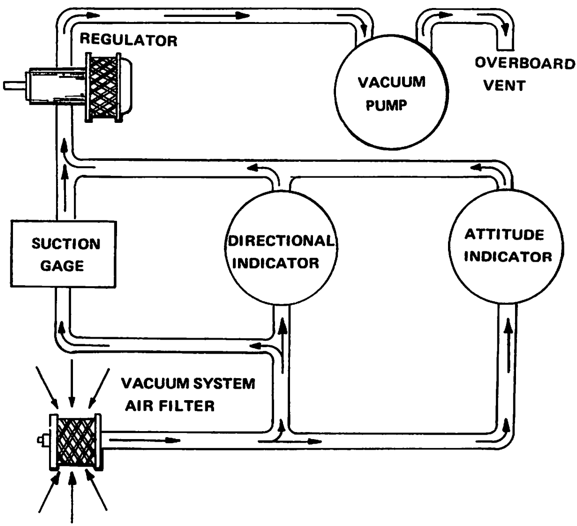


Figure 7-5. Vacuum System

A lift detector, located on the leading edge of the right wing actuates a stall warning delay of .9 seconds, which actuates a stall warning horn. As the airspeed and angle of attack of the wing change to the extent that a stall condition is imminent, a portion of the air flow over the wing leading edge lifts the tab on the lift detector. The lift detector then completes a circuit that applies electrical power to the stall warning horn located under the instrument panel. The stall warning horn provides an aural indication of an impending stall at approximately 5 KIAS to 10 KIAS above the stall speed.

AVIONICS SUPPORT EQUIPMENT

The AA-1C airplane may be equipped with a wide variety of avionics and its associated support equipment. Refer to the appropriate manufacturer's manuals for information regarding the avionics installed in your particular airplane.

SECTION 8
AIRPLANE HANDLING, SERVICE & MAINTENANCE

TABLE OF CONTENTS

INTRODUCTION

This section contains the procedures recommended by Grumman American Aviation Corporation for the proper ground handling and routine care and servicing of your AA-1C airplane. Also included in this section are the inspection and maintenance requirements which must be followed if your airplane is to retain its performance and dependability. It is recommended that a planned schedule of lubrication and preventive maintenance be followed, and that this schedule be tailored to the climatic or flying conditions to which the airplane is subjected.

Much valuable knowledge and experience are available to you through your Grumman American Dealer. It is suggested that you take advantage of the services he offers, since he is an expert on your airplane and its maintenance. He will remind you when lubrications and oil changes are necessary, and about other seasonal or periodic services needed.

IDENTIFICATION PLATE

All correspondence regarding your airplane should include its serial number. This number, together with the model number, type certificate number, and production certificate number are stamped on the identification plate attached to the left side of the fuselage beneath the horizontal stabilizer. On the upper left corner of the firewall is a plate giving the finish and trim code number of the particular airplane. This code number describes the interior color scheme and exterior paint combination of the airplane. This code number should be included in any correspondence regarding items requiring identification of color or trim.

PUBLICATIONS

When the airplane is delivered from the factory it is supplied with a Pilot's Operating Handbook and supplemental data covering optional equipment installed in the airplane.

In addition, the owner may purchase the following:

Maintenance Manuals
Illustrated Parts Catalogs

AIRPLANE FILE

Numerous data, information and licenses are required by Federal Aviation Regulations and by the Federal Communications Commission as parts of the airplane file. This file shall be maintained as a permenent record of the airplane. The applicable FAA regulations should be checked periodically by the owner to ensure that the file is current.

The following checklist contains a listing of required documents:

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

(2) To be carried in the airplane at all times:
   1. Weight and Balance, and associated papers (current copy of the Repair and Alteration Form FAA Form 337, if applicable)
   2. Equipment list.

(3) To be available upon request:
   1. Airplane Log Book
   2. Engine Log Book

The items listed are required by the United States Federal Aviation Regulations and by the Federal Communications Commission (if a transmitter is installed). Regulations of other nations may require other documents or data, therefore, owners of airplanes not registered in the United States should check with their own aviation officials to determine the requirements of the nation the airplane is to be flown in.

In addition to the forms listed, Grumman American Aviation suggests that the Pilot's Operating Handbook be kept in the airplane at all times.

AIRPLANE INSPECTION PERIODS

As required by Federal Aviation Regulations, all civil airplanes of U.S. registry must undergo a complete inspection (annual) each twelve (12) calendar months. In addition to the required annual inspection, airplanes operated commercially (for hire) must have a complete inspection every 100 hours of operation.

The FAA may require other inspections by issuance of airworthiness directives applicable to the airplane, engine, propeller and 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.

PILOT CONDUCTED PREVENTIVE MAINTENANCE

A certificated pilot who owns or operates an airplane not used as an air carrier is authorized by FAR Part 43 to perform limited maintenance on his airplane. Refer to FAR Part 43 for a list of the specific maintenance operations which are allowed.

NOTE

Pilots operating airplanes of other than U.S. registry should refer to the regulations of the country of certification for information on preventive maintenance that may be performed by pilots.

A Maintenance Manual should be obtained prior to performing any preventive maintenance to ensure that proper procedures are followed. Your Grumman American Dealer should be contacted for further information or for required maintenance which must be accomplished by appropriately licensed personnel.

ALTERATIONS OR REPAIRS

It is essential that the FAA be contacted **prior to** any alterations on the airplane to ensure that airworthiness of the airplane is not violated. Alterations or repairs to the airplane must be accomplished by licensed personnel.

GROUND HANDLING

TOWING

Towing of the airplane should be accomplished by the use of the nose gear tow bar.

CAUTION

USING THE PROPELLER FOR GROUND HANDLING COULD RESULT IN SERIOUS DAMAGE, ESPECIALLY IF PRESSURE IS EXERTED ON THE OUTER ENDS. DO NOT ATTEMPT TO PUSH THE AIRPLANE BACKWARD OR FORWARD WITHOUT THE AID OF A TOW BAR. THIS ACTION COULD RESULT IN THE NOSE WHEEL PIVOTING ABRUPTLY AND DAMAGING THE NOSE WHEEL STOPS.

PARKING

When parking, head the airplane into the wind. Do not set the parking brakes during cold weather when accumulated moisture may freeze the brakes, or when the brakes are overheated.

Care should be taken when using the parking brakes for an extended period of time during which an air temperature rise could cause the hydraulic fluid to expand. This in turn, could damage the brake system and/or cause difficulty in releasing the parking brake. For prolonged parking, tie-downs and wheel chocks are recommended.

Install the control wheel lock and chock the wheels. In severe weather and high wind conditions, tie the airplane down as outlined in the following paragraph.

CAUTION

WHEN USING CHOCKS ENSURE THAT THE CHOCKS DO NOT CONTACT THE LANDING GEAR WHEEL FAIRINGS. USING CHOCKS THAT ARE TOO HIGH COULD RESULT IN DAMAGE TO WHEEL FAIRINGS.

TIE-DOWN

Proper tie-down procedure is the best precaution against damage to the parked airplane by gusty or strong winds. To tie-down the airplane securely, proceed as follows:

(1) Chock all wheels and install the control wheel lock.
(2) Tie sufficiently strong ropes or chains (700 pounds tensile strength) to the wing and tail tie-down fittings and secure each rope to a ramp tie-down.
(3) Ensure that the canopy is closed and latched.

JACKING

When it is necessary to jack the entire airplane off the ground, or when jack points are used in the jacking operation, refer to the Maintenance Manual for specific procedures and equipment required.

If nose gear maintenance is required, the nose wheel may be raised off the ground by pressing down on the root of the horizontal stabilizer.

CAUTION

DO NOT ALLOW THE TAIL OF THE AIRPLANE TO CONTACT THE GROUND AS TAIL CONE AND/OR ELEVATOR DAMAGE MAY RESULT.

NOTE

Do not apply pressure on the outboard horizontal stabilizer surfaces. When pushing on the tail cone, always apply pressure at the root of the horizontal stabilizer to avoid buckling the skin.

Ensure that the nose will be held off the ground under all conditions by means of suitable stands or supports under the firewall of the airplane. (See jacking instructions in the Maintenance Manual.)

LEVELING

Level the airplane as described in Section 6.

FLYABLE STORAGE

Airplanes placed in storage for a maximum of 30 days or those which receive only intermittent use for the first 25 hours are considered in flyable storage. Every seventh day during these periods, the propeller should be rotated by hand through several revolutions. This action "limbers" the oil and prevents any accumulation of corrosion on engine cylinder walls.

WARNING

CHECK THAT THE IGNITION SWITCH IS OFF, THE THROTTLE IS CLOSED, THE MIXTURE CONTROL IS IN THE IDLE CUT-OFF POSITION, AND THE AIRPLANE IS SECURED BEFORE ROTATING THE PROPELLER BY HAND. DO NOT STAND WITHIN THE ARC OF THE PROPELLER BLADES WHILE TURNING THE PRO PELLER.

After 30 days in storage, the airplane should be flown for at least 30 minutes, or a ground runup should be made just long enough to produce an oil temperature within the lower green arc range. Excessive ground runup should be avoided.

Engine runup helps to eliminate excessive accumulations of water in the oil system and other air spaces in the engine. Keep fuel tanks full to minimize condensation in the tanks. Keep the battery fully charged to prevent the electrolyte from freezing in cold weather.

SERVICING (See Figure 8-1.)

In addition to the preflight inspection in Section 4, servicing, inspection, and test requirements for your airplane are detailed in the Maintenance Manual. The Maintenance Manual outlines all items which require attention at 50, 100, and 1000 hour intervals plus those items which require servicing, inspection, and/or testing at special intervals.

For quick and ready reference, quantities, materials, and specifications for frequently used service items are as follows:

ENGINE OIL

Average Ambient Air Temperature	Mineral Grade	Ashless Dispersant
Above 60°F (16°C)	SAE 50	SAE 40 or SAE 50
30°F (-1°C) to 90°F (32°C)	SAE 40	SAE 40
0°F (-18°C) to 70°F (21°C)	SAE 30	SAE 40 or SAE 20W-30
Below 10°F (-12°C)	SAE 20	SAE 20W-30

*Refer to latest revision of Lycoming Service Instruction No. 1014 for further information.

Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting in cold weather. Ashless dispersant oil, conforming to Specification No. MIL-L-22851 (Figure 1-2) should be used.

NOTE

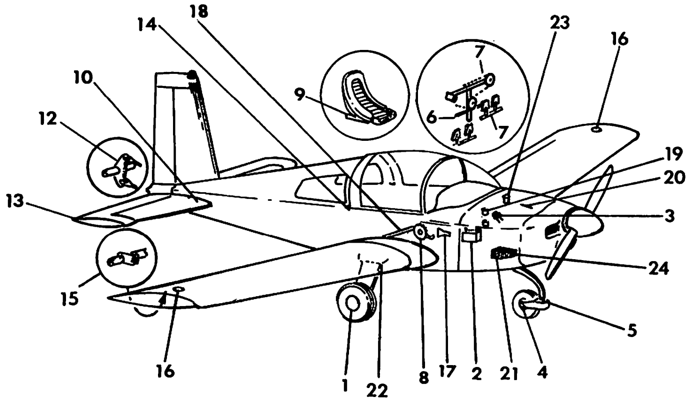
Your AA-1C was delivered from the factory with a corrosion preventive aircraft engine oil. If oil must be added during the first 25 hours of engine operation, use only aviation grade straight mineral oil conforming to Specification No. MIL-L-6082 (Figure 1-2).

CAPACITY OF ENGINE SUMP – 6 QUARTS

Do not operate on less than 2 quarts. To minimize loss of oil through the breather, fill to 5 quart level for normal flights of less than 3 hours. For extended flight, fill to 6 quarts. These quantities refer to oil dipstick level readings.

OIL CHANGE

After the first 25 hours of operation, drain engine oil sump and oil cooler, and clean the oil suction strainer. Refill sump with straight mineral oil and use until a total of 50 hours has accumulated; then change to dispersant oil. Drain the engine oil sump and clean oil suction strainer, each 50 hours thereafter. Change engine oil at least every 6 months even though less than the recommended hours have accumulated. Reduce intervals for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.



1. MAIN WHEEL BEARINGS (LEFT AND RIGHT) – Grease with MIL-G-25760 (Figure 1-2) grease every 100 hours or as required.
   TIRES – Inflate to 19 PSI as required.
2. BATTERY TERMINALS – Coat with VV-P-236 (Figure 1-2) petrolatum as required to prevent corrosion.
   BATTERY – Fill with distilled water as required to maintain fluid level at top of plate.
3. ENGINE OIL – (See Figure 1-2.) Change engine oil every 50 hours. Add oil as required to maintain safe level. See Section 8 for recommended seasonal grades.
4. NOSE WHEEL BEARINGS – Grease with MIL-G-25760 (Figure 1-2) grease every 100 hours or as required.
   NOSE WHEEL TIRE – Inflate to 22 PSI as required.
5. NOSE FORK SWIVEL AND BELLVILLE WASHERS – Grease with MIL-G-7711 (Figure 1-2) grease every 100 hours.
6. T-COLUMN NEEDLE BEARING – Grease with MIL-G-7711 (Figure 1-2) grease as required.
7. T-COLUMN, RUDDER AND FLAP TORQUE TUBE OILITE BEARING. – Oil with MIL-L-7870 (Figure 1-2) as required.

Figure 8-1. Servicing Points (Sheet 1 of 2)

8. TRIM WHEEL GEARS – Grease with MIL-G-7711 (Figure 1-2) grease every 100 hours.
9. SEAT TRACKS – Oil with MIL-L-7870 (Figure 1-2) oil every 100 hours.
10. TRIM ACTUATOR SHAFT – Grease with MIL-G-7711 (Figure 1-2) grease as required.
11. TRIM TAB BELLCRANKS – Oil with MIL-L-7870 (Figure 1-2) oil as required.
12. RUDDER AND ELEVATOR BELLCRANK CLEVIS PINS – Oil with MIL-L-7870 (Figure 1-2) oil as required.
13. TRIM TAB HINGE – Oil with MIL-L-7870 (Figure 1-2) oil (Note 2).
14. CANOPY SLIDES – Spray with E-Z-Free lubricant as required.
15. ALL CONTROL SURFACE BEARINGS – Grease with MIL-G-7711 (Figure 1-2) or AeroShell #6 grease as required.
16. FUEL SELECTOR VALVE AND FUEL CAP GASKET – Grease with MIL-G-6032A (Figure 1-2) grease as required.
    FUEL TANKS – Fill with 100/130 grade aviation fuel as required.
17. FRESH AIR VENTS – Oil with MIL-L-7870 (Figure 1-2) oil as required.
18. FLAP DRIVE JACKSCREW – Grease with MIL-G-7711 (Figure 1-2) grease. Coat with a light film (Note 1).
19. BRAKE RESERVOIRS – Fill to within 1/4 inch of top with MIL-H-5606 (Figure 1-2) hydraulic fluid, as required.
20. VACUUM SYSTEM FILTER – Replace filter at 400 hours or as required.
21. ENGINE AIR FILTER – Clean and service filter element every 50 hours. Replace when torn or damaged.
22. FUEL TANK DRAINS – Clear of water and sediment prior to first flight of day.
23. AUXILIARY FUEL PUMP FILTER – Clean filter element every 50 hours.
24. CARBURETOR FILTER – Drain carburetor bowl and clean filter every 100 hours.

NOTES:

1. Care should be taken to avoid grease contacting outer surface of nylon nut.
2. Acceptable substitute is powdered graphite MIL-G-6711 (Figure 1-2).

Figure 8-1. Servicing Points (Sheet 2 of 2)

FUEL

GRADE AND (COLOR) – 100/130 Minimum Grade Aviation Fuel (green). 100 low lead aviation fuel (blue) is also approved.

CAPACITY EACH TANK – 12 Gallons.

TIRE SERVICE

All tires and wheels are balanced at the factory prior to original installation. A similar relationship of the tire, tube and wheel should be maintained. If vibration is encountered, it may be due to out-of-round or out-of-balance conditions. When wheel, tire or tube is replaced due to wear, it is recommended that they be re-balanced.

NOSE WHEEL TIRE PRESSURE – 22 PSI on 5.00-5, 4-Ply Rated Tire.

MAIN WHEEL TIRE PRESSURE – 19 PSI on 6.00-6, 4-Ply Rated Tires.

BRAKE SERVICE

The brake system reservoirs, located on the pilot's brake master cylinders, should be filled to within 1/4 inch of the reservoir top with hydraulic fluid conforming to MIL-H-5606 (Figure 1-2).

BATTERY SERVICE

The battery is accessible by removing the top cowl. The battery is equipped with an overboard vent and drain. The battery is rated at 12 volt, 25 ampere-hours. It should be inspected periodically for proper fluid level. If the fluid level is found to be low, fill as recommended by the battery manufacturer. DO NOT fill above the visible battery baffle plates.

CLEANING AND CARE

EXTERIOR CARE

The painted surfaces of the airplane have a long-lasting, all-weather finish and should require no buffing or rubbing out in normal conditions. However, it is desirable to wax and polish it to preserve the outstanding exterior finish. It is recommended that wax or polish operations be delayed at least 60 days after date of certification to allow proper curing of the paint.

The paint can be kept bright simply by washing with water and mild soap. Avoid abrasive or harsh detergents. Rinse with clear water and dry with terry cloth towels or chamois. Oil and grease spots may be removed with kerosene or mineral spirits.

NOTE

No commercial paint removers are to be used on any airframe component unless specific prior approval has been received from the factory (See Maintenance Manual).

If you choose to wax your airplane, use a good automotive-type wax applied as directed. The use of wax in areas subject to high abrasion, such as leading edges of wings and tail surfaces, propeller spinner and blades, is recommended.

WINDSHIELD, CANOPY AND WINDOW CARE

It is recommended that you keep the plexiglas in the canopy, windshield and cabin windows clean and unscratched. The following procedures are recommended:

1. If large deposits of mud and/or dirt have accumulated on the plexiglas, flush with clean water. Rubbing with your hand is recommended to dislodge excess dirt and mud without scratching the plexiglas.
2. Wash with soap and water. Use a sponge or heavy wadding of a soft cloth. DO NOT rub, as the abrasive action in the dirt and mud residue will cause fine scratches in the surface.
3. Grease and oil spots may be removed with a soft cloth soaked in kerosene.
4. After cleaning, wax the plexiglas surface with a thin coat of hard polish-wax.
5. If a severe scratch or marring occurs, jeweler's rouge is recommended. Follow directions, rub out scratch, smooth, apply wax and buff.

CAUTION

NEVER USE GASOLINE, BENZINE, ALCOHOL, ACETONE, CARBON TETRACHLORIDE, FIRE EXTINGUISHER FLUID, ANTI-ICE FLUID, LACQUER THINNER OR GLASS CLEANER TO CLEAN PLASTIC. THESE MATERIALS WILL DAMAGE THE PLASTIC AND MAY CAUSE SEVERE CRAZING.

PROPELLER CARE

Damage from foreign objects, sometimes referred to as "nicks", may appear in the leading edges of the propeller from time to time. It is vital that these nicks be corrected as quickly as possible. Such minor damage may cause stress concentrations and result in cracks forming in the propeller. Keep the blades clean and free of dirt or grass build-up. This type of foreign material on the propeller may cause an imbalance and accompanying vibration. We recommend cleaning agents such as Stoddard solvent or equivalent followed by waxing or coating with a light film of oil.

INTERIOR CARE

Clean the interior regularly with a vacuum cleaner to remove dust and loose dirt from the upholstery and carpet.

If liquid (coffee, etc.) is spilled on the upholstery or carpet, blot it up promptly with cleansing tissue or rags. Continue blotting until no more liquid is taken up. Sticky materials may be scraped up with a dull knife, then cleaned up with a spot remover.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials

Soiled upholstery and carpet may be cleaned with foam-type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

The plastic trim, headliner, instrument panel and control knobs need only be wiped off with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with Stoddard solvent. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the plastic.

SECTION 9
SUPPLEMENTS
(Optional Systems Description & Operating Procedures)

TABLE OF CONTENTS

INTRODUCTION

This section consists of a series of supplements, each covering a single optional system which may be installed in the airplane. Each supplement contains a brief description, and when applicable, operating limitations, emergency and normal procedures, and performance. Other routinely installed items of optional equipment, whose function and operational procedures do not require detailed instructions, are discussed in Section 7.

SECTION 10
SAFETY INFORMATION

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TABLE OF CONTENTS (Continued)

INTRODUCTION

Your Grumman American airplane is a responsive, high-performance vehicle, designed to provide you with safe and efficient transportation. Like any other airplane, your Grumman American airplane operates most efficiently and safely in the hands of a skilled pilot.

We urge you to be thoroughly familiar with the contents of this handbook, placards, and checklists to ensure maximum utilization of your airplane. When the airplane was delivered, it was equipped with a Pilot's Operating Handbook, engine operator's manual, weight and balance information and placards. If the airplane has changed ownership, some of these may have been misplaced. If any are missing, replacements should be obtained as soon as possible.

We have added this special section of safety information to refresh owners' and pilots' knowledge of a number of safety subjects. We strongly recommend these subjects be reviewed periodically, along with other documents required for operation of the airplane.

Topics in this publication 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 Grumman American airplane is built to provide you with many years of safe and efficient transportation. By maintaining it properly and flying it prudently, you will realize its full potential.

GENERAL

Flying can be 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

Be thoroughly familiar with your airplane. If you are not current in your airplane, get a check ride.

Pre-plan all aspects of your flight. Include in your pre-planning a complete weather briefing.

Use all services available when needed (FSS, Weather Bureau, etc.)

Prior to takeoff, ensure that a complete pre-flight inspection has been performed.

Use your checklists.

Use seat belts and shoulder harness.

Prior to takeoff ensure that you have enough fuel aboard the airplane to make the intended trip and arrive at your destination with an adequate reserve.

Prior to takeoff ensure that the airplane weight and C.G. are within limits for the type of flying intended.

Be sure that articles and baggage are secured.

Check freedom of all controls.

Maintain an appropriate airspeed in takeoff, climb, descent and landing.

Remain alert to see and avoid other aircraft traffic.

Avoid big airplane wake turbulence.

Switch fuel tanks before you have to.

Keep your airplane in good mechanical condition.

Stay informed and alert, fly in a sensible manner.

DON'TS

Don't takeoff with frost, ice or snow on the airplane surfaces.

Don't takeoff with less than minimum recommended fuel, plus reserves.

Don't fly in a reckless, show off, or careless manner.

Don't fly into thunderstorms or severe weather.

Don't fly into possible icing conditions.

Don't fly close to mountainous terrain.

Don't apply controls abruptly or with high forces that could exceed design loads of the airplane.

Don't fly when physically or mentally under par.

Don't trust to luck.

GENERAL SOURCES OF INFORMATION

The FAA and various aviation service agencies provide the pilot with a wealth of information. This information is provided 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 event that one should occur. Your responsibilities as a pilot are clearly defined by government regulations. Since these regulations are designed for your own protection, compliance with them is not only mandatory, but beneficial to you.

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.

Part 91 includes such subjects as:

- Responsibilities and authority of the pilot in command.
- Certificates required.
- Liquor and drug usage
- 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 regulations in FAR Part 91 and to follow them.

FEDERAL AVIATION REGULATIONS, PART 39, AIRWORTHINESS DIRECTIVES

This document specifies that no person may operate an aircraft to which an airworthiness directive (issued by the FAA) applies, except in accordance with the requirements of that airworthiness directive. It is the responsibility of the owner or pilot to ensure that the airplane he intends to fly is in compliance with all applicable airworthiness directives before the airplane is operated.

AIRMAN INFORMATION. ADVISORIES. AND NOTICES – FAA AIRMAN'S INFORMATION MANUAL

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

ADVISORY INFORMATION

Airmen can subscribe to services that provide FAA NOTAMS and Airman Advisories. These documents are also available at most FAA Flight Service Stations, and at many Fixed Base Operations. When using these documents, ensure that they are current prior to using the information in them for flight planning.

NOTAMS are documents that provide information of a time-critical nature affecting a pilot's decision to make an intended flight. For example, closed airports, terminal radar out of service, enroute navigational aids out of service, etc.

GENERAL INFORMATION ON SPECIFIC TOPICS

FLIGHT PLANNING

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

All pilots are urged to obtain a complete pre-flight briefing, preferably from an expert such as an FSS briefer. The pre-flight briefing should consider such items as local, enroute and destination weather; alternate airports; enroute navaids; airport runways in use; length of runways; takeoff and landing performance of the airplane under expected conditions; etc.

The prudent pilot will review his planned enroute track and stations and make a list for quick reference. It is strongly recommended that a flight plan be filed with Flight Service Station even though the flight may be VFR. Also, advise Flight Service Stations of changes or delays of one hour or more in flight plans and remember to close the flight plan at your destination.

The pilot must be completely familiar with the performance of his airplane including 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 weight and balance forms must be aboard the airplane at all times.

The airplane must be loaded so that its maximum weight and center of gravity (C.G.) limitations are not exceeded. Also, enough fuel must be aboard to ensure that the intended trip can be made with sufficient reserve fuel remaining. The engine oil level should be checked and brought to the proper level prior to flight.

INSPECTIONS – MAINTENANCE

In addition to maintenance inspections and pre-flight information required by FAR Part 91, a complete pre-flight inspection is imperative. It is the responsibility of the owner and operator to assure that the airplane is maintained in an airworthy condition and proper maintenance records are kept.

While the following items cannot substitute for the pre-flight specified for each type of airplane, they will serve as reminders of general items that should be checked.

SPECIAL CONDITIONS AND PRECAUTIONS

NOTE

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. The required periods do not constitute a guarantee that the item will reach the period without malfunctions, as the above factors cannot be controlled by the manufacturer.

Corrosion, and its affects, 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 areas of high 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 checked for proper color, absence of water or sediment.
Fuel quantity, adequate for trip, plus reserve, visually checked.
Oil quantity checked and access doors secured.
General condition of airplane, engine, propeller, exhaust stack, etc., checked.
All external doors secured.

COCKPIT CHECKS

Flashlight available.
Required documents on board.
Use the checklist.
All internal control locks removed.
Freedom of controls checked.
Canopy properly closed and latched.
Seat belts and shoulder harnesses fastened.
Passengers briefed.
Engine operating satisfactorily.
All engine gauges checked for proper readings.
Fuel selector in proper position.
Fuel quantity checked by gauges.
Altimeter setting checked.
Carburetor heat control checked.

FLIGHT OPERATIONS

GENERAL

The pilot should be thoroughly familiar with all information published by the manufacturer concerning the airplane. He is required by FAA regulations to operate in accordance with the placards installed.

ENGINE OPERATION IN FLIGHT

In addition to leaning, the following techniques should be considered to minimize spark plug lead fouling:

1. Exchange top spark plugs with bottom spark plugs at mid-spark plug servicing periods (50 hours).

2. Avoid closed throttle idle operation on the ground whenever possible. Try to idle engine in the 1000 to 1200 RPM range whenever conditions permit.

3. Ensure that the idle mixture has been properly adjusted to avoid a rich condition.

4. Rather than closing the throttle, use other means to lower airspeed or altitude. Power landings prevent rapid temperature drop; retaining the advantage of proper operating temperature.

5. Use the correct heat range spark plugs.

TURBULENT WEATHER

A complete weather briefing prior to beginning a flight is an essential element of a safe trip.

Updating of weather information enroute is another safety aid. However, the wise pilot also knows weather conditions change quickly at times and treats weather forecasting as professional advice rather than an absolute fact. He obtains all the advice he can, but still stays alert by using his knowledge of weather 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 avoided. The hail and tornadic wind velocities encountered in thunderstorms 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. If you maintain an excessive airspeed, you run the risk of structural damage or failure, or if your airspeed is too low, you run the risk of stalling.

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, listed in the limitations section of this handbook. This speed gives the best assurance of avoiding excessive stress loads, and at the same time provides a margin of airspeed to prevent 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.

FLIGHT IN ICING CONDITIONS

An airplane which does not have all critical areas protected in a proper manner must not be exposed to icing encounters – the pilot should make an immediate 180 degree turn or seek a different altitude when icing conditions are encountered.

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 available; altocumulus standing lenticular clouds are also visible signs that a mountain wave exists, but their presence is likewise dependent upon 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 a 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, obstacles such as TV towers, or communities in the area flown. This is especially true in mountainous terrain, where there is usually very little ground reference and absolute minimum clearance is 2,000 feet. Don't depend on your being able to see obstacles in time to miss them.

VERTIGO – DISORIENTATION

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

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

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

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

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

STALLS, SPINS AND SLOW FLIGHT

Stalls, and slow flight, should be practiced at safe altitudes to allow for recovery. Either of these maneuvers should be performed at an altitude in excess of 6,000 feet above ground level.

Spins are prohibited in this airplane. Since spins are preceded by stalls, a prompt and decisive stall recovery protects against inadvertent spins.

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 Flight 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 large airplanes and in all takeoff, climb out, approach and landing operations.

TAKEOFF AND LANDING CONDITIONS

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 and 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.

When 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 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 marked 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. Wide individual variation occurs with respect to susceptibility to hypoxia. In addition to progressively insufficient oxygen at higher altitudes, anything interfering with the blood's ability to carry oxygen can contribute to hypoxia (anemias, carbon monoxide, and certain drugs). Also, alcohol and various drugs decrease the brain's tolerance to hypoxia.

Your body has no built in alarm system to let you know when you are not getting enough oxygen. It is impossible to predict when or where hypoxia will occur during a given flight, or how it will manifest itself. A major early symptom of hypoxia is an increased sense of well-being (referred to as euphoria). This progresses to slow reactions, impaired thinking ability, unusual fatigue, and dull headache feeling.